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From Critical Success Factors to Critical Success Processes

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Abstract

After myriad studies into the main causes of project failure, almost every project manager can list the main factors that distinguish between project failure and project success. These factors are usually called *Critical Success Factors* (CSF). However, despite the fact that CSF are well-known, the rate of failed projects still remains very high. This may be due to the fact that current CSF are too general and don't contain specific enough know-how, to better support project managers' decision making. This paper analyzes the impact of 16 specific planning processes on project success and identifies *critical success processes* (CSP) that project success is most vulnerable to. Results are based on a field study, which involved 282 project managers. It was found that the most critical planning processes, which have the greatest impact on project success, are "definition of activities to be performed in the project", "schedule development", "organizational planning", "staff acquisition", "communications planning" and "developing a project plan". It was also found that project managers usually do not divide their time effectively among the different processes, following their influence on project success.

Key words: project management, project planning, critical success processes, project success

Introduction

After myriad studies into the main causes of project failure, almost every project manager can list the main reasons or factors responsible for project failure and project success. These factors are usually called *Critical Success Factors* (CSF). Despite this, the rate of failed projects still remains very high (i.e. Zwikael & Globerson, 2004; Kerzner, 2001; Johnson et. al., 2001 and others). One reason that may explain this contradiction is that CSF are rarely specific enough for project managers to act on. Therefore, the objective of this paper is to develop a more applicative and detailed list to be used by project managers. This list will include *Critical Success Processes* (CSP), which are the unique project processes that have the greatest influence on the success of projects. Being explored on this list is how a project manager will be able to focus on these critical project processes and to insure that they are performed with high quality in the project. Firstly, the following paragraph briefly explains the development and meaning of CSF in the project management literature.

Literature Review

CSF for any business consists of a limited number of areas in which results, if satisfactory, will ensure the organization's successful competitive performance. Being aware of CSF is of great importance, since it helps managers to focus on the most relevant factors.

Critical Success Factors

Daniel (1961) was the first to introduce the concept of CSF. This concept became popular when it was later used to assist in defining the CEO's information needs that are most critical to the success of the business (Rockart, 1979). Since then, the use of CSF has become widespread in many areas. Leidecker & Brunu (1984) defined CSF for strategic planning and business strategy, as many others (e.g. Davenport et. al, 1998; Trussler, 1998; Bassi, 1999; Skyrme & Amidon, 1999 etc.) did for knowledge management. CSF was also used in defining the information needs of academic department heads at the University of Sheffield (Pellow & Wilason, 1993) and, more recently, for total quality management (Dayton, 2001) and the implementation of nursing equipment (Kennedy, 2000). Li et al. (2005) found three CSF for the construction industry, including "a strong and good private consortium", "appropriate risk allocation" and "available financial market.

Shenhar et. al. (2002) divided CSF models into three levels. The first level includes models that focus on product success (Maidique and Zirger, 1984; Cooper & Kleinschmidt, 1987). The second level includes strategic models that focus on the business unit (Dvir et. al., 1993). The third level, which is the project management level, has received vast attention, and will be introduced in the following paragraphs.

The first application of CSF in the project management arena was made by Rubin & Seeling (1967), who investigated the impact of project managers' experiences and the size of the previously managed project, on project success. They found that only the former has a significant impact. Avots (1969) identified the main reasons for project failure to be the wrong choice of a project manager, unplanned project termination and non-supportive top management.

Pinto & Slevin (1987) published a major research study on CSF within project-oriented environments. In their research, 418 project managers were requested to evaluate the importance of different factors relating to project success. The research identified ten CSF, including factors such as: top management support, project planning and customer involvement.

Many researchers followed this line of investigation to identify specific CSF for different types of projects. Cooper and Kleinschmidt (1996) concentrated on the identification of CSF for new product development, including a defined strategy and adequate R&D spending. Lester (1998) found a different set of CSF for new product development projects, among which were senior management commitment, organizational structure and risk management. The Standish Group (Johnson et. al., 2001) found management support, customer involvement and project planning among CSF for software projects. Abdel-Hamid, et al. (1999) found that defining the project team with specific project goals is a critical success factor in software organizations. The list of CSF literature also includes sources, such as Cooke-Davies (2001); Reel (1999); Freeman & Beale (1992); Soliman, Clegg & Tantoush (2001) and many others.

