THE BENEFITS OF PROJECT MANAGEMENT

FINANCIAL AND ORGANIZATIONAL REWARDS TO CORPORATIONS

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Executive Summary

This book summarizes the preliminary results of research sponsored by the Project Management Institute Educational Foundation and the Project Management Institute Northern California Chapter and conducted by a team from the University of California at Berkeley.

The goal of this research is to measure the influence of improvements in the application of project management tools, practices, and processes, as correlated to the project management maturity, on the return on investment for project management. Project management maturity is defined as the level of sophistication for an organization's current project management practices and processes. It does this by quantitatively examining current project management processes and practices of thirty-eight different companies and government agencies in four different industries and application areas. A project management benchmarking procedure is developed to assess the project management maturity of these different organizations. Integrated Project Systems of San Carlos, California, generously donated its project management maturity assessment questionnaire, and the University of California at Berkeley research team further amended it to meet the specific needs of this study.

The overall project management maturity for all companies is 3.26 on a relative Likert Scale of one (lowest) to five (highest). Overall, the engineering-construction industry is the most mature, and the information systems application area is the least mature. The high-tech manufacturing and information management and movement industries rank comparatively high. Nevertheless, all industries and application areas have substantial opportunity to improve.

This information is used to measure the relative sophistication and maturity of different organizations and industries in applying project management processes. Then actual cost and schedule information are collected from these organizations for recently completed, representative projects. Using a schedule index and a cost index, which measure actual performance relative to planned performance, the study shows that a positive association exists between organizations with higher project management maturity and favorable cost and schedule project performance.

These data are used to develop curves that show predicted cost and schedule performance levels for a specific project management maturity level. These resulting curves can then be used by the individual organization to estimate what project performance gains might reasonably be expected if the organization takes steps to improve its project management maturity. That information, in turn, can be used to estimate its specific project management/return on investment.

Other findings from this research relate to the level of an organization's project management maturity in project management processes and specific knowledge areas of *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*. For example, risk management and quality management are two major *PMBOK Guide* knowledge areas that need further improvement for the typical company reviewed in this study. Also, early project planning processes such as the initiating processes and the planning processes scored relatively high based on the benchmarking results of project management processes' maturity. Cost, communications, scope, and time are the four major *PMBOK Guide* knowledge areas that scored relatively high based on the benchmarking results of project management knowledge areas' maturity.

In addition, the average organization in this study spends 6 percent of its annualized project-based sales or revenues on total project management expenditures, including salaries, systems, and annualized procedures and training expenses.

Finally, recommendations of this study include the following:

- Organizations should continue project management upgrade efforts through training, system development, definition of processes, and utilization of project management tools, and so on. The study results have shown that even the organizations with the highest project management maturity scores can improve their overall project management processes.
- A continuous, industry-wide benchmarking effort should be launched to enable managers to track, over time, the results of their project management improvement efforts. Benchmarking allows an organization to identify its project management maturity in specific areas, which, in turn, permits carefully targeted investments in training, system development, hiring, and so forth.
- An "Excellence in Project Management Practice" award should be established by the project management community. This proposed award would focus on and recognize organizations that have superior project management processes. It would advance recognition of project management as an important and timely professional discipline.

This study is a significant first step in articulating and defining the characteristics of the best project management practices. The study method provides an invaluable set of tools for organizations to use in identifying key areas of opportunity for improvement in project management. The benchmarking process itself can lay out a definite path to "world class" project management capability that can yield tangible and measurable improvement in business results for your organization.

Introduction

Background and Purpose of Study

Project management, as a professional discipline, is enjoying an unprecedented wave of popularity and interest. As a result, specific project management techniques and practices of organizations have grown increasingly sophisticated. Many organizations are adopting some form of project management to improve the effectiveness and efficiency of their operations. This sudden increase in corporate appetite for project management brings with it the danger of hurriedly coming up with something that can be presented as project management, which may do more harm than good. It is essential to establish a benchmarking process for all current and future users of project management, to assess their levels of project management maturity, and to formulate ways to improve their levels of project management.

Yet, investment in and implementation of project management tools and practices are difficult to justify as are rationalizing the benefits of project management processes. Previous research in project management identified some of these benefits, albeit in qualitative and anecdotal fashion. Such benefits include meeting quality standards, fulfilling customer satisfaction, and improving organizational effectiveness. This research was, however, very general and largely unsubstantiated, which means that it was not very helpful to managers trying to answer fundamental and challenging questions regarding project management needs, advantages, and *quantitative* benefits.

The principal goal of this study is to determine the organizational and financial benefits to organizations that result from the implementation of project management tools, processes, and practices. In particular, the participants in this study were most interested in the return on investment organizations realized by investing in all aspects of project management.

This study provides a vehicle for estimating what kind of project management/return on investment improvement an organization can expect from taking certain actions to increase its project management maturity, enabling it to justify the investment of money and effort to achieve its goal. Such information will help managers better understand and respond to queries from top management about the cost effectiveness of project management. It will also help them make more prudent project management investment decisions.

This research was sponsored by the Project Management Institute Educational Foundation (PMI/EF) and the Project Management Institute Northern California Chapter (PMI/NCC) and was conducted by a University of California at Berkeley research team. Integrated Project Systems of San Carlos, California, donated the project management benchmarking questionnaire. The University of California at Berkeley research team then amended the questionnaire to meet the specific needs of this particular study.

Scope of the Study

This study takes a broad view of project management in terms of the industries and the applications areas. After lengthy consideration, the study team decided to investigate project management processes, procedures, and systems in four different industries and application areas: engineering-construction; information management and movement; information systems; and high-tech manufacturing. The study is empirical in nature. Both private and public sector organizations are examined.

Project management processes are normally investigated at a department level. The organizations are asked to provide information on *typical* project management processes and *typical* project performance.

Use of the Results

This research can be used to provide an organization with an evaluation of its project management processes relative to peer organizations. It also provides solid, comparative studies on project management practices across industries and application areas. The project management/return on investment curves that are empirically derived can be used to estimate how much cost and schedule improvement might be achieved by moving from the current project management maturity level to a higher project management maturity level.

By analyzing the size and profitability of its typical projects, a company can estimate how much more profit and schedule improvement might be realized for its own unique circumstance. Although there are many exogenous variables at work in any analysis like this, at least these results can provide an order of magnitude estimate of the potential gains.

Another use of this research is prescriptive. Reviewing the project management benchmarking questionnaire and the "high-low standards" inferred by the multiple choice answers of each question provides organizations with an independent reference point on "best project management practices and processes." These "high-low options" have been found to prod some managers independently to review and

improve their existing project management processes before the quantitative results were computed.

All of this will, consequently, help decision-makers and managers understand and evaluate project management practices better and help promote project management in their organizations.

Structure of the Report

Chapter 1 explains the background and purpose of the study. It also describes the study's scope and the structure of the report.

