Planning Effort as an Effective Risk Management Tool

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Abstract

In project management, high levels of risk are considered to be a significant obstacle for project success. This paper investigates whether improving the project plan can lead to improved success for high-risk projects. A quality of planning index was designed to explore how the presence of high risk affects the quality of planning and project success. The index includes managerial aspects such as costs, human resources, procurement and quality, as well as organizational support aspects based on organization maturity models. In a field study based on data collected from 202 project managers regarding their most recent projects, it was found that the levels of risk at the beginning of projects has no effect on their final success. Drilling down to find an explanation for this surprising phenomenon, we found that in the presence of high risk, project managers significantly improve their project plans. Hence, in high-risk projects, better project plans improve all four dimensions of project success: schedule overrun, cost overrun, technical performance and customer satisfaction. However, in low-risk projects, better project plans did not contribute to reducing schedule or cost overruns. In other words, while endless risk management tools are developed, we found that improving the project plan is a more effective managerial tool in dealing with high-risk projects. Finally, the paper presents the most common planning tools currently being used in high-risk projects.

1. Introduction

The area of project management has recently received vast attention in the business discipline. One of the major characteristics of projects is their high level of risk. This means that too many undesirable events may cause delays, excessive spending, unsatisfactory project results or even total failure (Raz et al., 2002). In order to increase the chance of project success, project managers are motivated to reduce risks by implementing better planning and control. Risks must be managed throughout the entire life cycle of the project, starting with the planning phase, when risks must be identified and analyzed. Next, solutions, which may reduce threats, must be developed and a response plan to some of the critical risks should be implemented. Throughout the execution phase of the project, risk monitoring is needed in order to keep track of the identified risks, monitor residual risks, identify new risks and ensure the execution of risk plans (PMI Standards Committee, 2004).

The objective of this paper is to explore the influence of project planning on project success under different levels of project risk. Specifically, we are interested in examining (i) the impact of the presence of risk on project managers' planning; (ii) the impact of an organizational support environment on planning efforts; (iii) the impact of the presence of risk on a project's success and (iv) the impact of planning efforts on project success in the presence of risk.

The following section introduces the relevant literature from the areas of project management, project planning and risk management.

2. Literature Review

A *project* is defined as *a temporary endeavor undertaken to create a unique product or service* (Project Management Institute, 2004). According to the Project Management Body of Knowledge (PMBOK), a project includes the following four phases: initiation, planning, execution and closure (PMI, 2004). *Initiation* is the phase where a new project is formally authorized. This phase links the project to the ongoing work of the performing organization. *Planning processes* define and refine objectives and select the best of the alternative courses of action to attain the objectives that the project was undertaken to address. *Executing processes* coordinate people and other resources to carry out the plan. Finally, *closing processes* formalize acceptance of the project and bring it to an orderly end.

Planning was found to be a critical phase in project management (Pinto & Slevin, 1987; Johnson et al., 2001; Turner, 1999 and others). Project planning specifies a set of decisions concerning the ways that things should be done in the future, in order to execute the design for a desired product or service. The project manager is responsible for completing the project to the satisfaction of all relevant stakeholders. Therefore, he/she must ensure not only that actions are executed according to plan, but also that the plan is reliable and properly represents stakeholders' requirements.

Kerzner (2006) finds uncertainty reduction to be one of the basic reasons for planning a project. Meredith & Mantel (2003) identified six planning sequences, including preliminary coordination, detailed description of tasks, adhering to project budget, adhering to project schedule, a precise description of all status reports and planning the project's termination. Russell & Taylor (2003) identified seven planning processes - 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. De Meyer et al., 2002 claim that deciding of the best way of planning the project is influenced by the level of risk, whether it is a "variation", "foreseen uncertainty", “unforeseen uncertainty" or a "chaos" project.

Since a project manager has to deal with high uncertainty levels, the subject of risk management has received much attention, being one of the nine knowledge areas of a project (PMI, 2004). According to Wideman (1992), risks can be divided into five groups: (1) external, unpredictable and uncontrollable risks, (2) external, predictable and uncontrollable risks, (3) internal, non-technical and controllable risks, (4) internal, technical and controllable risks and (5) legal and controllable risks. However, Shtub et al. (2005) and Couillard (1995) classified risk events into three groups: (1) risks linked to technical performance, (2) risks linked to budget and (3) risk linked to schedule.

Risk management deals with identifying and reducing the project’s risk level, including risk management planning, monitoring and control processes (PMI, 2004). Risk management planning processes include risk identification, qualitative and quantitative risk analysis and risk response plans. Risk monitoring and control is the last risk management process, which is performed during the project’s execution phase.

In order to deal with risks, project managers may choose to use several tools from the vast variety of risk management software and tools available, both from finance and project management disciplines, such as planning meetings, risk rating and risk control. Software packages for project risk management include @Risk, Risk+, Crystal Ball simulation tool, Predict and others. Literature shows that despite

the high number of available tools, frequency of implementation by project managers is still very low (Zwikael & Globerson, 2004; Raz et al., 2002). The reason for this could be their low impact on project success (Zwikael & Globerson, 2005). These facts point to a specific need to improve project managers' handling of risk events.

