Benchmarking of Project Planning and Success in Selected Industries

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Abstract

Purpose

To identify the industry in which projects are best planned and executed and use it as a benchmark for improving project planning in other industries.

Methodology

Based on data collected from 280 project managers, project success and quality of project planning were evaluated and analyzed for four industries - construction & engineering, software & communications, services and production & maintenance.

Findings

Quality of project planning was found to be the highest in construction and engineering organizations and the lowest in manufacturing organizations. This is a result of a few factors, among them the intensive organizational support which is offered to project managers working in construction and engineering organizations. The other three industries limit their support mostly to tactical aspects, such as the purchasing of project management software. The high quality of project planning in the construction and engineering organizations resulted in their ability to complete projects by almost half the cost and schedule overruns, as compared to organizations

belonging to the other industries. Finally, results of the industries in Israel and Japan are compared and analyzed.

Research limitations

Findings are limited to the four industries included in the study.

Practical implications

If organizations, not belonging to the construction industry, wish to improve the probability of success in project planning and execution, they should follow methodologies commonly used in the construction industry.

The value of the paper

The paper introduces a valid field study, exploring project management practices in four industries and identifies the one which may be used as a benchmark for the others. It also identifies specific strengths and weaknesses in project management within the explored industries.

Introduction

Different industries face different challenges while managing projects. For example, software development organizations have to deal with high technology uncertainty, while construction organizations are usually more troubled with engineering or finance problems. Moreover, same processes may have different boundaries in some industry types (Plemmons & Lansford, 1994). These differences end with as much as 30% in project cost and schedule among industries (Lavingia, 2001).

Benchmarking is efficient and frequently used in the project management environment. For example, when building the Hasbro Children's Hospital in the early 1990s benchmarking "best-in-practice" pediatric facilities was used. The planning team visited a number of notable children's hospitals, and then shared findings with other teams. Hasbro's success at incorporating the best processes resulted in the hospital becoming a benchmark partner for other institutions (Egan, 1996). Bombardier Inc. used benchmarking in information technologies projects. By pinpointing problems, the firm saved an estimated $5 million to $6 million on its annual data center costs alone, or about 1/3 of its data center budget (Buckler, 1994). The companies included in Benchmark Capital's portfolio improve their projects by working cooperatively and benchmarking; instead of compete with one another (Asadullah, 1999). Benchmarking was also introduced in the project management environment for the fiber optic networks industry (Bachhiesl, et. al., 2003) and project management re-use (Cooper, 1993). Finally, Stork (1997) suggests focusing on effectiveness rather than efficiency when benchmarking for project purchasing.

A common notion presently used in benchmarking organizational capabilities and analysis differences among industries is called "maturity". There are methods to evaluate company's maturity, either in general managerial capabilities, for example Capability Maturity Model (Paulk, et. al., 1995) or in specific areas, such as project management i.e. Organizational Project Management Maturity Model (PMI Standards committee, 2004), Project Management Maturity Model (Ibbs & Kwak, 2000), Project Management Assessment (Lubianiker, 2000), etc. These models can be used to compare project management capabilities and for benchmarking among countries (i.e. Dutta et. al., 1998; Dey, 2002), among industries (i.e. Ibbs & Kwak, 2000) or among organizations (i.e. Paulk et. al., 1993; Milosevic, et. al., 2001).

In recent literature, Engineering and construction organizations were found to have high maturity levels and capabilities of performing project processes (i.e. Pennypacker & Grant, 2003; Ibbs & Kwak, 2000). The main reasons for these results are leadership, information sharing and degree of authorization (Cooke-Davies & Arzymanow, 2002). High-tech manufacturing and telecommunications organizations also score high in project management capabilities (i.e. Pennypacker & Grant, 2003; Ibbs & Kwak, 2000). Telecommunication organizations especially excel in managing multi projects (Cooke-Davies & Arzymanow, 2002).

The findings regarding the information systems industry is ambivalent. In some researches, organizations belonging to that industry score the lowest (Pennypacker & Grant, 2003); while in others they achieved high project management performances (Ibbs & Kwak, 2000). Another interesting finding is related to the maturity level of the ownership nature of the company (Mullay, 1998).