Table 1 compares CSF in selected project management literature, sorted by the frequency of quotation of each success factor.

Literature Source # / Critical Success Factor	1	2	3	4	5	6	7	8	9	∑
Project plan	+	-	+	+	+	-	+	+	+	7
Top management support	+	+	+	+	-	-	+	+	-	6
Personnel recruitment	+	+	+	+	+	-	-	+	-	6
Monitoring and feedback	+	-	-	+	+	-	+	+	+	6
Customer involvement	+	-	+	-	-	+	+	-	+	5
Project requirement & objectives	+	-	+	-	+	+	-	+	-	5
Adequate spending	-	+	-	+	+	+	+	-	-	5
Technical tasks	+	-	-	+	+	+	-	-	-	4
Communication	+	-	-	+	+	-	+	-	-	4
Project strategy	-	+	+	-	-	-	-	+	-	3
Trouble-shooting	+	-	-	-	-	+	-	-	-	2
High-quality processes	-	+	-	+	-	-	-	-	-	2
Ownership	-	-	+	+	-	-	-	-	-	2
Goal commitment of project team	-	-	-	+	+	-	-	-	-	2
Customer acceptance	+	-	-	-	-	-	-	-	-	1
Realistic expectations	-	-	+	-	-	-	-	-	-	1
Smaller project milestones	-	-	+	-	-	-	-	-	-	1
On-site project manager	-	-	-	-	+	-	-	-	-	1
Politics	-	-	-	-	-	+	-	-	-	1
Logistics requirements	-	-	-	-	-	-	+	-	-	1

Table 1 – Frequencies of CSF in Project Management Literature

(1) Pinto & Slevin, 1988
(2) Cooper and Kleinschmidt, 1995
(3) Johnson et. al, 2001
(4) Turner, 1999
(5) Baker, Murphy & Fisher, 1983
(6) Morris & Hough, 1987
(7) Cleland & King, 1983
(8) Martin, 1976
(9) Sayles & Chandler, 1971

An analysis of the findings presented in *Table 1* identifies two major characteristics of the common CSF. The first one is that they all state an out-come with foggy advice, such as “improve the relationship with your customer” or “obtain management support”. Although these factors may serve in improving project managers' general know-how, they are not specific enough to support better decision-making. Therefore, despite common knowledge, project managers still have difficulties implementing these ideas. The second characteristic derived from the analysis of *Table 1* is that planning is repeatedly a critical success factor in most of these studies. However, the studies mentioned above were not specific enough to point out the relevant critical processes within the planning phase of a project.

In recent years, researches have tried to specify some specific planning processes that are most vulnerable to project success. Shenhar et. al. (2002) identified the project management processes of developing a work breakdown structure, PERT, a project plan and a quality plan as processes that significantly impact on project success. Raz, et. al. (2002) found that the process of developing a risk plan significantly impacts on the cost overrun at the end of the project.

The greatest impact of planning on a project’s success, coupled with a lack of knowledge concerning the relative importance of each planning process, was the motivation for the present research. Moreover, since success factors vary over the life cycle of a project (Lewis, et al., 2002), it is important to focus on one phase of a project. Therefore, the objective of this study is to identify specific Critical Success Processes (CSP) required for the planning phase of a project. The concept of CSP may be more focused, exact and practical to project managers, compared to the traditional CSF concept. The next paragraph describes a literary review regarding the processes required in the planning phase of a project.

Project Planning

Planning is the second phase of a project, following initiation and prior to execution and closure (PMI, 2004). The techniques of planning are diverse from simulation, buffer management, risk management and iterative planning, as dependent on project uncertainty, whether it is "variation", "foreseen uncertainty", unforeseen uncertainty" or a "chaos" project (De Meyer et al., 2002).