For summary, literature emphasizes the current problems with risk management tools within the project management environment. Literature also shows the high impact of project planning on project success. Hence, we may raise the hypothesis that improving the project plan may be an effective tool in order to deal with high-risk projects. This theory, which includes the improvement of all planning processes, (i.e. schedule planning and quality planning) may replace the traditional approach which focuses only on the improvement of risk management processes. The model proposed is described in Figure 1.

< Figure 1 – The Research Theory >

The first research's hypothesis states that planning contributes to project success (hypothesis 1). The second hypothesis states that project managers and organizations that usually face high-risk projects tend to plan their projects better than those who usually face low-risk projects (hypothesis 2). As a result, with better preparations, high-risk projects don't increase project failure (hypothesis 3). The last research hypothesis states that the quality of planning affects project success at different intensities depending on the level of risk (hypothesis 4).

H_1: Project managers and organizations that plan their projects better succeed more in their projects.
H_0: Project managers and organizations that plan their projects better succeed in their projects as those who have a low-quality project plan.

H_2: Project managers and organizations that face high-risk projects plan their projects better than those facing low-risk projects.
H_0: Project managers and organizations that face high-risk projects plan their projects in the same quality as those facing low-risk projects.

H_3: Project managers and organizations that face high-risk projects succeed less in their projects than those who face low-risk projects.
H_0: Project managers and organizations that face high-risk projects succeed in their projects in the same level as those who face low-risk projects.

H_4: The impact of project planning on project success is influenced by the level of project risk.
H_0: The impact of project planning on project success is not influenced by the level of project risk.

The next section describes the study's methodology, the designing of an index to assess the quality of project planning processes, its variables and data collection. Then, we test the validity of the index and explore the impact of risk on planning processes and derive conclusions.

3. Methodology

Following the high importance of project planning, this section introduces an index developed to measure the processes implemented by project managers during the planning phase of a project. This index is used to find out which planning processes work better in high-risk project environments and result in better project results. First, we introduce the developed planning index, followed by the research description.

3.1 Quality of Planning Index

The Quality of Planning (QP) index assesses the way in which project plans are being developed in organizations. The QP index, introduced in Zwikael & Globerson (2004), consists of two parts: (1) **Project know-how processes,** defined as planning processes executed by the project manager; and (2) **Organizational support processes,** defined as the means that the organization places at the disposal of the project manager to enable proper project planning, execution and completion.

The first part of the index, 'project know-how processes', is based on the planning processes that are included in the most common project management body of knowledge, called Project Management Body of Knowledge (PMBOK) developed by the Project Management Institute (PMI Standards Committee, 2004). Quality of planning is measured by the frequency with which project managers achieve the desired outcomes of planning processes. The output of the process was chosen to reflect the quality of each process for the following three reasons: First, models such as the “learning curve” have proved an ongoing improvement as a function of the number of repetitions (e.g. Yiming & Hao, 2000; Snead & Harrell, 1994; Griffith,

1996; Watson & Behnke, 1991). Second, the “expectancy theory model” suggests that one will not repeat a process that has no significant benefit to his objectives (Vroom, 1964). Finally, the control models suggest “output control” when it comes to operational processes, such as project management (Veliyath et al., 1997).

Since the output of a planning process may include several products, the most significant product was chosen to describe process output. Each project manager was asked to indicate the usage frequency of planning products in projects that were under his or her responsibility within the past year. The list of planning products appears in the questionnaire (Appendix 1), while their frequency of use was measured as follows:

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 pilot study was executed in order to ensure that all products were essential. The pilot phase involved 26 questionnaires, completed by project managers and others involved in the project. As a result, five planning products having too high a correlation among them were combined and the number of planning products was reduced to 16. These were then grouped into the nine knowledge areas included in the PMBOK (see Figure 2). The final list of planning products that are included in the QP (Quality of Planning) index is presented in the questionnaire (Appendix 1).

The second part of the QP index, 'organizational support processes', was based on top management support in projects, which was found to be critical for project success (Brown & Eisenhardt, 1995; Cooper & Kleinschmidt, 1987; Gupta &

Wilemon, 1990). The organizational support processes are divided into four areas according to the PMBOK classification, namely, “organizational systems”, “organizational cultures and styles”, “organizational structure”, and “project office”. One significant supporting product was identified for each area, according to what is described in the PMBOK. For example, the “project office” area includes the product “extent of project office involvement.”