This paper focuses on the study of the differences among the industries, when performing the planning stage of projects. Project planning is a very critical stage during the project life cycle, since if planning is faulty; a proper execution following the approved plan will end with a faulty project.

Studies have identified planning as one of the critical success factors in a project (i.e. Pinto & Slevin, 1989; Meredith & Mantel, 1995; Johnson et. al., 2001 etc.). Thus, high-quality planning increases the chances that the project will be properly executed and completed. Responsibility for planning lies with the project manager, who must ensure that it is carried out properly, and to the complete satisfaction of all relevant stakeholders.

Research Hypotheses

Literature review presented above, introduced vast use of benchmarking in the project management environment. Much of these researches were focused on the differences in project management capabilities among industries. Since this paper is focused on project planning, hypotheses were based on previous findings and were adapted to the planning phase. The main question to be tested in this paper is whether differences found among industries exist in the planning phase as well.

Following the above discussion, the following four hypotheses are raised and tested as part of this study:

1. Construction and engineering organizations plan their projects better than other organizations.
2. Construction and engineering organizations succeed in their projects better than other organizations.
3. Production & maintenance organizations plan their projects worse than other organizations.
4. Production & maintenance organizations succeed in their projects less than other organizations.

The study uses the Project Management Planning Quality (PMPQ) model, which was recently introduced by Zwikael & Globerson (2004), for analyzing the use of project planning process in each industry type. The next section describes the model briefly, followed by data analysis.

The PMPQ model

The PMPQ model evaluates the overall quality of project planning. It is based on the processes to be performed during the planning phase of a project, by both the project manager and the organization to which the project manager belongs to. The model analyses project planning processes that are defined by the Project Management Body of Knowledge (PMI Standards Committee, 2004), which is recognized as the main body of knowledge in the project management area, and is accepted as a standard by the American National Standard Institute (ANSI). It is assumed that the more frequent a certain process is performed by an organization, the more competent the organization is in that process. Since a process has products to be achieved at its end, a major product was identified for each of 16 planning processes. For example, the major product that project managers should generate as an output for the “scope definition” planning process is a Work Breakdown Structure (WBS) chart. The frequency, in which a planning product is generated, is easy to estimate and, therefore, was used to estimate the frequency in which a process is performed – the maturity level of that organization on that specific process. Yet, the quality of planning is not impacted only by processes that are performed by a project manager, but also depends on organizational support. Therefore, the second group of items in the PMPQ model includes 17 organizational support processes.

All together, there are 33 products in the PMPQ model. A questionnaire was used for collecting the required data. Participants were requested to evaluate the use intensity of the planning products, by using a scale ranging from one (low use intensity) to five (high use intensity). Participants were also requested to evaluate 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 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 derived from the model, with the projects' success, as estimated by a separate set of questions. It was found that quality of planning 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 1. 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**

Table 1 – 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.

Data Collection

The questionnaire was administered to 282 project managers in Israel, in 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. The other 10 workshops were open to project managers from different organizations. A questionnaire was dropped from the final analysis, if less than 80% of its data has been completed. Using this criterion, 201 questionnaires remained for the final analysis. Based on these questionnaires, an analysis of project results and the use intensity of different project processes are described below.

Results and discussion

The questionnaires were divided into the following four industries: Construction & Engineering (i.e. building companies), Software & Communications (i.e. telecommunications companies), Services (i.e. banks) and Production & Maintenance (i.e. food industry). In this section, the use intensity analysis of the planning processes will follow the comparison of project success among the industries.

Project Success Analysis

This section introduces overall success results followed by a comparison among the four industries. The analysis of technical performances and customer satisfaction indices will follow the analysis of cost and schedule performance of projects.

Cost and Schedule Overruns. The average cost overrun quoted by the participants 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%. The frequency distribution of cost and schedule overrun is presented in Figure 1.