Many examples are available to illustrate the impact of planning on the successful completion of a project. For example, the project of building the Denver International Airport failed, reaching a final cost of 5 billion dollars compared to the 1.2 billion dollars projected in the planning stage. Further analysis revealed that this failure was mostly due to poor planning, such as lack of proper consideration for major stakeholders, (i.e. airline companies), lack of proper risk analysis and starting construction without a signed agreement (Kerzner, 2001).

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 or she should not only make sure that actions are executed according to plan, but also insure that this plan is reliable and properly represents stakeholders' requirements. Some of the main models for project planning will be introduced next.

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 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.

The Project Management Body of Knowledge - PMBOK (PMI Standards Committee, 2004) suggests a more detailed construct of processes for the planning phase. It identifies 21 planning processes, out of the 44 processes required to manage a project. That is to say, planning processes consist of 47% of all processes that should be properly performed by a project manager during the entire life cycle of a project. However, project literature does not clearly identify which of the 21 planning processes are more crucial than others. The end result is that project managers, who are short of time and therefore unable to properly perform all planning processes, may choose to perform those processes which are easiest to execute or those mandatory to the start of a project, rather than those that actually contribute the most to the success of the project. The remainder of this paper deals with identifying those planning processes, which the project's success is more vulnerable to. Then, These CSP will be compared with the processes that have the actual greatest extent of use by project managers.

Research Configuration

In order to identify CSP, which have the greatest influence on project success, a linear model was designed. The independent variables of the model are project planning processes and the dependent variables are project success measures, as is presented in Figure 1.

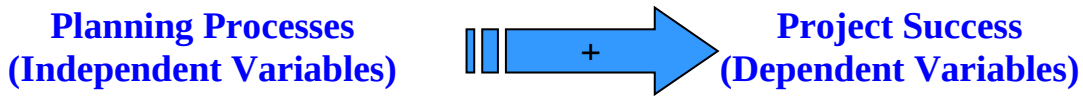

Figure 1 – The Designed Model

In this research, a critical success process will be defined as a project process which has a significantly higher impact on project success, compared to other planning processes. A successful project is defined as one which was completed on time, on cost, achieving performance envelope and with high customer satisfaction (Globerson & Zwikael, 2004). Hence, four dependent variables are introduced – cost overrun, schedule overrun, technical performance and customer satisfaction.

The independent variables consist of planning processes that have to be performed by project managers. In order to identify and analyze planning processes, a measurement tool is needed. Recently, a Project Management Planning Quality (PMPQ) model was introduced by Zwikael & Globerson (2004), to evaluate the quality of project planning processes. This model, briefly described in the next section, was used in the present research as the vehicle for the identification of CSP.

The Project Management Planning Quality (PMPQ) Model

The objective of the PMPQ model is to assess the quality of project planning, based on knowledge areas from the fields of Project Management, Control, Organizational Maturity and Organizational Support. The model consists of one major planning product that should be generated by the end of each planning process. The extent of use of a planning product is easy to measure and therefore was used to express the frequency with which a process is performed.

The PMPQ model consists of 16 major planning processes, which generate 16 products. For example, the major product that project managers should generate as an output product for the "scope definition" process is a Work Breakdown Structure (WBS) chart. These products were grouped according to the nine knowledge areas, identified by the PMBOK (PMI, 2004) and are presented in *Table 2*.

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	List of 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 2: Sixteen Planning Processes and Products, Grouped by Knowledge Areas

Based on this model, a questionnaire, presented in Appendix A, was designed and was used in a pilot exercise. All participants also received an oral explanation and a written guide describing all planning processes and products. The model's reliability was calculated using a number of statistical tests, such as Cronbach alpha. Results ($\alpha = 0.93$) were considerably higher than the minimum value required by the statistical literature (Garmezy et. al., 1967). 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 derived from the model (PMPQ index), with the projects' success. It was found that the PMPQ index was significantly correlated with the perception of projects' success, as measured by cost, time, performance envelope, and customer satisfaction. A summary of the regression analysis between PMPQ index and four project success measures are presented in *Table 3*.