The list of organizational support variables was enriched by variables taken from a few dozen maturity models developed over the past few years, e.g. the Capability Maturity Model (Paulk et al., 1995). From more than a hundred organizational support processes that have been recognized, only 13 mutually exclusive processes remained, and each organizational support process is represented by a single product. These 13 products were added to the four PMBOK products mentioned earlier, to include the 17 organizational supporting products which appear in Table 3. Each project manager was asked to describe the level of each organizational support product that was available for his or her projects. The organizational support level ranges from one to five, in which one represents a low level and five represents a high level of organizational support for the projects in their planning stages.

In conclusion, the QP index has two groups of products, associated with project know-how and organizational support. Since there is no identification for the level of process influence, each group has an equal weight. Therefore, each group was divided into equally weighted areas, each area including equal weight products. The QP index contains 33 products, 16 relating to project know-how processes and the other 17 to organizational support processes, as illustrated in Figure 2.

< Figure 2: The QP (Quality of Planning) Index Breakdown Structure >

3.2 Data Collection

The questionnaire was administered to 19 different project management workshops in Israel; nine workshops were administered as part of an internal project management-training program. An average of 13 individuals belonging to the same company participated in each of the nine workshops. Participants in the other 10 workshops came from different companies. All together, 202 project managers and other individuals working in a project environment completed the model's questionnaire, each for the projects that he had lately been responsible for. The questionnaire appears in Appendix 1. The data contains 16 project know-how variables, 17 organizational support variables, four success dimensions and the level of risk variable. Each project manager was asked to report average values for these variables regarding his recent projects, assuming those projects were of the same nature, e.g. software development projects or engineering projects.

Four variables describing success dimensions were adopted from project management literature. They include cost overrun and schedule overrun, measured in percentages from the original plan. Success dimensions also included technical performance and customer satisfaction measured on a scale of one to ten. One represents low technical performance and low customer satisfaction, while ten represents high technical performance and high customer satisfaction.

In this paper, the level of risk represents the uncertainty of a project that a project manager has recently managed, as was estimated at the beginning stage of that project, including technical, financial, human resources and other uncertainties. All project managers were given clear instructions regarding the way to assess the level of

risk and were asked to estimate the level of risk in the beginning of the project on the scale of one to ten. In this study, the level of risk index is treated as a two-level variable, in which one is considered to be a low-risk project (1-6), while two is considered to be a high-risk project (7-10). Lastly, the QP index was calculated as a weighted average of all 33 products.

In all 202 questionnaires, we found 4 percent of missing values. These were filled in by the mode value of the variable calculated from the same organization's observations. 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. Finally, the source of the questionnaires, according to industry type is presented in Table 1.

< Table 1: Source of Questionnaires in the Sample, according to Industry Types >

3.3 The Model's Reliability and Validity

The reliability of the QP index and its variables was tested first. Reliability was calculated using a number of statistical tests. For example, Cronbach alpha's value (0.92) was found to be much higher than the minimum (0.80) required by the statistical literature (Garmezy et al., 1967). This result reflects internal consistency, meaning that all variables contribute to the QP index and none of them are redundant.

The model's validity was evaluated by comparing the overall project planning quality indicator (QP index) derived from the model, with the projects' success, as estimated by a separate set of questions. It was found that QP 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 2. All results are statistically significant with p-values under .01.

< Table 2 – Validity Tests for the PMPQ Model >

The QP index was correlated with each of the project's final results, supporting the first research hypothesis. In other words, better planning contributes to project success. The second conclusion from the above statistical analysis is that the model is reliable and valid and can be used in this study. Further validity and reliability tests for the model can be found in Zwikael & Globerson, 2004.

4. Analysis and Findings

The next sections analyze the relationships among the quality of project planning, project success and level of risk.

4.1 Influence of Risk on Project Planning

The managerial objective in this section is whether the quality of project plan improved in the presence of high-risk. The impact of risk on the quality of planning index is measured using two levels of low and high risk and three aggregation levels of the quality of planning. The first aggregation level is a weighted linear combination of all 33 planning variables, called the QP index. The second aggregation level includes a weighted linear combination of the 16 project manager-related variables, named the QPM index. The third aggregation level includes a weighted linear combination of the 17 organizational support-related variables, named the QPO index.

Table 3 describes the impact of risk levels on the quality of planning. It shows the means of quality of planning for all three main indices, for both low and high levels of risk. The percentage difference is presented along with the t-test significance level under the assumption of unequal variance.

< Table 3: Influence of Risk Level on the Quality of Planning >

The results indicate a significant difference between project managers who face low and high-risk projects when it comes to the quality of the project plan. Results support the first hypothesis. This means that project managers who usually manage high-risk projects invest more planning effort in an attempt to cope with the risk. As seen in Table 3, better planning effort derives from steps taken by both the organization and the project managers. The former takes the needed steps towards handling the presence of risk, while the latter enhances these steps.

A more detailed analysis is presented in Table 4, in a breakdown of the nine areas of knowledge. The means of quality for all 16 planning products, divided into the PMBOK's nine knowledge areas are presented for both low and high levels of risk, along with the percentage of increase in the quality of the processes and its significance (p-value).