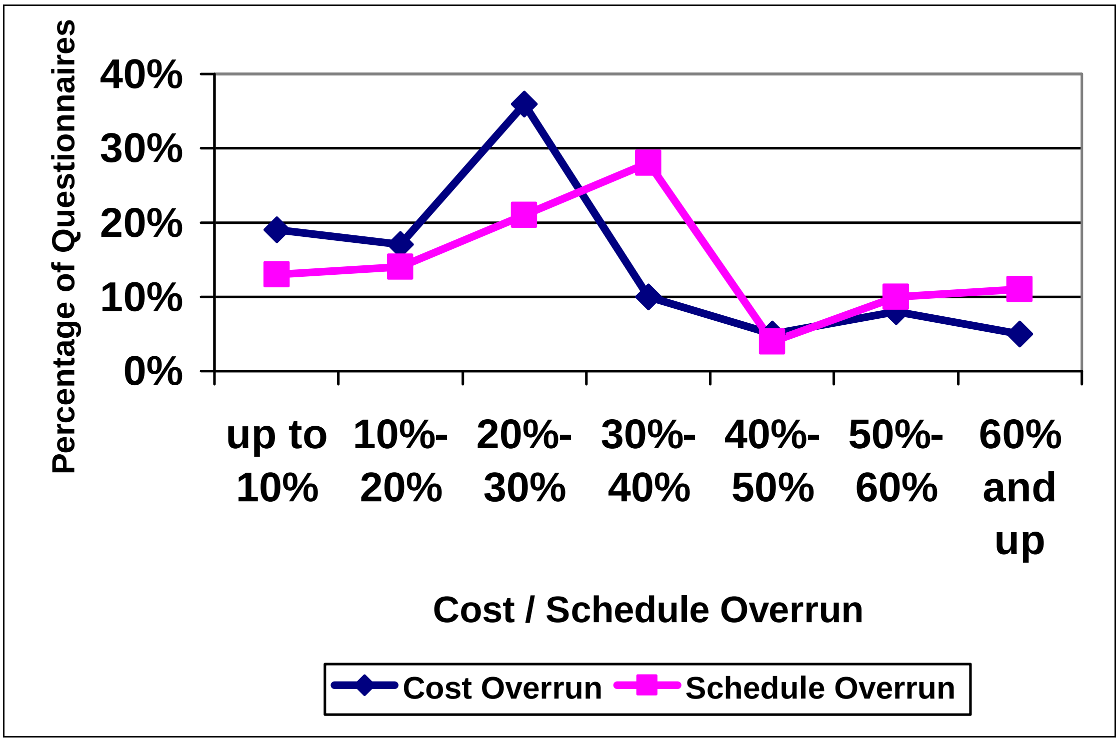

Figure 1 – Frequency Distribution of Cost and Schedule Overrun

Most project managers reported cost deviations within the range of 20% to 30% and 30% to 40% in duration deviation, while a few showed significantly larger deviations, thus leaving a long tail at the right side of the graph representing overruns. Similar overrun findings were found in previous studies (i.e. Johnson et. al, 2001). The R square to the linear correlation between cost as the dependent, or the effected, variable and schedule overrun as the independent one was found to be 0.57 (p value< 0.001), showing a strong relationship between the two, with the following linear equation between the two:

Cost Overrun = 0.76 * Schedule Overrun

The interpretation of the equation shown above is that the value of the cost overrun is 76% of the schedule overrun, when the two are presented in percentages. A major reason for the relationship between increase in duration and cost increase stems from the additional cost required for the supporting the required infrastructure; as long as a project is running it requires a certain infrastructure per unit of time. Such infrastructure items are the project manager, quality assurance support, data processing support and so on. A good example is a crane in a construction site; as long as construction is going on, the crane is needed. In other words, a significant portion of the infrastructure resource is paid per unit of time. The above finding is also supported by previous findings (i.e. Chittister & Haimes, 1996).

Technical performance and customer satisfaction. Both measures are of a similar frequency pattern, as presented in Figure 2.