Chapter 2 discusses the research methodology used in this study. A brief literature review of previous project management-related research is included, and project management knowledge areas and project management processes are defined. An explanation of how the project management benchmarking questionnaire was developed, tested, and applied to measure project management maturity levels in companies is included. Also, the five-level project management process maturity model is presented to locate and understand an organization's levels of project management sophistication more effectively.

Chapter 3 describes the quantitative, comparative project management maturity results. This is done for organizations on an overall basis as well as for maturity levels in terms of project management knowledge areas and project management processes.

Chapter 4 explains the project management/return on investment findings. First, the results of two correlation analyses between project management maturity levels and project cost and schedule performance indexes are presented. The methodology to derive an order-of-magnitude project management/return on investment are then presented.

Chapter 5 was written by Jim McFarlin, vice president of ABT Corporation, and Dan Ono, PMP and national project director of Lucent Technologies-BCS. They used the results of Chapter 4 to present a business perspective of this research.

Finally, Chapter 6 summarizes the key findings and recommendations of this research and suggests future directions for research and development.

CHAPTER ONE
Research Methodology

Literature Review

Project Management Basics: Knowledge Areas and Processes

Project management is defined as the application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholders' needs and expectations from a project. When this study was initiated in 1995, the study team used *Exposure Draft of a Guide to the Project Management Body of Knowledge (PMBOK Exposure Draft)*, which was published in August 1994, as a primary reference. Therefore, the study team was unable to include project integration management, which later became one of the project management knowledge areas. Also, the study team decided to include additional project management processes called project-driven organization environments that sustain project-driven organizations. As a result, a project is viewed as having six project management processes and eight knowledge areas, almost consistent with the Project Management Institute's *PMBOK Guide*, published in 1996.

These six project management processes and eight project management knowledge areas are used to analyze project management maturity in detail later in the study. (See Figure 1-1 and 1-2.)

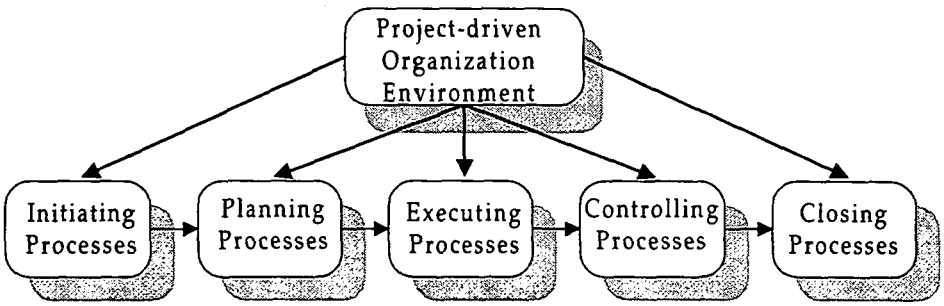

Figure 1-1. Six Project Management Processes

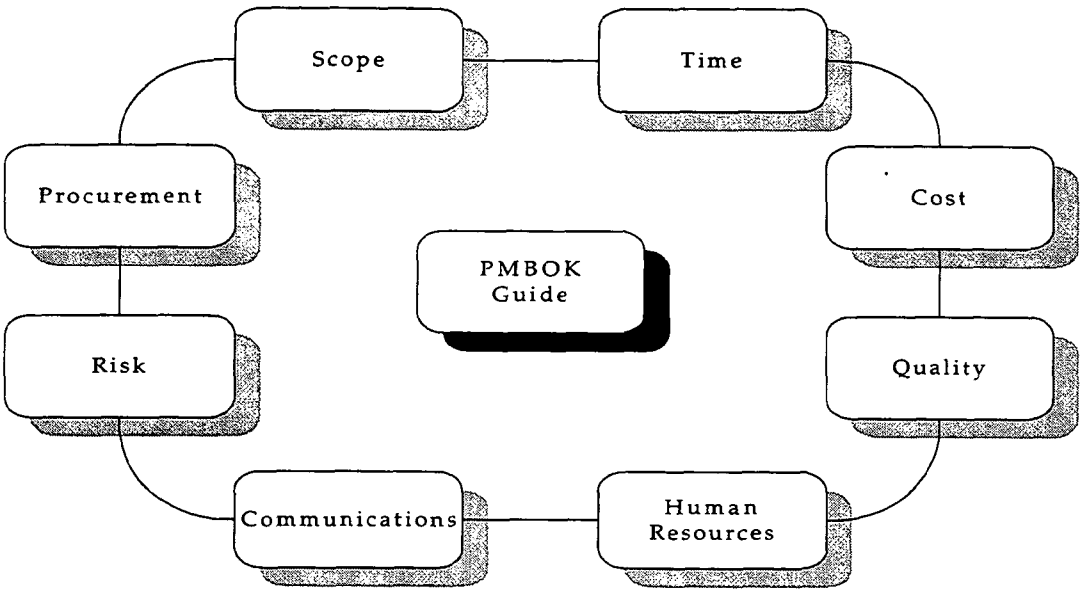

Figure 1-2. Eight Project Management Knowledge Areas

Project Management Benefits

Previous research on the benefits of project management is limited. Most of the prior works are quick surveys of the perceptions of corporate managers, academics, or other industrial professionals. They tend to focus on the application of project management practices and tools rather than a rigorous study of the project management/return on investment (Al-Sedairy 1994; Boznak 1988; Bu-Bushait 1989; CII 1990; Cleland 1993; Deutsch 1991; Gross 1990; Kerzner 1987; Ziomek 1984). None of them examine an organization's project management processes or practices in detail. Other works focus on the productivity impact of applying a project-driven organizational structure. They examine the relation between organizational structures and organizational productivity by comparing functional and matrix organizational structures (Donnelly 1993; Gobeli 1986; Larson 1989; Lundin 1994; McCollum 1991; Might 1985).

Neither of these two groups of studies really answers the question of what is the project management/return on investment (McFarlin 1995).

Benchmarking

Many different industries are benchmarking to evaluate current practices and performances. The automotive industry (Womack, Jones and Roos 1991) and semiconductor manufacturing sector (Berkeley 1993) are prime examples of efforts to measure performance factors in terms of production time, cost, and quality. The

engineering and construction industry (CII 1990, 1995, 1996; Russell 1992) has collected and compared metrics such as schedule, cost, change incidence and impact, customer satisfaction, safety, and design objectives. The software development sector has benchmarked the relationship between organizational productivity and the financial impact of implementing a category of software called "groupware" in different organizations (Henry, Blum and Salloway 1992; IDC 1994).

The objective of the project management benchmarking study is to collect an organization's best project management practices information and to compare it with other leading organizations to improve the organization's project management effectiveness. Many previous studies support the advantages of using benchmarking to improve an organization's or industry's effectiveness. The study team therefore concluded that we should develop and use our own benchmarking procedure, not only to analyze current project management/return on investment but also to provide a tool that can be used in the years to come for such peer comparisons.