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**

Table 3 – Validity Tests for the PMPQ Model

We can see in *Table 3* that the extent of use of planning processes was correlated with each of the project's final results. All results are statistically significant with p-values under .01. The conclusion from the above statistical analysis is that the PMPQ model is reliable and valid and can be used to evaluate the extent of use of project planning processes. The PMPQ model also assisted us in identifying 16 planning processes. In order to find out which of them has the greatest impact on project success, the model presented in Figure 2 was charted. The model includes 16 planning processes, as appears in the PMPQ model to become independent variables, and four project success measures, act as the model's dependent variables.

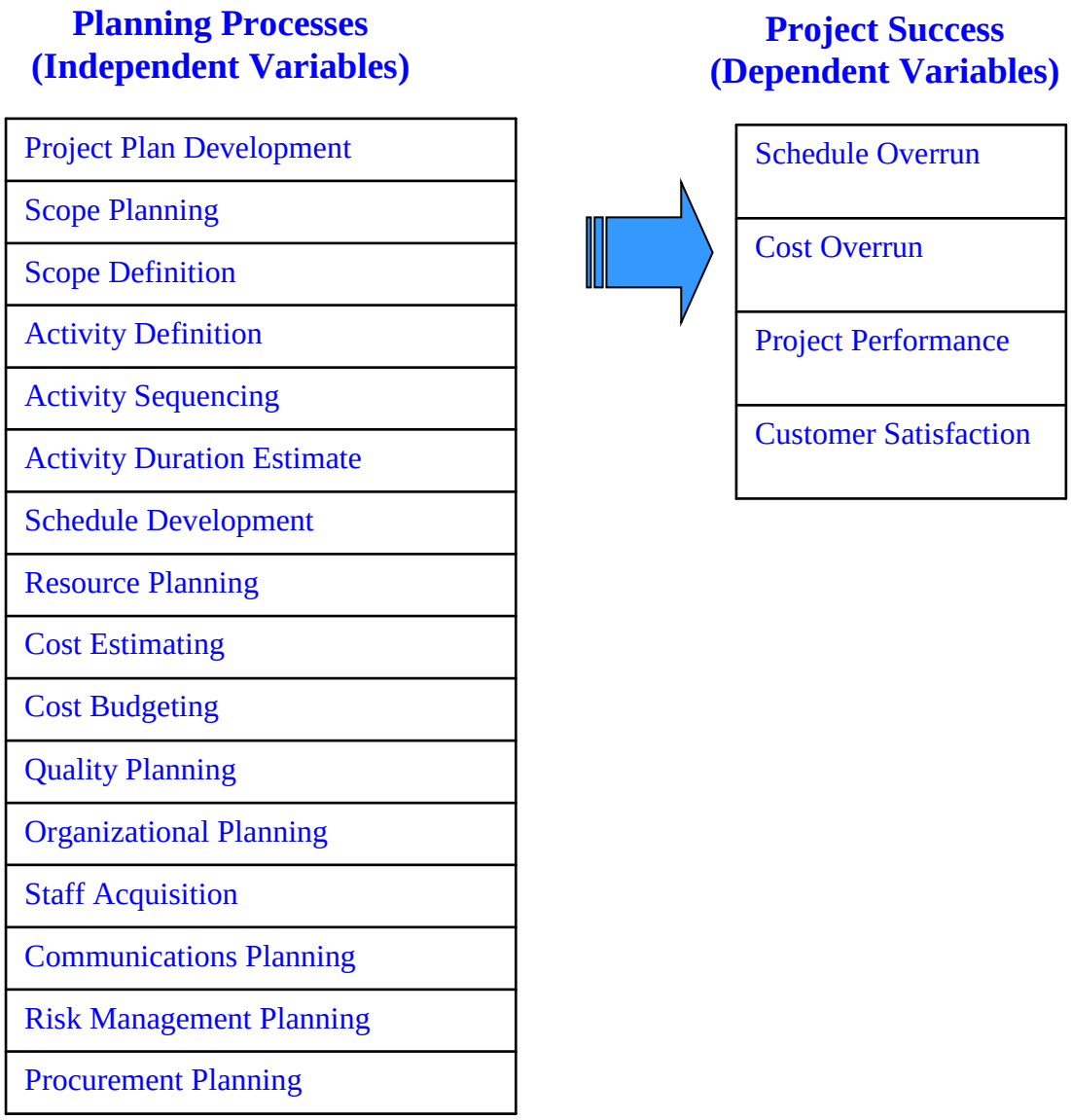

Figure 2: Sixteen Planning Processes and Four Project Success Measures

Research Hypotheses

A process may be considered as 'critical' for a project's success if its impact is greater than most of the other planning processes. Therefore, we will identify critical processes by comparing the linear coefficients coming out of multi-variable linear regressions with each of the four project success measures. Following the literary review, the following hypothesis was raised:

1. Critical Success Processes (CSP) – It is expected that different planning processes have different impacts on project success. According to literature review, processes involved with scope, schedule and quality planning have the greatest impact on project success. Hence, the first hypothesis will be phrased as follows:

H1: scope planning, schedule planning and quality planning have a greater impact on project success, compared to all other planning processes

In order to investigate whether critical success processes are actually performed in projects, project managers reported on the extent of use of 16 planning processes in their projects. We may now phrase the second research hypothesis:

2. Actual use of CSP – Project managers are unable to identify those critical planning processes that have greater impact on project success. Therefore, they do not necessarily invest more efforts in them, as compared to the other processes. In this case, project managers may choose to invest their limited time in processes that are easier to perform or are supported by friendly software. Hence, the second hypothesis to investigate is:

H2: The selection of more frequently used planning processes in projects is not based on their impact on project success.

Data Collection

Data for the model was collected via questionnaires, which were administered in about 50 different organizations in Israel. Participants came from different industries, such as engineering, construction, software development, services, etc. Together, 282 project managers completed the questionnaire. A questionnaire was included in the final analysis, if at least 80% of its data had been completed. Using the above criterion, 202 questionnaires remained for the final analysis.

Participants were requested to evaluate the extent of use of the 16 planning products outlined in *Table 2*. This was reported by using a scale ranging from 1 (low extent of use) to 5 (high extent of use). In addition, we collected data representing the following four project success dimensions: Cost overrun and schedule overrun, measured in percentages from the original plan; technical performance and customer satisfaction, measured on a scale of one to ten (1 representing low technical performance and low customer satisfaction, and 10 representing high technical performance and high customer satisfaction).

The average cost overrun was 25%, ranging from savings of 20% and up to spending 400% more than the original budget. The average schedule overrun was 32%, ranging from 5% ahead of time, up to a schedule overrun of 300%. Similar overrun findings were found in previous studies (i.e. Johnson et. al, 2001). Average scores of technical performance and customer satisfaction were around 8.

Results and Analysis

The objectives of this section are to identify the most critical success planning processes, compare their relative importance to their actual extent of use by project managers, and test the research hypotheses outlined above.

Critical Success Planning Processes

In order to identify CSP, the relative impact on project success of each planning process was calculated. A multi-variable regression was calculated using 16 planning processes (as independent variables) and one project success measure (as the dependent variable) at a time. For each run of the regression analysis, the linear coefficients (beta) were used to evaluate the importance of a planning process on a project success variable. Then, the 16 planning processes were ranked by their impact on project success. This calculation was repeated four times for all project success indices. *Table 4* ranks the impact of all 16 planning processes on each project success measure, sorted by the "cost overrun" ranking.

Project Success Measure / Planning Process	Cost Overrun n=144 R^2=0.25 F=0.002	Schedule Overrun n=171 R^2=0.17 F=0.015	Technical Performance n=190 R^2=0.23 F<0.001	Customer Satisfaction n=189 R^2=0.15 F=0.030
Activity definition	1 *	1 *	1 *	5
Schedule development	2	3	13	3
Project plan development	3	6	3	1
Procurement planning	4	12	12	12
Cost budgeting	5	4	9	9
Scope planning	6	7	6	14
Organizational planning	7	2	4	4
Activity sequencing	8	10	14	10
Quality planning	9	5	5	8
Communications planning	10	9	7	2
Risk management planning	11	15	15	16
Scope definition	12	8	11	13
Activity duration estimating	13	14	8	7
Staff acquisition	14	11	2 *	6
Cost estimating	15	13	10	11
Resource planning	16	16	16	15