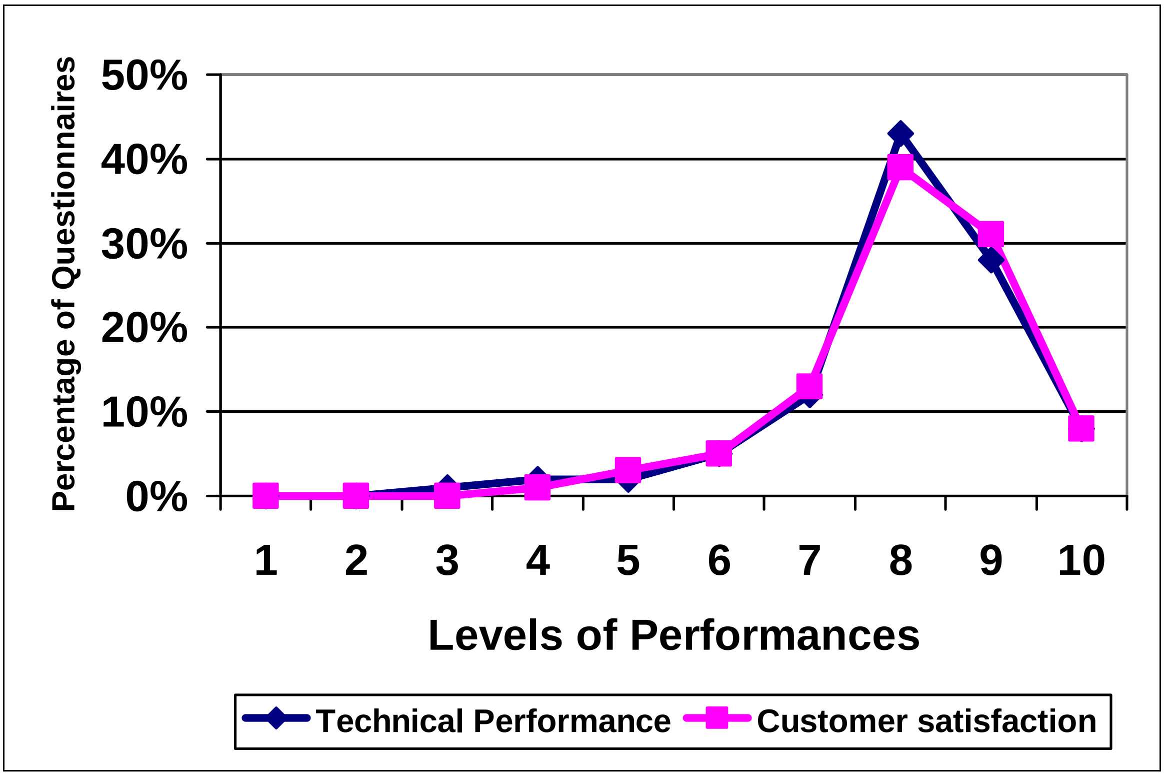

Figure 2 – Frequency Distribution of Technical Performance and Customer Satisfaction

The horizontal coordinates represent the performance level of either technical performance or customer satisfaction, on a scale of 1 to 10, where "1" is the lowest level. The distributions of both are of a similar nature with an average of around 8, which is considered a high performance level. The R square to the linear correlation between technical performance and customer satisfaction was found to be 0.37 (p value< 0.001), showing a strong relationship between the two.

The high score on these two measures, as compared to the relatively poor performance on cost and schedule, points out that customers may be more interested to achieve high technical performance rather than to keep the project on schedule and without cost overrun.

In order to explore the differences in project success among the industries, results were separated accordingly and are presented in Table 2.

Industry Type	**Number of Questionnaires**	**Cost Overrun (%)**	**Schedule Overrun (%)**	**Performance Envelope (1-10 scale)**	**Customer Satisfaction (1-10 scale)**
Construction & Engineering	35	17%	19%	8.1	8.1
Software & Communications	98	27%	33%	8.2	8.3
Services	58	23%	27%	8.3	8.3
Production & Maintenance	10	26%	32%	7.9	7.9

Table 2: Project Success Indices for Four Industry Types

As can be observed from Table 2, construction & engineering organizations finish their projects with significantly (p-values<0.01) lower cost and schedule overruns, compared to other organizations belonging to the other three industries. These results fit findings quoted of other studies (e.g. Pennypacker & Grant, 2003; Ibbs & Kwak, 2000), in which construction & engineering organizations have the highest level of project maturity.

Software & communication organizations, as well as services ones, usually do not reach cost and schedule targets. However, performance envelop of their projects is relatively high and their customers are more satisfied. These results may derive from the customer service orientation of these companies.

Production & maintenance organizations were found to be the poorest performer in all four criteria, which may result from the fact that projects are not part of the regular operation of such companies as they focus on operations. The next section will evaluate the ability of companies within each industry to plan the project, and relates their planning ability to their end results in project execution.