< Table 4: Influence of Risk Level on Quality of Planning Products >

There is a significant increase in the means of quality of planning between low and high-risk projects in each of these four knowledge areas: “Scope” (14%), “Cost” (13%), “Quality” (15%) and “Human Resources” (11%). This means that project managers who manage high-risk projects tend to make much more of an effort in performing the planning processes, which are included in these knowledge areas, compared to project managers who usually manage low-risk projects. This means that project managers who confront high levels of risk pay more attention to the areas they can more easily control, e.g. cost management. Project managers seem to believe that they can exercise better cost control if they have a project plan. Therefore, they try to construct a better cost plan, under high-risk levels. The same holds true for human resources, scope and quality management.

These four knowledge areas have some complexity in their planning, hence project managers tend to seriously deal with them only in high-risk projects. In the “Scope” knowledge area, the processes are clear and the tools are available, but the processes are time-consuming (e.g. developing a detailed work breakdown structure chart). In the “Cost” knowledge area, although the know-how is available, the processes require the participation of a cost specialist, such as an economist or a cost accountant. Project managers tend to ignore the need for detailed cost planning. In general, project managers do not have a good enough quality management background to develop a quality control plan and it is often customary to leave such activities to the organization’s quality assurance staff. In the “Human Resources” knowledge area, one reason that project managers don’t have a high quality plan is their desire to avoid conflicts regarding their employees when it comes to defining responsibility and authority.

Hence, it seems that in the presence of a high-risk project, project managers take additional steps in the planning phase, for example, investing more effort in identifying project activities, paying more attention to cost analysis, involving the quality personnel in the planning team or defining clear role and responsibility assignments.

In the “Time” knowledge area, know-how is common and the available tools are popular, user-friendly and do not require special skills. Therefore, project managers perform these processes at a high frequency (3.8 out of 5), regardless of the level of risk. In this knowledge area, “defining exact start and end dates for each project activity” is the only process, which shows a significant difference in the frequency of use between high and low risk projects.

The “Integration” knowledge area is necessary and therefore normally performed at a very high frequency (3.9). Consequently, there is no significant difference between low and high levels of risk.

In the “Risk” knowledge area, it was found that project managers tend not to prepare risk management plans, which should include specific responses to the critically risky events of a project (PMI, 2004). In this study, the average frequency of developing risk management plans was found to be very low, ranging from 2.5 to 2.8. These findings support and enhance previous ones reported by Raz et al. (2002), who claim that project managers do not take more efficient steps in initiating risk management plans in the presence of high risk. This means that project managers do not see the process of developing a risk management plan as being an adequate tool when confronting risks.

The same analysis, which was illustrated for the ‘project know-how’ group was also performed for the second part of the model, which is the ‘organizational support’ group, as is shown in Table 5. This group includes all activities performed by the organization in order to improve project management planning.

< Table 5: Influence of Risk Level on Quality of Planning by Organizational Support Areas >

The first supporting area in this group, the “organizational system” area, is associated with a strategic concept. It was found that organizations facing frequent high-risk projects have already adjusted their attitude toward a project management approach and became “project-based organizations”. Therefore, they are different from organizations, which usually face low-risk projects. For example, these organizations tend to manage both resources and budget at the project level, rather than at the functional level.

High scores were found in the “organizational cultures and styles” supporting area. In this area, project managers reported receiving wide support from their organizations, regardless of the project’s level of risk. Only in a particular case, “refreshing project procedures”, the presence of risk raises the level of organizational support from 2.7 to 3.2. This level of support of this process is relatively low, meaning that organizations who seldom face high-risk projects do not invent time and effort in updating project management procedures.

The processes included in the “organizational structure” supporting area are more ‘tactical’ than the previous processes. It was found that organizations infrequently perform these processes, regardless of the level of risk, e.g. project management training.

In the “project office” supporting area, there is no significant difference between low and high-risk projects. Some organizations have no project office at all. The activities related to the project office area are of a technical orientation. Organizations perform these types of activities at low (i.e., identification of new tools and techniques) or high (i.e., project management software) frequencies, regardless of the level of risk.

In conclusion, organizations which usually face high-risk projects tend to adapt a proper organizational structure, such as a pure-project, which gives more authority to project managers. However, these organizations do not supply their project managers more tactical tools to cope with the high level of risk, i.e. project management software or project management training. In these cases, it is only self-excellence and extensive efforts on the part of the project manager that can elevate the quality of the plan.

4.2 Influence of Risk on Project Success

The analysis of different approaches in choosing project planning processes to be performed for high vs. low risk projects might be of interest only if it makes a significant impact on project success. For this purpose, results for project success were also collected in this research. In general, it was found that the average cost overrun was 25%, ranging from saving 20% of the budget up to spending 400% of the original budget. The average schedule overrun was 32%, ranging from 5% ahead of

time up to a schedule overrun of 300%. Technical performance average was 8.0, ranging from one to ten, while the customer satisfaction average was 8.1, ranging from four to ten.