* $p<0.05$

Table 4 – Ranking of the Impact of Planning Processes on Project's Success

As can be seen from *Table 4*, “activity definition” is the first CSP, since it has the greatest significant influence on three project success measures – cost overrun, schedule overrun and technical performances. This process has a lower impact on the "customer satisfaction" success measure, since the customer is not directly influenced by the exact definitions of activities in a project. This means that proper identification of a project’s activities is one of the most critical planning processes to be performed by the project manager. This finding makes a lot of sense, since if an activity is left out during the planning phase, its late inclusion afterwards may cause a strong negative impact on various aspects, such as scheduling and required budget.

The second process in Table 4 is "schedule development", which has a great impact, yet not significant, on three out of four project success measures. This process has a direct impact on schedule overrun, since it involves the planning of start and end dates for each activity of a project. This process has indirect impact on the satisfaction of the customer (who is affected by the duration of the project) and on project cost (which is impacted by project duration as well). The "schedule development" process may have a limited impact on technical performance, due to the fact that the time the activities are performed doesn't affect its performance.

The third process in Table 4 is “project plan development”. This process involves the development of a formal plan for the project, which is based on the integration of several planning processes related to duration, time, cost, risk and others. It has a great impact on all project success measures.

The next group of planning processes to discuss includes budget-impacting processes, which are “procurement planning" and “cost budgeting", which unsurprisingly have a great impact on cost overrun, but a very limited impact on technical performance and customer satisfaction.

Finally, the “activity definition” process is a significantly critical planning process. Yet, some other processes were not found to be significantly impacting project success, but are still ranked among first three processes for at least one success measure. Six planning processes meet the above definition - “activity definition”, “developing a project plan”, “organizational planning”, “schedule development”, "staff acquisition" and "communications planning".

A planning processes that hardly impact project success is “resource planning”, but still is performed in every single project. For example, activities will not be performed and the project will fail, if the definition of the required resources needed for executing activities is inadequate. In other words, this process is mandatory to the start of a project, but project success will not be improved if the project manager invests more effort in performing it.

Another low impact process is “risk management planning". Lately, this process has been frequently quoted in the project management literature, but it is rarely performed in a formal manner (Raz et. al, 2002). According to this research, the relative impact of risk management planning on project success is low, compared to other important processes the project manager has to execute during the planning phase of a project. Risk planning has a significant positive correlation only with the project’s cost overrun. This means that project risk planning is probably perceived as a cost containment tool, rather than a comprehensive technique for dealing with all aspects of the projects.

The first hypothesis of this research claimed that planning processes in the areas of scope, schedule and quality have the greatest impact on project success. Analyzing the above research hypothesis, we found that it is processes in the areas of schedule, human resources and communications that actually have the greatest impacts on project success. Unfortunately, human resources and communications project processes get very little attention in the project management literature and project management software tools.

Yet, the conclusions derived from the above results are based on equal weights that were assigned to each of the four measures of project success. If an organization decides that one certain measure is more important than the other three, the focus of project planning should change accordingly. For example, if "customer satisfaction" is selected as the most critical success measure, greater efforts must be invested in the ”communications planning” process. This process has the second largest impact on customer satisfaction (see *Table 4*), rather than on cost overrun.

After identifying CSP, it is expected that project managers will invest more effort in them, rather than in non-critical processes. The remainder of the paper will analyze this expectation by calculating the actual extent of use of each critical success process.

Actual Extent of Use of Planning Processes

In the questionnaires, every project manager was asked to report the extent of use with which planning processes were performed in his project, on a scale of 1 (low extent of use) to 5 (high extent of use). For every planning process, an average extent of use was calculated, based on all projects. The average extents of use scores for each planning process are presented in *Table 5*, in descending order.