Planning Processes Analysis

The quality of planning was calculated as the weighted average of the frequency in which each of the 33 planning products was executed, as execution frequency is an indicator of quality of planning. Figure 3 presents the quality of planning of the four industries.

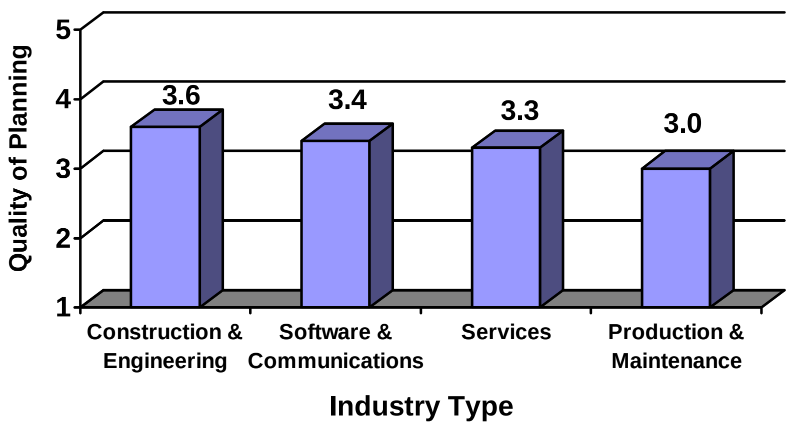

Figure 3: Quality of Planning, by Type of Industry

Similar performance ranking on project's success that was found among industries was repeated in ranking the industries on the level of quality of planning. Construction and engineering organizations, which scored the highest on project success, also obtained the highest score on quality of planning. Production and maintenance organizations, which scored the lowest on project success, received the lowest quality score as well. This performance deviation among the industries is probably due to the difference in the nature of their operations. While construction and engineering companies are project oriented, as most of their work involves initiation and execution of new projects, production and maintenance organizations are engaged mostly with day-to-day operations, and their planning is oriented to that rather than to project planning.

It may be surprising to note that despite a high quality level of planning in software & communications organizations, these organizations still often conclude projects with poor results. The reason for this may be due to a riskier technology and environment, poor control or too ambitious commitments taken during the initiation phase.

Although the data in Figure 3 shows possible differences among the industries, a statistical analysis should be used for reliable analysis. A cluster analysis was performed for this purpose. The p-values that support a significant difference between two industry types was calculated using t-tests are presented in Table 3.

Industry Type	**Construction & Engineering**	**Software & Communications**	**Services**	**Production & Maintenance**
Construction & Engineering	-			
Software & Communications	**0.04**	-		
Services	0.07	0.49	-	
Production & Maintenance	**0.003**	**0.02**	0.49	-

Table 3: p-values representing Differences in Quality of Planning among Four Industry Types

The cluster analysis places the construction & engineering organizations as the leaders in project planning, and the production & maintenance organizations as the ones having the worst quality of project planning.

The analysis described in this paper was repeated for a cluster of eleven organizations in Japan, with the participation of 88 project managers from those companies. Sixty of the project managers were from software organizations, 19 more from production organizations and nine others from other organizations. The next paragraphs will compare project results and quality of planning in both countries and analyze the findings.

Cost and schedule overruns in Japanese production organizations were the highest among production organizations (20% and 10% respectively) and lowest among Software & communications organizations (5% and 3% respectively). While the ranking is similar to the ones found in Israel, the values are quite different between the countries. Average overruns in Japan are significantly lower than in Israel and may be a result of the importance of meeting objectives, as is reflected in the Japanese culture.

Japanese production organizations also scored lower in the quality of planning, compared with software organizations, although results came out statistically non-significant due to the small number of questionnaires addressed in Japan. Still, industry ranking found in Israel, was identical to the one found in Japan, serving as an indication that the above finding may be a general one and not dependent on culture.

Project Manager's Expertise versus Organizational Support Analysis

Since quality of planning indication is a combination of two major groups, “manager's expertise” and “organizational support”, it is of interest to analyze the relative impact of each. Table 4 introduces the overall quality of planning and the contribution of each group, for each industry.