An interesting managerial question is whether project success is influenced by the level of risk. The third research hypothesis is that project managers who usually face low-risk projects tend to succeed more than project managers facing high-risk projects. We examined the direct impact of risk on project success. Table 6 represents the value of four dimensions of project success under the influence of low and high levels of risk, according to the two-risk levels and four project success measures that have already been described. It shows the means of project success for all four main success indices, for both low and high levels of risk. The percentage difference is presented along with the t-test significance level, under the assumption of unequal variance.

< Table 6: Influence of Risk Level Presence on Project Success >

Following the high p-values seen in Table 6, we are not able to reject the third null hypothesis. This means that there is no significant difference in project success between projects performed by project managers facing low or high-risk levels in their projects. Similar results were reported in Raz et al. (2002). One explanation for this may be the improvement of project plans in high-risk projects, as was found in the previous section. The next section drills down the results in order to expand the understanding of this behavior.

4.3 Project Success versus Quality of Planning in the Presence of Risk

Let us summarize some findings both from this study and from the literature:

(1) In a previous section, it was found that project managers who report higher levels of risk result in better quality of planning in their projects.

(2) In this study, it was also found that the level of risk doesn't impact project success.

(3) In previous studies, it was found that planning has a positive impact on project success (Zwikael & Globerson, 2004; Pinto & Slevin, 1987).

This section combines the effect of level of risk and quality of planning on project success. The last research hypothesis states that the quality of planning affects project success at different intensities depending on the level of risk.

Since a high correlation was found between level of risk and quality of planning, their interaction on project success was investigated along with their implicit impact on success. We based our model on the design of the risk variable as a dichotomy variable. Results were analyzed using linear regression, while the suggested model is:

$$\text{Success} = a_o + a_1 * R + b_0 * QP + b_1 * QP * R$$

In this equation, the dependent variable (success) is any of the four success variables for measuring project success (cost overrun, schedule overrun, technical performance and customer satisfaction). The independent variable QP is the average level of Quality of Planning on a scale of 1 to 5 that a project manager exercised. The qualitative variable R represents the average level of risk, 0 for low average and 1 for high average risk level. The product of R and QP reflects the impact of risk on the slope of success against quality of planning for projects with high risk. The arguments a_0, a_1, b_0, and b_1 are coefficients to be estimated.

If the risk level has no impact on the intercept of the regression, then the hypothesis that a_1 is zero is accepted, otherwise rejected. If the risk level has no impact on the slope of the regression, then the hypothesis that b_1 is zero is accepted, otherwise rejected. For each success dimension, there are eight possible regression models of explanatory variables (including the null regression). A series of F tests were conducted to choose the significant models with all significant coefficients. The results from the four runs are presented in Table 7 (t values in brackets):

< Table 7: Coefficients' Estimates and their t-Values for Success versus Quality of Planning and Level of Risk >

The quality of planning was correlated with the project's final results in various ways, depending on the nature of the success dimension and the presence of risk, meaning at least one b coefficient was significant in each run.

In the presence of high risk, there is a significant impact of quality of planning on each success measure. There is a reduction of 23 percent in cost overrun and 21 percent in schedule overrun due to an increase by one unit of quality of planning. On the other hand, there is an increase of 0.67 and 0.56 units (on a scale of 1 to 10) on the project's technical performance and customer satisfaction, respectively, because of an increase by one unit of quality of planning.

The intercepts of all four models, cost overrun, schedule overrun, technical performance and customer satisfaction, in the presence of high risk are (0.22+0.84=1.06), (0.35+0.69=1.04), 5.84 and 6.41, respectively.

In the presence of low risk, the intensity of quality of planning on project success is equal for technical performance (0.67) and customer satisfaction (0.56), and diminishes for cost and schedule overrun. Actually, in the presence of low risk, there

is no impact of quality of planning on cost and schedule overrun. The average cost overrun is 0.22 and schedule overrun is 0.35. These two numbers match the findings of Table 4, as expected. These findings are explained by previous analyses (see Tables 2 and 3), which showed that in the presence of low risk, project managers tended to pay more attention to available planning tools, but did not take any special steps toward implementing better planning tools and techniques.

5. Conclusion

This paper shows that the practical solution being implemented by most project managers in order to deal with high project risk is the improvement of the project plan. This approach significantly improves project success. Hence, due to these efforts, project managers facing high-risk projects do not tend to fail more than project managers managing low-risk projects.

In addition, it was found that in the presence of high risk, increasing the quality of the project plan improves project success. However, in the presence of low risk, increasing the quality of planning doesn't reduce cost and schedule overrun. The impact of increasing the quality of planning on better customer satisfaction has the same intensity in the presence of both low and high risk. The same finding holds true for the technical performance success measure. These results emphasize the importance of a high quality project plan to be performed by project managers that manage high-risk projects.