Planning Process	Average Extent of Use (1-5 scale)
1. Activity duration estimating	4.2
2. Scope planning	4.1
3. Activity definition	4.1
4. Schedule development	4.0
5. Project plan development	4.0
6. Organizational planning	3.8
7. Resource planning	3.7
8. Staff acquisition	3.6
9. Scope definition	3.6
10. Activity sequencing	3.4
11. Cost budgeting	3.2
12. Procurement planning	3.0
13. Cost estimating	3.0
14. Quality planning	2.9
15. Risk management planning	2.7
16. Communications planning	2.3

Table 5 – The Average "Actual Extent of Use" of each Planning Process

As can be seen from *Table 5*, the most frequently used planning process - ”activity duration estimating”- is followed by “scope planning” and “activity definition”. The first and third planning processes are mandatory inputs for the use of any project management software. Even the second process, “scope planning”, is required for schedule planning, since “activity definition” is a result of “scope planning”. In advance, “scope planning” is materialized through a software package via the assignment of the WBS code. Therefore, one may conclude that planning processes, which produce outputs required for generating a proposed project schedule

via a software package, are used more intensively by project managers than other processes.

Using the logic specified above, planning processes with the lowest extent of use, such as “risk management planning” and “communication planning” are not required as inputs for formal tools such as software packages. Another possible reason for their low extent of use may be due to the lack of a relatively simple formal template to aid in implementing those processes.

Comparing the Actual Extent of Use and the Criticality of the Processes

In the previous sections, we ranked 16 planning processes according to their impact on project success (see *Table 4*) and actual extent of use (see *Table 5*). This section will compare these two measures, in order to identify those planning processes that receive too little attention, when compared to their impact on project success. In this analysis, processes that are ranked as highly impacting project success, but are ranked low in extent of use, indicate that project managers do not perform them frequently enough.

For example, the “quality planning” process, which has a moderate impact on all measures of project success, has a very low actual extent of use by project managers. This means that although the importance of this process, project managers do not use it often enough. *Table 6* summarizes the results for all planning processes.

Planning Process	Impact on Project Success Ranking				Average Extent of Use Ranking
	Cost Overrun	Schedule Overrun	Technical Performance	Customer Satisfaction	
Activity definition	1	1	1	5	3
Schedule development	2	3	13	3	4
Project plan development	3	6	3	1	5
Procurement planning	4	12	12	12	12
Cost budgeting	5	4	9	9	11
Scope planning	6	7	6	14	2
Organizational planning	7	2	4	4	6
Activity sequencing	8	10	14	10	10
Quality planning	9	5	5	8	14
Communications planning	10	9	7	2	16
Risk management planning	11	15	15	16	15
Scope definition	12	8	11	13	9
Activity duration estimating	13	14	8	7	1
Staff acquisition	14	11	2	6	8
Cost estimating	15	13	10	11	13
Resource planning	16	16	16	15	7

Table 6 – Ranking of Planning Processes by Impact on Project Success and Average Extent of Use

One may assume that project managers intuitively sense the importance of each process. However, there are some major differences between the importance of a process and its extent of use. These results in *Table 6* support the second research hypothesis, which claimed that the actual use intensity of planning processes is not based on their impact on project success. In other words, project managers do not distribute their efforts according to the potential impact that each process may have on project success.

It was found that in some processes, project managers tend to overestimate the importance of the process and spend too much effort in executing it, while in other crucial processes, they tend to spend too little effort. Project managers tend to execute easier processes more frequently, although they have a lower impact on project success, i.e. “activity duration estimating”. Generally speaking, project managers tend to spend more time on planning processes of a technical nature, since they are easy to perform. However, some of these processes don’t contribute as much to project success as the ones that require a more conceptual treatment.

The same results were found for “resource planning”. This process supports project managers in estimating the amount of labor required to complete each activity. According to the above finding, too much relative energy is consumed by this process, compared to its low impact on project success. Project managers may not take into account the likelihood that the amount of work an activity requires will change during execution, making the first estimation less valid.

On the other hand, the extent of use of the processes “communications planning" and "quality planning" is ranked significantly lower as compared to its importance on project success. The explanations for the above findings may be lack of efficient tools and know-how which is not as developed as the know-how for some of the other processes.