Research Methodology and Research Hypothesis

The study team met several times and discussed general approaches to measuring the project management/return on investment. Collectively, the sentiment of the study team was that the research needed to be academically credible and impartial; thus, the study team concluded that it was important to develop and test a research hypothesis.

Several prospective hypotheses were reviewed and debated over the course of several subcommittee team meetings before the following hypothesis was selected:

Hypothesis H_0: There is a positive correlation between an organization's level of project management maturity and its actual project performance.

There are other important quantitative relationships related to the benefit of project management, but the study team determined that this particular hypothesis is testable and that it more than adequately represented the principal objective of the study.

The next step of the research was to develop a rigorous and comprehensive project management benchmarking process that could be used to assess and evaluate the maturity of project management processes and practices among different industries. The project management benchmarking process made use of a very comprehensive and detailed questionnaire for data collection. Integrated Project Systems of San Carlos, California, generously donated its proprietary benchmarking questionnaire (1995). The University of California at Berkeley researchers further reviewed and amended this questionnaire to meet the specific needs of this particular study.

The objective of the three-part project management benchmarking questionnaire is to collect information effectively and efficiently about an organization's general information, its project management maturity level, and one of its recent, representative projects and that project's cost and schedule performance.

This three-part benchmarking questionnaire was developed and modified to capture the essence of the project management processes and the practices of an organization. It is used to evaluate precisely an organization's current project management level in an overall sense as well as according to the eight project management knowledge areas and six project management processes. The project management maturity levels are defined as a one to five Likert Scale, with a one being the lowest level of project management maturity and a five being the highest level. Some of the information collected in part one included organizational information such as size, product focus, and years of project management practices.

Table 1-1 shows the distribution of the project management benchmarking questionnaire breakdown. The numbers in the cells of this spreadsheet show how many questions for that project management knowledge area—project management processes combination—were contained in the questionnaire.

There are 148 multiple choice questions in this questionnaire. An example of the detail and rigor of each question is illustrated with Question #56.

Question #56: How a Schedule's Critical Path Is Identified.

No critical path calculation done. Each sub-project identifies critical tasks independently and sets work priorities..... 1
Critical path based on committed milestone dates. No critical path method calculation performed, or critical path method used on individual sub-projects.... 2
Key critical tasks identified through non-quantifiable means and used to drive the critical path calculation.....3
Critical path calculated through integrated schedule but only key milestone dates communicated back to sub-projects..... 4
All critical tasks identified and indicated in each individual sub-project schedule; critical path determined through integrated schedule.....5

To calculate the overall project management maturity, we averaged the score of all 148 questions of each company. To calculate six project management processes and eight knowledge areas, we averaged each row or column of the matrix in Table 1-1 to calculate the maturity score for any requested project management knowledge areas or project management processes.

Underlying Assumptions

There are two underlying assumptions in this research. First, we assume that all of the participating organizations are equal. This enables us to compare different companies, industries, and application areas "apple-to-apple."

Project Management Processes and Knowledge Areas	Initiating	Planning	Executing	Controlling	Closing	Project-Driven Organization Environment
Scope 30	6	7	8	3	3	3
Time 18	1	2	12	1	1	1
Cost 11	2	2	2	1	1	3
Quality 13	1	2	3	3	3	1
Human Resource 22	2	4	5	2	2	7
Communi-cations 30	5	3	12	7	2	1
Risk 17	1	1	7	6	1	1
Procurement 7	1	1	1	1	1	2
Total (148)	19	22	50	24	14	19

Table 1-1. Structure of Project Management Benchmarking Questionnaire

Second, we assume all questions have the same weight for organizational maturity assessment. There might be more or less important questions depending on the companies, industries, or application areas that we analyze. By eliminating weight factors for each question, this study achieves non-bias circumstances to specific variables.

The Five-Level Project Management Process Maturity $(PM)^2$ Model

This research develops and applies a five-level project management process maturity $(PM)^2$ model to better understand an organization's levels of project management sophistication. The objective of developing the five-level $(PM)^2$ model is to use it as a basis to locate an organization's current project management maturity level. This five-level $(PM)^2$ model is developed by adapting Crosby's maturity model (Crosby 1979), SEI's capability maturity model (SEI 1993), McCauley's organizational maturity model (McCauley 1993), and Microframe's project management maturity model (Microframe 1997) as primary references.

The five-level $(PM)^2$ model illustrates a series of steps to help an organization incrementally improve the organization's overall project management effectiveness. Each level of the $(PM)^2$ model breaks project management processes and practices into eight project management knowledge areas and six project management processes shown in Figure 1-3. This allows an organization to determine project management strengths and to focus only on the weak areas to achieve higher project management maturity.

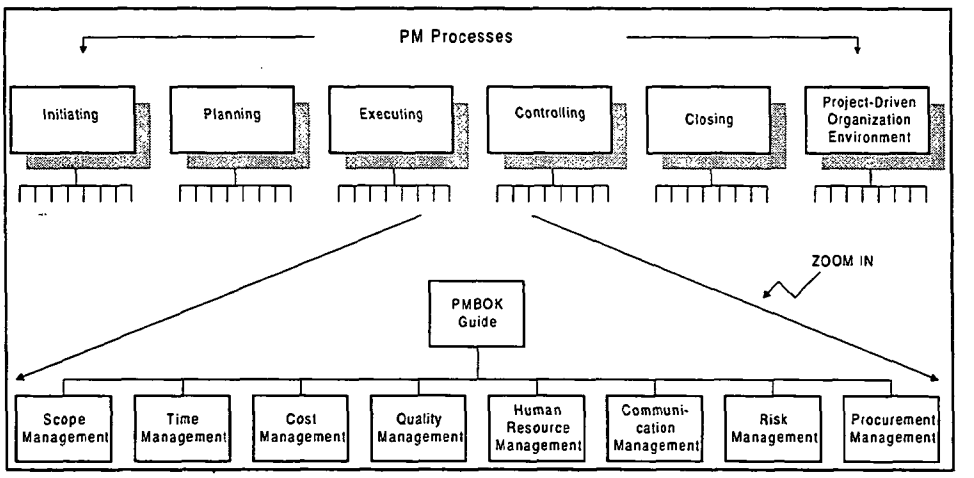

Figure 1-3. Blending Project Management Knowledge Areas with Project Management Processes

The goal of the five-level $(PM)^2$ model is to motivate organizations and people to accomplish higher and more sophisticated project management process maturity by a systematic and incremental approach. Figure 1-4 presents an overview of the five-level $(PM)^2$ model.