Project managers use more advanced tools and techniques when the level of risk is high. Since these planning tools takes time and require special expertise, project managers tend to ignore them in low-risk conditions, and to use them extensively only in the presence of a high risk level. The tools that are currently being

used more frequently in high-risk projects include definition of project deliverables, development of the project work breakdown structure, definition of exact start and end dates for each project activity, resource cost estimation, role and responsibility assignments and quality management plans.

Project managers tend to use simple project planning tools at a high frequency, regardless of the level of risk. One example of this is developing a Gantt chart, in which project management software is easily accessible.

At the organizational support level, it was found that top management increases its project management involvement when the level of project risk rises. Yet, in most organizations this involvement affects only the strategic level support, rather than daily activities. This means that organizations regularly face high-risk projects, i.e. R&D organizations are equipped with the suitable organizational structure and updated project management procedures. The problem is located with organizations that are not used to facing high-risk projects on a regular basis. When high-risk projects appear in an organization, which is not used to managing such projects, no unique organizational support is offered to assist the project manager.

This paper also repeats the well-known finding (Raz et al., 2002; Couture & Russett, 1998; Mullaly, 1998; Ibbs & Kwak, 2000, etc.) in which risk management practices are not widely used. It reveals that even in high-risk projects, no special efforts are being made in this field. The reason for this may be a lack of relevant knowledge on the part of project managers. It may also appear due to an organizational failure in implementing the use of risk management tools as part of the mainstream of project management practices. Both explanations reinforce the conclusion that project managers should adopt a different risk management attitude. Various risk management tools are available, but unfortunately they aren’t suitable for

many industries, organizations and projects. Only further research that will identify the best tools for each project type may help to implement these skills in organizations.

Finally, some methodology limitations should be discussed. First, this paper highlighted only those processes that should be performed during the planning phase of a project. Secondly, the results reflect projects that have been performed in one country only. Further research should be conducted in other countries, using the same methodology, aimed at identifying any existing cultural differences. Finally, the QP index assumes an equal weight for all planning products, due to the lack of relative importance of planning processes in literature. Further research that will identify the importance of each planning process is being performed regarding this matter.

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Appendix 1 - Project Planning Assessment Questionnaire

Please indicate the most suitable answer for each planning product as it relates to the projects you are currently involved in, according to the following scale:

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 currently involved in.
B - I do not know whether the product is obtained.

Part A – Project Planning

Planning Product	Never				Always	Irrelev	Do not
1. Project Plan	1	2	3	4	5	A	B
2. Project Deliverables	1	2	3	4	5	A	B
3. WBS (Work Breakdown Structure) Chart	1	2	3	4	5	A	B
4. Project Activities	1	2	3	4	5	A	B
5. PERT or Gantt Chart	1	2	3	4	5	A	B
6. Activity Duration Estimate	1	2	3	4	5	A	B
7. Activity Start and End Dates	1	2	3	4	5	A	B
8. Activity Required Resources	1	2	3	4	5	A	B
9. Resource Cost	1	2	3	4	5	A	B
10. Time-phased Budget	1	2	3	4	5	A	B
11. Quality Management Plan	1	2	3	4	5	A	B
12. Role and Responsibility Assignments	1	2	3	4	5	A	B
13. Project Staff Assignments	1	2	3	4	5	A	B
14. Communications Management Plan	1	2	3	4	5	A	B
15. Risk Management Plan	1	2	3	4	5	A	B
16. Procurement Management Plan	1	2	3	4	5	A	B

Part B – Organizational Support

Planning Product	Never				Always	Irrele	Do not
17. Project-Based Organization	1	2	3	4	5	A	B
18. Extent of Existence of Project's Procedures	1	2	3	4	5	A	B
19. Appropriate Project Manager Assignment	1	2	3	4	5	A	B
20. Extent of Refreshing Project Procedures	1	2	3	4	5	A	B
21. Extent of Involvement of the Project Manager during Initiation Stage	1	2	3	4	5	A	B
22. Extent of Communication between the Project Manager and the Organization during the Planning Phase	1	2	3	4	5	A	B
23. Extent of Existence of Project Success Measurement	1	2	3	4	5	A	B
24. Extent of Supportive Project Organizational Structure	1	2	3	4	5	A	B
25. Extent of Existence of Interactive Inter-Departmental Project Planning Groups	1	2	3	4	5	A	B
26. Extent of Organizational Projects Resource Planning	1	2	3	4	5	A	B
27. Extent of Organizational Projects Risk Management	1	2	3	4	5	A	B
28. Extent of Organizational Projects Quality Management	1	2	3	4	5	A	B
29. Extent of On-going Project Management Training Programs	1	2	3	4	5	A	B
30. Extent of Project Office Involvement	1	2	3	4	5	A	B
31. Extent of Use of Standard Project Management Software (e.g. Ms-Project)	1	2	3	4	5	A	B
32. Extent of Use of Organizational Projects Data Warehouse	1	2	3	4	5	A	B
33. Extent of Use of New Project Tools and Techniques	1	2	3	4	5	A	B