Finally, the impact of the "risk management planning" process on project success was found to be surprisingly low, in spite of the perceived importance of this process as claimed by many authors **(**i.e. Williams, 1995; Simon, 1997). This finding may explain the low extent of use of this process, as reported by many studies (Raz et. al., 2002; Couture & Russett, 1998; Mullaly, 1998; Ibbs & Kwak, 2000, etc.). On the other hand, this finding raises some questions regarding the great importance that project management literature has lately attributed to this process. Accepting that risk management is an important factor in project planning, we suggest that risk management is executed implicitly by every person in every activity. It resembles the application of principles, such as "minimization of cost". Although we do not mention it much, we assume that every professional strives towards achieving it.

Differences among industries

Since results presented in previous sections of this paper may differ among industries, we further analyzed the data according to the following three industries: engineering, software development and services organizations. Searching for differences among them, we found some unique characteristics as presented in Table 7.

Planning Process	Overall Results	Engineering industry	Software industry	Service industry
Activity definition	+	+	+	
Schedule development	+	+	+	
Project plan development	+	+	+	+
Procurement planning				+
Cost budgeting		+		+
Scope planning			+	
Organizational planning	+		+	
Activity sequencing		+		
Quality planning				+
Communications planning	+			+
Risk management planning				
Scope definition		+		
Activity duration estimating			+	
Staff acquisition	+		+	
Cost estimating		+		
Resource planning			+	+

Table 7 – Processes that were identified as "Critical Planning Processes" for the whole sample and for each industry.

From Table 7 we can derive the following conclusions:

1. "Project plan development" is a Critical Success Process for all the investigated industries. Hence, a reliable project plan should be developed and approved, regardless of the industry.
2. Two "Time" processes, namely "activity definition" and schedule development" were found to be CSP in all industries, except for the service industry. These processes are the core when developing a Gantt chart, which is performed by most project managers and have a positive impact on project success.
3. The uniqueness of the service sector is expressed by CSP, such as "quality planning" and "communications planning". The relative importance of these two may result from the unique characteristics of the service sector, which requires heavy interaction with stakeholders.
4. The unique CSP for the engineering industry include "cost planning" and "scope definition". The high importance of these CSP may result from the competitive nature of projects executed in this industry.
5. Software development organizations place high importance on "resource planning". This emphasis may come from lack of resources, which force project managers to invest more planning efforts in this process.

Conclusion

Not all of the 16 project planning processes analyzed in this study and included in the PMBOK have an equal impact on project success. The six processes with the highest impact include “definition of activities to be performed in the project”, “schedule development”, “organizational planning”, "staff acquisition", "communications planning" and “developing a project plan”.

By far, the identification of project's activities is the most significantly critical planning process. This process is part of the "Schedule" knowledge area and is detailed described in the project management literature. In order to correctly execute this planning process, a project manager has to own a Work Breakdown Structure (WBS) and a project management plan. Then, decomposition is required, subdividing the project work packages into smaller, more manageable components, called activities. The activity definition process defines the final outputs as schedule activities rather than as deliverables, as is done in the WBS (PMI, 2004). Implementing these steps in performing this process in every single project may increase the chance of project success.

The two low impact processes include: “risk management plan” and “resource planning”. Obviously, it is impossible to execute a project without performing these processes. One may also assume that the above processes may be performed in different ways by each project manager, without his awareness concerning their actual execution (for example, developing a risk management plan without applying the formal risk management approach). Yet, expanding the efforts invested in these processes may not contribute to project success, when compared to the expanded efforts relating to the critical processes.

Analyzing the project managers' efforts, it was found that project managers usually do not divide their time effectively among the different processes, when applying a "cost benefit analysis". For example, too much time is spent on "resource planning", while too little time is spent on conceptual processes, such as "quality planning" and "communications planning". Based on the findings of this paper, a project manager may consider a different distribution of effort among the planning processes, leading to improved overall effectiveness of the planning processes in a project environment.

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Appendix A - Project Planning Assessment Questionnaire

For each planning product written, please mark the most suitable answer referring to the projects you were recently 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 involved in
B - I do not know whether the product is obtained

Planning Product	***Never***				***Always***	**Irrelevant**	**Do not know**
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. List of 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