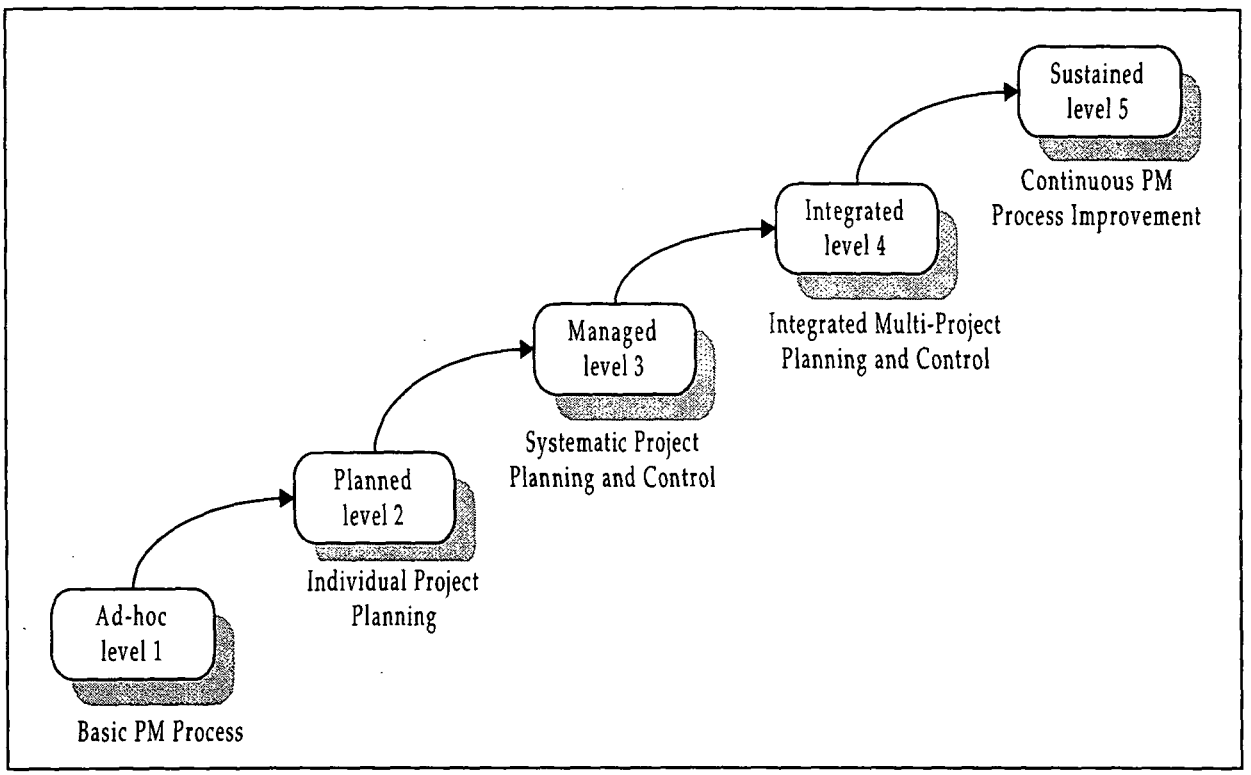

Figure 1-4. Five-Level Project Management Process Maturity $(PM)^2$ Model

The five-level $(PM)^2$ model evolves from a functionally driven organization to a project-driven organization. The usage of this five-level $(PM)^2$ model is to determine and position an organization's *relative* project management level with other organizations. It consists of the major characteristics, factors, and processes of each $(PM)^2$ level.

The primary purpose of the five-level $(PM)^2$ model is for use as a reference point or a yardstick for an organization applying project management practices and processes. This five-level $(PM)^2$ model further suggests an organization's application expertise and the organization's use of technology, or it might produce recommendations on how to hire, motivate, and retain competent people. It can also provide and guide necessary processes and requirements for what is needed to

achieve a higher project management maturity level. The following sections describe each level in more detail.

Level 1: Ad-Hoc Stage

At the ad-hoc stage, there are no formal procedures or plans to execute a project. The project activities are poorly defined, and cost estimates are inferior. Project management-related data collection and analysis are not conducted. Project management processes are totally unpredictable and poorly controlled. There are no formal steps or guidelines to ensure project management processes and practices. As a result, utilization of project management tools and techniques is inconsistent and applied irregularly if at all.

Organizations at Level 1 are functionally isolated and are not familiar with the project management concept or the project-oriented organizational structure. Moreover, senior management does not understand key issues of project management. Therefore, the project's success depends on individual efforts rather than the implementation of effective project management processes. Overall, the project lacks the disciplined process that project management affords. A Level 1 organization can be described as trying to establish a basic project management process.

Level 2: Planned Stage

At the planned stage, informal and incomplete procedures manage a project. Some of the project management problems are identified, but these problems are not documented or corrected. Project management-related data collection and analysis are informally conducted but not documented. Project management processes are partially recognized and controlled by project managers. Nevertheless, planning and management of projects depend on individuals.

The organization at Level 2 is more team-oriented than the organization at Level 1. The project's basic commitments are understood by the project team. This organization possesses a strength in doing similar and repeatable work. However, when the organization is presented with new and unfamiliar projects, the organization confronts major chaos in managing and controlling the project. Level 2 project management processes are efficient in individual project planning.

Level 3: Managed Stage

At the managed stage, project management processes become partially formal and demonstrate a basic project planning and control system. Most of the problems regarding project management are identified and informally documented for project control purposes. Project management-related data are collected across the organization for project planning and management. Various types of analyzed trend data are shared by the project team to help it work together as an integrated unit.

An organization at Level 3 concentrates on systematic and structured project planning and control. Project groups work together to manage the projects efficiently. People are trained to understand and to apply project management skills and practices. This organization works hard to integrate cross-functional teams to form a project team.

Level 4: Integrated Stage

At the integrated stage, project management processes are formal, and information and processes are documented. The organization at Level 4 can plan, manage, integrate, and control multiple projects efficiently. Project management processes are well defined, quantitatively measured, understood, and executed. Project management process data are standardized, collected, and stored in a database to evaluate and analyze the process effectively. Also, collected data are used to anticipate and prevent adverse productivity or quality impacts. This allows an organization to establish a foundation for fact-based decision-making.

A Level 4 an organization can conduct multiple project planning and control. Also, a strong sense of teamwork exists within each project and within project teams. Project management training is fully planned and is provided to the entire organization according to the respective role of people in the project team. Integrated project management processes are fully implemented at this level. Level 4 organizations succeed in planning and controlling multiple projects in a professional matter.

Level 5: Sustained Stage

At the sustained stage, project management processes are continuously improved. Problems associated with applying project management are fully understood and eliminated to ensure project success. Project management data are collected automatically to identify the weakest process elements. This data is then rigorously analyzed and evaluated to select and improve the project management processes. Innovative ideas are also vigorously pursued and organized to improve an organization's project management processes and practices.

Organizations at Level 5 are involved in the continuous improvement of project management processes and practices. Each member of the project team makes efforts to maintain and sustain the project-driven environment. Project teams are dynamic, energetic, and fluid to achieve project-oriented, project-centered organization.

Discussions on the Five-Level $(PM)^2$ Model

Based on the five-level $(PM)^2$ model, an organization evolves from a less project management-sophisticated organization to a highly project-oriented organization. This does not necessarily mean that at level N+1, all the characteristics of level N are

fully implemented. At level N+1, an organization has the capability to choose selectively the proper and eligible project management practices or tools that are suitable for a given project.