Figure 1 – The research theory

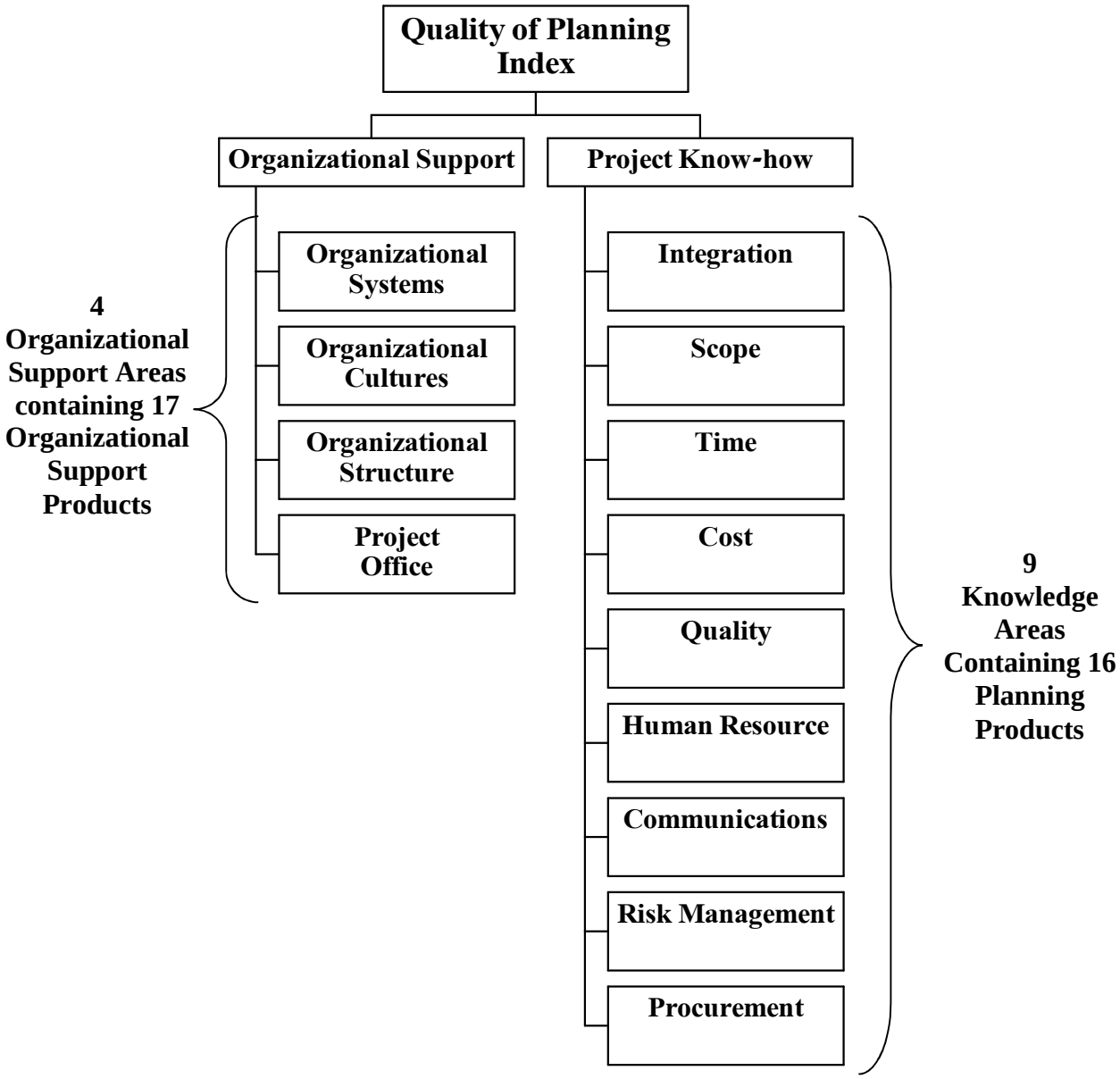

Figure 2: The QP (Quality of Planning) Index Breakdown Structure

Industry Type	Percentage of Questionnaires
Construction & Engineering	17%
Software & Communications	49%
Services	29%
Production & Maintenance	5%

Table 1: Source of Questionnaires in the Sample, according to Industry Types

Success Measure	R	p-value
Cost Overrun	0.52	< **0.001**
Schedule Overrun	0.53	< **0.001**
Technical Performance	0.57	= **0.001**
Customer Satisfaction	0.51	< **0.001**

Table 2 – Validity Tests for the PMPQ Model

Index	Means of Quality of Planning for Managers of Projects with		Difference between Means (%)	t-test sig. level
	Low-Risk Level	High-Risk Level		
QP	3.1	3.4	+10%	**0.003 ****
QPM	3.1	3.4	+10%	**0.002 ****
QPO	3.2	3.4	+6%	**0.018 ***