Industry Type / Planning Component	CE	SC	SE	PM	Average
Overall quality of planning	3.6	3.4	3.3	3.0	**3.3**
manager expertise group	3.4	3.3	3.5	3.1	**3.3**
organizational support group	3.8	3.5	3.2	3.0	**3.4**

Table 4: Quality of Planning Scores

The following abbreviations were used in Table 4:
CE - Construction & Engineering
SC - Software & Communications
SE - Services
PM - Production & Maintenance

It was found that both construction & engineering and software & communication industries derive their project planning strength from the "organizational support" group ($p<0.01$). This means that in the organizations belonging to theses industries, management is highly involved in the planning phase of projects. The reason for this may be the strategic importance of projects in these organizations.

In both service and production & maintenance industries, the quality of the organizational support group was found to be significantly lower than the quality of manager's expertise group ($p<0.01$). These organizations do not view projects as their core business, the number of projects being performed in these organizations is small and they rely heavily on the individuals that run the projects. This means that the level of success of projects in these organizations depends mostly on the qualification of the project manager, who receives very little organizational support.

After analyzing the overall quality of planning, major findings in each of the two groups (manager's expertise and organizational support) will be presented and their impact on the four industries will be analyzed.

Analysis of the Manager's Expertise Processes

Manager's expertise processes are performed by project managers and are consist of the nine knowledge areas specified in the PMBOK. Table 5 presents the average quality of planning scores for each project knowledge area and the standard deviation (in brackets) for each industry type.

Industry Type / Knowledge Area	CE	SC	SE	PM	Average
Integration	4.0 (1.1)	3.8 (1.1)	4.5 (0.8)	3.9 (1.0)	**4.1 (1.0)**
Time	4.1 (0.8)	4.0 (0.7)	4.2 (0.5)	3.7 (0.8)	**4.0 (0.7)**
Scope	3.9 (1.0)	3.9 (0.8)	4.2 (0.5)	3.6 (0.9)	**3.9 (0.8)**
Human Resources	4.0 (0.8)	3.8 (0.8)	3.5 (0.6)	3.4 (1.0)	**3.7 (0.8)**
Cost	3.3 (1.0)	3.4 (1.0)	3.4 (0.7)	3.1 (0.9)	**3.3 (0.9)**
Procurement	3.2 (1.3)	2.9 (1.2)	3.0 (0.6)	2.9 (1.2)	**3.0 (1.1)**
Quality	3.1 (1.2)	2.9 (1.2)	2.7 (0.8)	2.8 (1.2)	**2.9 (1.1)**
Risk	2.4 (1.0)	2.8 (1.3)	3.1 (0.9)	2.5 (1.3)	**2.7 (1.1)**
Communications	2.3 (1.1)	2.3 (1.2)	2.6 (1.2)	2.3 (1.1)	**2.4 (1.2)**
Average	**3.4 (1.0)**	**3.3 (1.0)**	**3.5 (0.7)**	**3.1 (1.0)**	**3.3 (0.9)**

Table 5: Quality of Planning Scores and Standard Deviation by Knowledge Areas

The following abbreviations were used in Table 5:
CE - Construction & Engineering
SC - Software & Communications
SE - Services
PM - Production & Maintenance

It was found that the highest quality of planning was done by project managers from the service industry, while organizations belonging to the production & maintenance industry perform planning in the lowest quality.

The quality of “Cost” and “Procurement” planning was found to be of a similar magnitude for all industries. This may be a result of the high importance of financial aspects in all organizations. The fact that a knowledge area such as “Time” obtained a score higher than “Cost”, is probably due to the simplicity of dealing with planning of time as compared to planning of cost.

The largest difference in planning quality among industries was identified in the “Risk” knowledge area. The poor quality in this knowledge area may result from lack of simple supporting tools to analyze and manage the processes including in this area. A large difference in the quality of “Integration” planning was found as well. This may result from the nature of integration, which requires a joint organizational effort, as it is impossible to obtain if a company does not maintain an appropriate infrastructure for project management organizational support.

The structure of the model, where each knowledge area contains several planning products, allows identifying the strongest and weakest products for each industry. For example, the weakest planning process in the construction & engineering industry is “risk management plan”. This may result from the nature of construction projects, which are mistakenly perceived as not risky, and are typically managed by individuals who may not have the same mathematical background as project managers from the High-Tech. industry.

In the production & maintenance industry, the use of WBS was found to be the major problem. Since WBS is part of scope planning, this may explain the poor performance of projects in this industry.