For example, assume that scheduling techniques evolve from drawing simple bar charts, to developing project network diagrams, to conducting a complex simulation for resource optimization. An organization that has a high project management level does not always have to conduct expensive simulation or resource leveling to find an optimal schedule and resources using highly sophisticated project management tools. At a higher project management level, an organization can apply eligible sets of project management processes and requirements based on the nature or complexity of a project.

Chapter Summary

This chapter presents the project management benchmarking process used for this study. First, a literature review of project management-related studies and benchmarking studies are presented. Second, the three-part project management benchmarking questionnaire is introduced to provide an assessment tool to find the strengths and weaknesses of project management process maturity, analyze project management process maturity against actual project performance data, and calculate an order-of-magnitude estimate of the project management/return on investment. Third, the five-level project management process maturity $(PM)^2$ model is developed and presented in order to understand the level of an organization's project management sophistication. This five-level $(PM)^2$ model provides a reference point for an organization that is trying to improve its project management effectiveness gradually through a series of structured steps. This five-level $(PM)^2$ model assists managers strategically to outline project management processes and characteristics and to become a project-driven, multifunctional, and cross-disciplinary organization.

CHAPTER TWO
Results of Project Management Maturity Benchmarking

Organizational Demographics

This research carefully selected thirty-eight companies and public agencies to participate in the project management benchmarking study. This took considerably more time than originally planned. The main reasons for this were that many companies did not see the true value in this research, or they were reluctant to share the details of their project management practices. Some were simply embarrassed by their current project management practices and processes. Others believed that they had something special that they did not want to share with other companies.

The thirty-eight companies that participated in this study include fifteen engineering and construction (EC) companies, ten information management and movement (IMM) companies, ten information systems (IS) companies, and three high-tech manufacturing (HTM) companies. Forty percent of the responses come from engineering and construction companies. This is because engineering and construction has a longer history of using project management practices than most other industries. Consequently, it was easier to recruit these participants. (See Figure 2-1.)

Organizations were classified by their size. Forty-eight percent of the organizations employed between zero and one hundred people, and 52 percent of the companies exceeded one hundred employees in their respective organizations. Figure 2-2 shows the distribution of organization size.

Organizations were divided by years of experience in project management practices. "Numbers of years in PM practices" answers ranged from zero to fifty years, with averages of 15.4 years for engineering and construction; 10.7 years for high-tech manufacturing; eight years for information systems; and six to eight years for information management and movement. The average was 10.7 years. Sixty-one percent of the organizations had fewer than ten years of experience with project management, and only 39 percent exceeded ten years. One interpretation of this result is that companies have only recently begun to recognize the benefits of using project management. See Figure 2-3 for a comparison of the different industries and application areas.

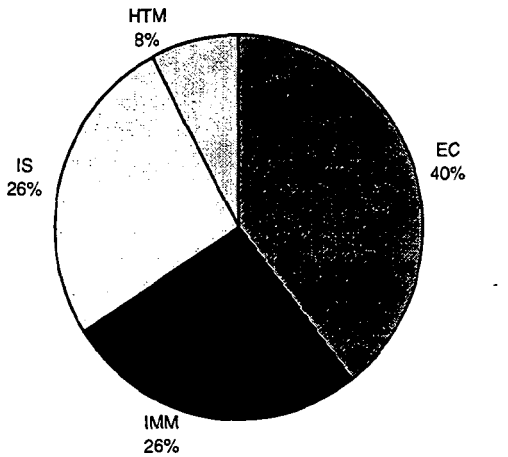

Figure 2-1. Industry Distribution for this Study (38 companies)