Table 3: Influence of Risk Level on the Quality of Planning

* $p<0.05$; ** $p<0.01$

PMBOK Knowledge Area	Planning Product	Means of Quality of Planning for Project Managers that Face Projects with		Difference between Means (%)	t-test sig. level
		Low-Risk Level	High-Risk Level		
Integration	Project plan	3.9	4.0	+3%	0.466
Scope	Project deliverables	3.8	4.2	+11%	0.023 *
	WBS (Work Breakdown Structure) chart	3.2	3.8	+19%	0.004 **
	"Scope" average	**3.5**	**4.0**	**+14%**	**0.001 ****
Time	Project activities	3.9	4.1	+5%	0.093
	PERT or Gantt chart	3.3	3.5	+6%	0.446
	Activity duration estimates	4.2	4.2	0%	0.869
	Activity start and end dates	3.8	4.1	+8%	0.045 *
	"Time" average	**3.8**	**4.0**	**+5%**	**0.114**
Cost	Activity required resources	3.5	3.8	+9%	0.044 *
	Resource cost	2.6	3.1	+19%	0.018 *
	Time-phased budget	2.9	3.3	+14%	0.072
	"Cost" average	**3.0**	**3.4**	**+13%**	**0.008 ****
Quality	Quality management plan	2.6	3.0	+15%	0.050 *
Human Resources	Role and responsibility assignments	3.4	4.0	+18%	0.001 **
	Project staff assignments	3.5	3.7	+6%	0.137
	"HR" average	**3.5**	**3.9**	**+11%**	**0.003 ****
Communications	Communications management plan	2.2	2.4	+9%	0.177
Risk	Risk management plan	2.5	2.8	+12%	0.091
Procurement	Procurement management plan	2.7	3.1	+15%	0.063

Table 4: Influence of Risk Level on Quality of Planning Products

* $p<0.05$; ** $p<0.01$

Supporting Area	Supporting Product	Means of Quality of Planning for Project Managers that Face Projects with …		Difference between Means (%)	t-test sig. level
		Low-Risk Level	High-Risk Level		
Organizational Systems	Project-based organization	3.2	3.8	19%	0.001 **
	Project procedures	3.6	3.9	8%	0.077
	"Organizational systems" average	**3.4**	**3.9**	**15%**	**0.002 ** **
Organizational Cultures and Styles	Appropriate project management assignment	3.6	3.7	3%	0.545
	Refreshing project procedures	2.7	3.2	19%	0.022 *
	Project manager takes part in initiating phase	3.8	3.8	0%	0.594
	Fluent communication between project manager and the organization during planning phase	3.9	4.0	3%	0.473
	Project measurement existing	3.1	3.3	6%	0.287
	"Organizational cultures and styles" average	**3.4**	**3.6**	**6%**	**0.090**
Organizational Structure	Project supportive organizational structure	3.3	3.5	6%	0.302
	Interactive inter-department project planning groups	3.4	3.5	3%	0.602
	Organizational projects resource planning	2.8	3.1	11%	0.169
	Organizational projects risk management	2.8	2.9	4%	0.422
	Organizational projects quality management	2.8	3.1	11%	0.089
	Fluent project management training	2.6	2.8	8%	0.173
	"Organizational structure" average	**2.9**	**3.1**	**7%**	**0.095**
Project Office	Project office involvement	2.6	2.7	4%	0.824
	Project management software	4.1	4.3	5%	0.203
	Organizational previous project data warehouse	2.7	2.8	4%	0.688
	New project tools and techniques identification	2.6	2.8	8%	0.393
	"Project office" average	**3.0**	**3.1**	**3%**	**0.370**

Table 5: Influence of Risk Level on Quality of Planning by Organizational Supporting Areas

* $p<0.05$; ** $p<0.01$

Success Measure	Average Project Success		Difference between Means (%)	t-test sig. level
	Low Level of Risk	High Level of Risk		
Cost Overrun	22%	27%	+5%	0.727
Schedule Overrun	35%	32%	-3%	0.339
Technical Performance	7.9	8.2	+4%	0.259
Customer Satisfaction	8.0	8.4	+5%	0.095

Table 6: Influence of Risk Level Presence on Project Success

Success Measure	Intercept (a_0)	R (a_1)	QP (b_0)	QP*R (b_1)	R^2	t-test sig. level
Cost Overrun	0.22 (5.33)	0.84 (5.83)		-0.23 (-5.82)	0.15	<**0.001**
Schedule Overrun	0.35 (8.01)	0.69 (4.63)		-0.21 (-5.04)	0.11	<**0.001**
Technical Performance	5.84 (10.54)		0.67 (4.13)		0.08	<**0.001**
Customer Satisfaction	6.41 (14.04)		0.56 (4.16)		0.08	<**0.001**

Table 7: Coefficients' Estimates and their t-Values for Success versus Quality of Planning and Level of Risk