Analysis of Organizational Support Processes

A similar analysis was performed for the organizational support group. "Organizational systems" and "Organizational cultures" areas are considered to contain strategic support, such as project oriented organizational structure or selecting the right project manager to fit the characteristics of the project. "Organizational structure" and the "Project office" areas include tactical support, such as ongoing project management training or establishing a project office.

Table 6 presents the average score and the standard deviation (in brackets) for the four organizational support areas.

Supporting Area	CE	SC	SE	PM	Average
Organizational Systems	4.2 (0.9)	3.8 (0.9)	3.3 (0.9)	3.0 (1.1)	**3.6 (1.0)**
Organizational Cultures and Styles	3.8 (0.6)	3.6 (0.7)	3.8 (0.7)	3.2 (0.7)	**3.6 (0.7)**
Organizational Structure	3.4 (0.8)	3.2 (0.7)	3.0 (0.7)	2.7 (0.8)	**3.1 (0.8)**
Project Office	3.7 (1.1)	3.1 (0.9)	2.8 (0.8)	2.9 (1.2)	**3.1 (1.0)**
Average	**3.8 (0.9)**	**3.5 (0.8)**	**3.2 (0.8)**	**3.0 (0.9)**	**3.4 (0.9)**

Table 6: Average and Standard Deviation of Quality of Planning for the Organizational Support Areas, by Industry Type

The following abbreviations were used in Table 6:
CE - Construction & Engineering
SC - Software & Communications
SE - Services
PM - Production & Maintenance

In general, the two strategic areas obtained significantly higher scores than the tactical ones ($p<0.001$). The only tactical support process, which is properly supported by the industries, is the purchasing of project management software. In other words, with the exception of construction & engineering organizations, all other industries still do not fully understand the importance and the impact of equipping project managers with proper support, as a mean to impact project success.

As can be observed from Table 6, the organizational support group is more stabilized than the manager's expertise group previously presented, and the ranking of industries is not impacted by the specific supporting area. For example, construction & engineering organizations acquire the best planning quality in all four supporting areas. It means that once an organization decides that it is vital to support projects properly, it supports both strategic and tactical processes.

Drilling down the analysis of the organizational support group, the strongest and weakest products were identified for each industry. The issue of risk management appears once again as a weak one in the construction & engineering industry. Lack of support for the application of organizational risk management in these organizations obviously contributes to the finding indicating the absence of a risk management planning process performed by their project managers.

The weakest process in the software & communications industry is the lack of available data on previous projects. It indicates poor learning processes in these organizations. One possible explanation for this finding may be meaningful differences among projects in this industry. Hence, the motivation for data collection reduces, while the similarity between projects reduces.

The low quality of planning and project results in the production & maintenance industry is probably derived from the fact that no supportive organizational structure exists for projects in this industry, as reflected in the industry’s nature.

Conclusion

By analyzing the quality of project planning in different industries, it was found that construction and engineering organizations maintain the highest quality of planning, both in the organization level and the project manager level. It is probably due to the project-oriented nature of these organizations. Its greatest weakness is risk management, which may stem from lack of managerial know-how. The other extreme industry is production and maintenance organizations, which plans their projects at the lowest level of quality, perhaps due to the difficulty they have in comprehending the basic difference between managing a project and carrying out their day-to-day tasks.

The organizational support processes were found to have a great influence on the quality of the processes performed by project managers. An organization that does not make enough effort to support its projects gets in return low-quality project plans, such as the situation in the production and maintenance industry. On the other hand, construction and engineering organizations that support projects effectively, obtain higher quality project plans from their project managers.

A correlation between the quality of planning and the success of the project at its conclusion was also found. For example, construction and engineering organizations have the greatest project success, compared to other industries. Finally, the impact of improving project plan may improve project management at the entire life cycle of the project. Once processes are performed correctly at the planning phase, it will be easier for the project manager to continue manage the other project phases at the same level of quality, until the project's successful conclusion.