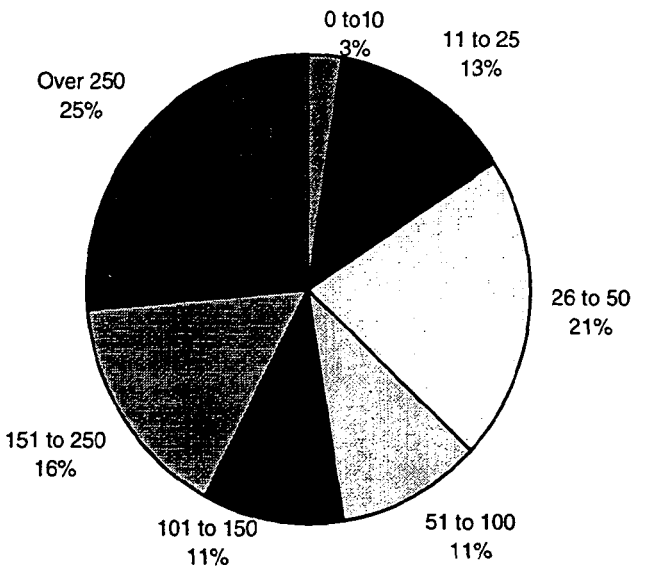

Figure 2-2. Organization Size

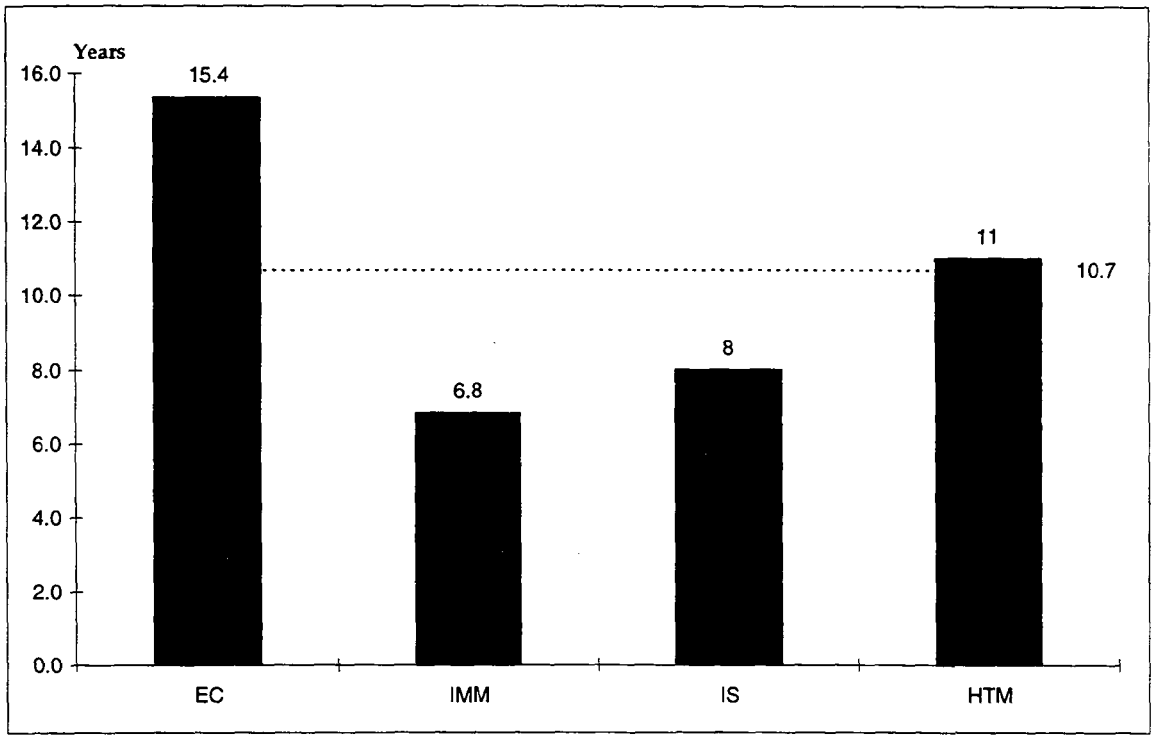

Figure 2-3. Number of Years in Project Management Practices

Annualized Cost of Project Management Services

Another key question that this research wanted to explore was the cost of project management services as a percentage of total project cost. These costs were computed as a percentage of a company or department's revenues or sales, if that company or department were entirely projectized. Lists of items that are classified as project management expenditure cost were provided to help managers better estimate the average cost of project management services in the organization. Table 2-1 presents a checklist of project management expenditure cost.

Admittedly this question is difficult to answer precisely. However, the information was provided with careful thought by the participating organizations, and the study team tried to collect the best estimates.

Project Management Expenditures Checklist	- Professional, Technical, and Administration People Salaries - Fringe Benefits of Project Management Personnel - Training Costs - Travel and Transportation Costs - Project Management-related Consulting Services Costs - Hardware and Software Purchase and Network Installation, Maintenance, and Upgrade Costs - Moving, Storage, and Rental Costs - Office, Supply, and Equipment Costs - Utilities, Telecommunications, Mailing, and Shipping Costs - Professional Associates and Society Membership Costs

Table 2-1. Project Management Expenditures Checklist

The average cost of project management services as a percentage of project management spending was 6 percent. This result was actually higher than previously reported by earlier sources (Archibald 1967). Table 2-2 and Figure 2-4 show the results of twenty organizations that provided information. Eighty percent of the companies answered that they spend less than 10 percent of total project cost for utilizing project management practices.

Project Management Cost as a Percentage of Total Project Cost	Number of Organizations	Percentage
0 to 1%	3	15%
1.1 to 3%	5	25%
3.1 to 6%	5	25%
6.1 to 10%	3	15%
Over 10%	4	20%
Total	20	100%

Table 2-2. Average Total Cost of Project Management Services

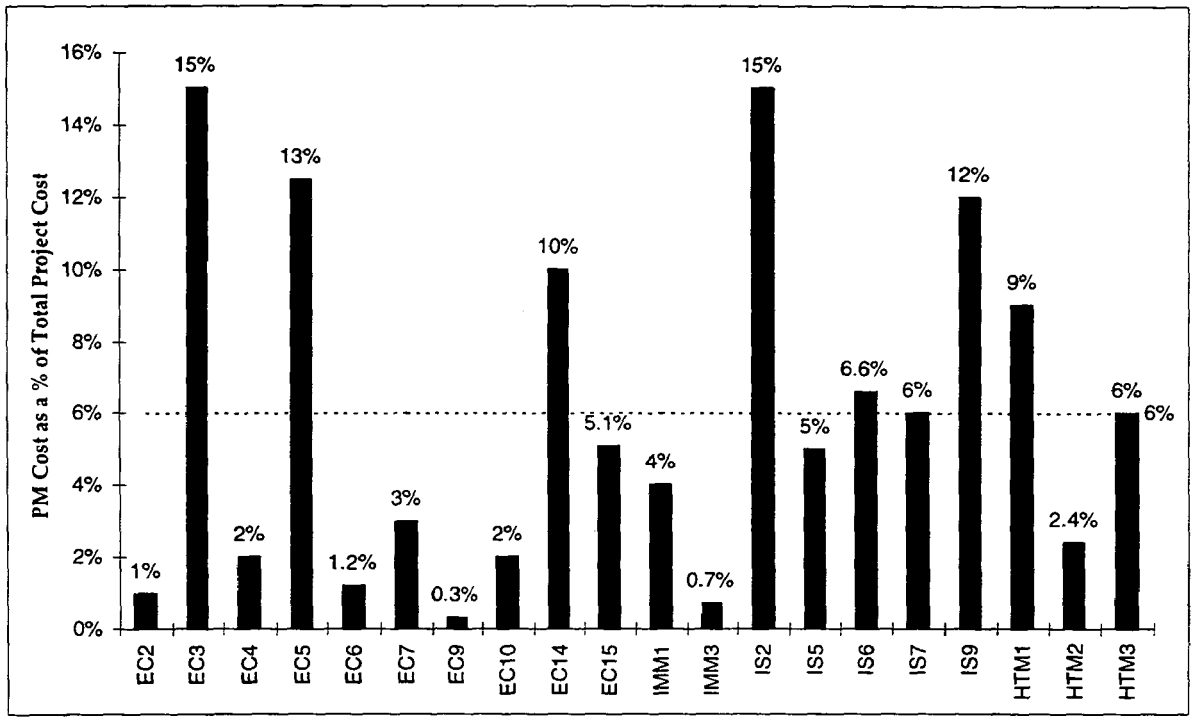

Figure 2-4. Project Management Cost as a Percentage of Total Project Cost (20 organizations)

Benchmarking Overall Project Management Maturity

The overall average project management maturity of the thirty-eight organizations and four industries and application areas ranged from a low of 3.06 for information systems to a high of 3.36 for engineering and construction. Average overall project management maturity for all companies was 3.26. Since the rating scale ranged from one to five, there is still a substantial opportunity for improvement of project management practices for all four industries. Company EC2 scored the highest overall project management maturity (4.60) and IS1 scored the lowest (1.77).

Figures 2-5 and 2-6 and Table 2-3 contain detailed information on the overall average project management maturity of all organizations.

	E-C	IMM	IS	HTM	All 38 Companies
Project Mgt. Maturity	3.36	3.30	3.06	3.34	3.26
Standard Deviation	0.66	0.77	0.88	0.87	0.74

Table 2-3. Overall Average Project Management Maturity (4 industries)

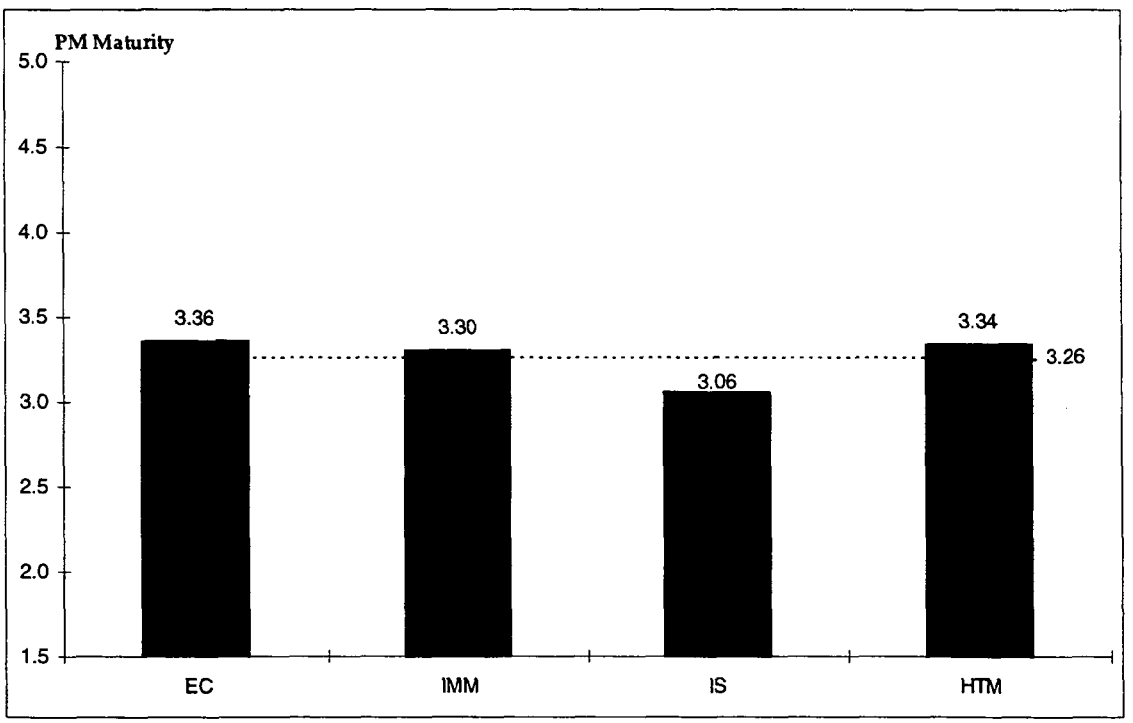

Figure 2-5. Overall Average Project Management Maturity (4 industries)

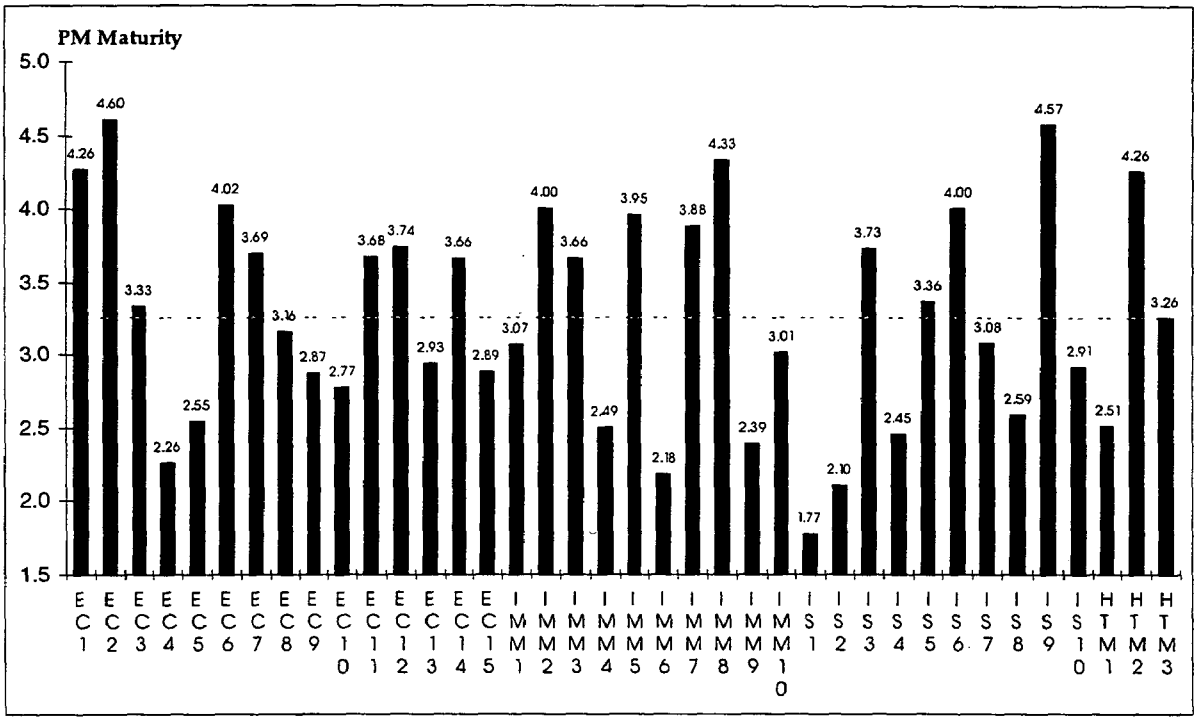

Figure 2-6. Overall Average Project Management Maturity (All 38 organizations)

Engineering and construction (3.36), high-tech manufacturing (3.34), and information management and movement (3.30) have relatively high project management maturity compared to information systems (3.06). However, the project management maturity of high-tech manufacturing should be de-emphasized because only three companies represented the high-tech manufacturing industry. In that regard, the high-tech manufacturing organizations have a wide variation compared to other industries.

Benchmarking Eight Project Management Knowledge Areas Maturity Levels

Also of interest to the research were the details of how companies and industries compared. One way to examine the data was to investigate the project management

maturity levels according to each of the eight project management knowledge areas. Table 2-4 contains the details.

PM Knowledge Areas	E-C	IMM	IS	HTM	All 38 Companies
Scope	3.52	3.45	3.25	3.37	3.42
Time	3.55	3.41	3.03	3.50	3.37
Cost	3.74	3.22	3.20	3.97	3.48
Quality	2.91	3.22	2.88	3.26	3.06
Human Resources	3.18	3.20	2.93	3.18	3.12
Communications	3.53	3.53	3.21	3.48	3.44
Risk	2.93	2.87	2.75	2.76	2.85
Procurement	3.33	3.01	2.91	3.33	3.14
Overall PM Knowledge Areas Maturity	3.34	3.24	3.02	3.36	3.24

Table 2-4. Eight Knowledge Areas Project Management Maturity

In general, information systems had the lowest project management maturity score and engineering and construction and high-tech manufacturing had the highest. Again, high-tech manufacturing organizations' overall project management knowledge areas maturity should be de-emphasized because it only had three companies. The details are summarized in the following sections.

Project Scope Management

Project scope management ensures that the project includes all the work required by the client to complete the project successfully. It consists of scope planning, scope definition, scope verification, and scope change control.

Figures 2-7 and 2-8 and Table 2-5 contain detailed information regarding scope management maturity.