References

- Asadullah, A. (1999). "High roller: Bob Kagle, Benchmark Capital", Upside. (U.S. ed.). Foster City: Jan., Vol. 11, Iss. 1, p. 128.
- Bachhiesl, P., Prossegger, M., Paulus, G., Werner, J., Stogner, H. (2003). "Simulation and Optimization of the Implementation Costs for the Last Mile of Fiber Optic Networks", Networks and Spatial Economics. Boston: Vol. 3, Iss. 4, p. 467
- Buckler, G. (1994). "Do you measure up?" I.T. Magazine. Toronto: Vol. 26, Iss. 1, p. 14-17.
- Chittister, C. G. & Haimes, Y. Y. (1996). "Systems Integration via Software Risk Management". IEEE Transactions on Systems, Man, and Cybernetics-Part A: Systems and Humans, Sept, 26, 5, p. 521-532.
- Cooke-Davies, T. J. & Arzymanow, A. (2002). "The Maturity of Project Management in Different Industries: An Investigation into Variations between Project Management models". International Journal of Project Management, 21, p. 471-478.
- Cooper, K.G. (1993). "The rework cycle: benchmarks for the project manager". Project Management Journal, 24(1), 17-21.
- Dey, P. K. (2002). "Benchmarking project management practices of Caribbean organizations using analytic hierarchy process". Benchmarking. Bradford: Vol. 9, Iss. 4; p. 326-357.
- Dutta, S., Wassenhove, L., Kulandaiswamy, S. (1998). "Benchmarking European software management practices". Association for Computing Machinery. Communications of the ACM. New York: Jun, Vol. 41, Iss. 6; p. 77-86.
- Egan, N. C. (1996). "Komiske & team put patients first at Hasbro Children's". Facilities Design & Management. New York: Vol.15, Iss. 2, p. 42-45.
- Garmezy, N., Harlow, H. F., Jones, L. V. & Stevenson, H. W., (1967). Principles of general psychology. New York, Ronald Press Co.

- Globerson, S. & Zwikael, O. (2002). "Impact of the Project Manager on Project Management Planning Processes". Project Management Journal, 33, 3, 58-64.
- Ibbs, C. W. & Kwak, Y. H. (2000). "Assessing Project Management Maturity". Project Management Journal, 31, 1, 32-43.
- Johnson, J., Karen, D., Boucher, K. C. & Robinson, J. (2001). "Collaborating on Project Success". Software Magazine, February/March.
- Lavingia, N. J. (2001). "Pacesetter project performance". AACE International Transactions. Morgantown: p. PM2.1-PM2.3.
- Lubianiker, S. (2000). "Opening the Book on the Open Maturity Model". PM Network, 14, 3, 30-34.
- Meredith J. R. & Mantel, S. J. (1995). Project Management – A Managerial Approach, John Wiley & Sons Inc.
- Milosevic, D., Inman, L., Ozbay, A. "Impact of project management standardization on project effectiveness". Engineering Management Journal. Rolla: Dec. Vol. 13, Iss. 4; p. 9-16.
- Mullaly, M. (1998). "1997 Canadian Project Management Baseline Study". Proceedings of the 29th Annual Symposium, Long Beach, CA. Newtown Square, PA: PMI, 375-384.
- Paulk, M. C., Curtis, B., Chrissis, M. B. & Weber, C. V. (1995). The Capability Maturity Model for Software, Software Engineering Institute, Carnegie Mellon University, Pittsburg, PA, USA.
- Pennypacker, J. S. & Grant, K. P. (2003). "Project Management Maturity: An Industry Benchmark". Project Management Journal, March, 4-9.
- Pinto, J. K. & Slevin, D. P. (1989). "Critical Success Factors in R&D Projects". Research Technology Management. January-February, 31-35
- Plemmons, J. K., Lansford, C. (1994). "Measuring and benchmarking materials management effectiveness". Transactions of AACE International, Vol. 1994; p. MAT2.1-MAT2.9.

- PMI Standards Committee. (2004). A Guide to the Project Management Body of Knowledge, third edition, Newtown Square, PA: Project Management Institute.
- PMI Standards Committee. (2004). Organizational Project Management Maturity Model. Newtown Square, PA: Project Management Institute.
- Stork, K. (1997). "Old mindsets may hinder benchmarking success". Purchasing. Boston: Vol. 122, Iss. 4, p. 24.
- Zwikael, O. & Globerson, S. (2004). "Evaluating the Quality of Project Planning: A Model and Field Results". International Journal of Production Research, 42, 8, p. 1545-1556.