	E-C	IMM	IS	HTM	All 38 Companies
Scope Maturity	3.52	3.45	3.25	3.37	3.42
Standard Deviation	0.74	0.79	0.82	0.71	0.75

Table 2-5. Scope Management Maturity

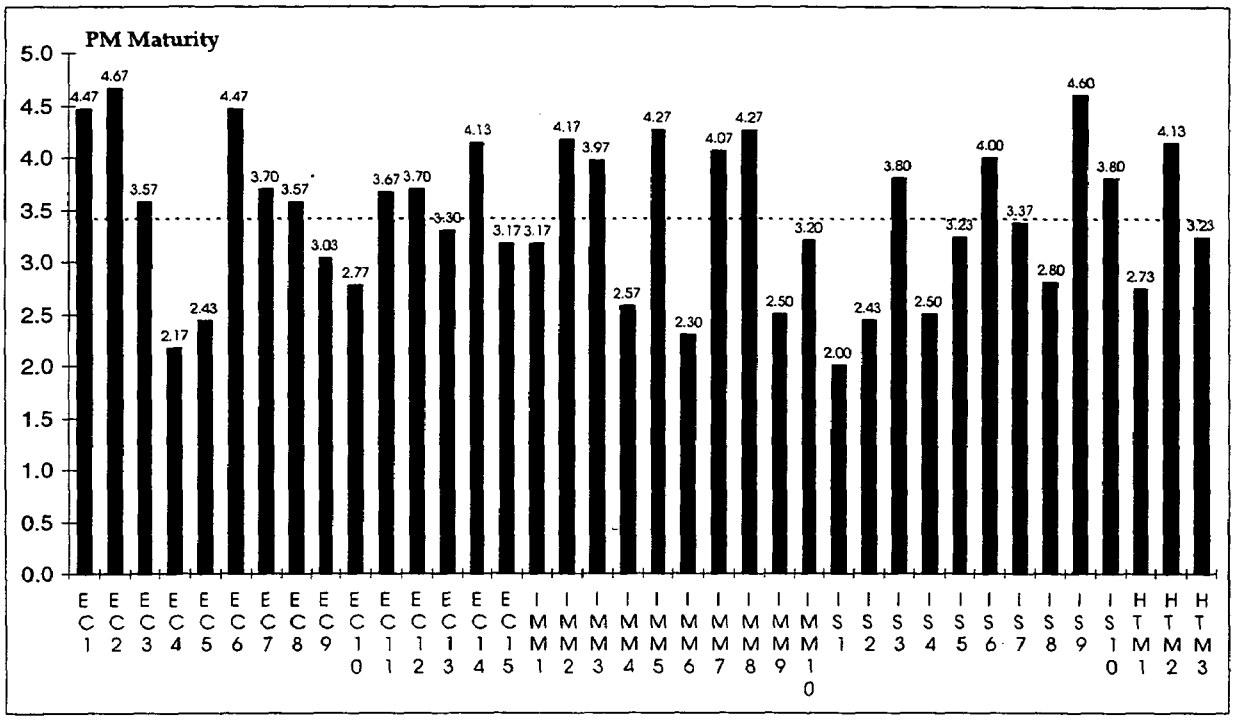

Figure 2-7. Scope Management (All 38 organizations)

There were no significant differences in scope management maturity among the four industries and application areas. Engineering and construction was the highest (3.62), and information systems was the lowest (3.25). Engineering and construction's relatively high score indicates that this industry puts more emphasis on scope management than other industries and application areas. Information systems also had the most variability (S.D.= 0.82). According to the data, information systems is still behind in scope management practices.

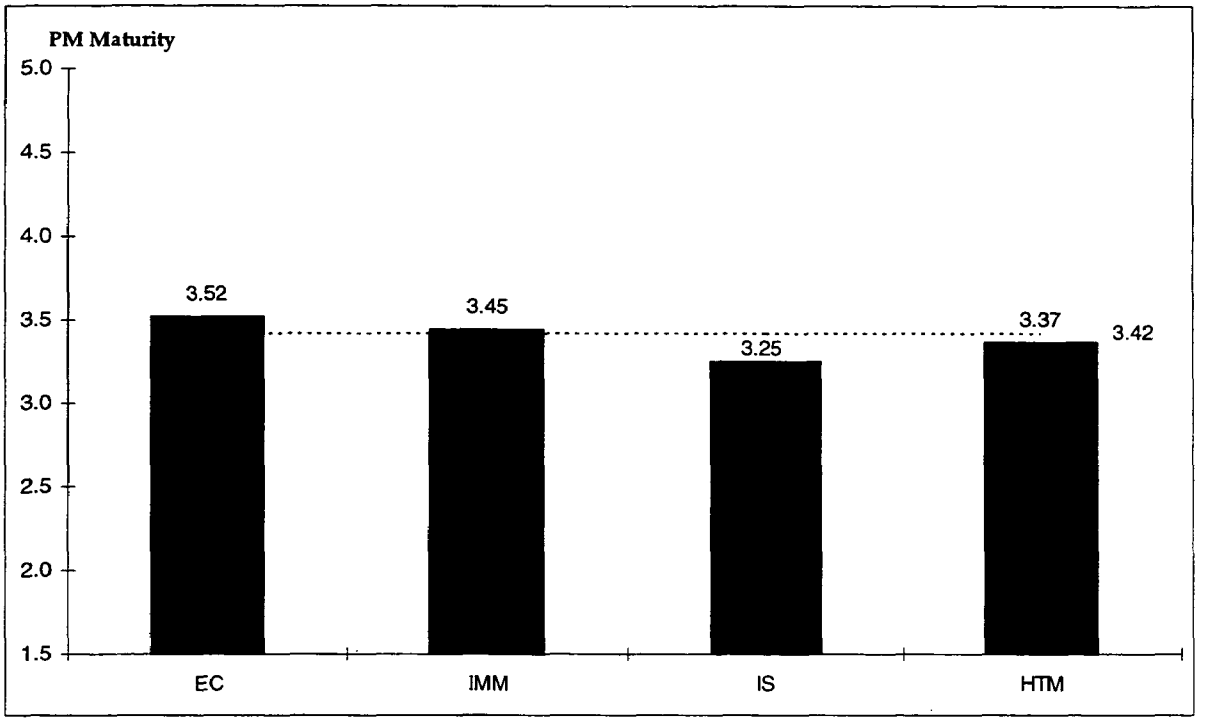

Figure 2-8. Scope Management (4 industries)

Project Time Management

The main objective of project time management is to ensure efficient completion of the project. It includes activity definition, activity sequencing, activity duration estimating, schedule development, and schedule control. Table 2-6 and Figures 2-9 and 2-10 report the time management maturity of these industries.

	E-C	IMM	IS	HTM	All 38 Companies
Time Maturity	3.55	3.41	3.03	3.50	3.37
Standard Deviation	0.70	0.89	0.96	0.91	0.83

Table 2-6. Time Management Maturity

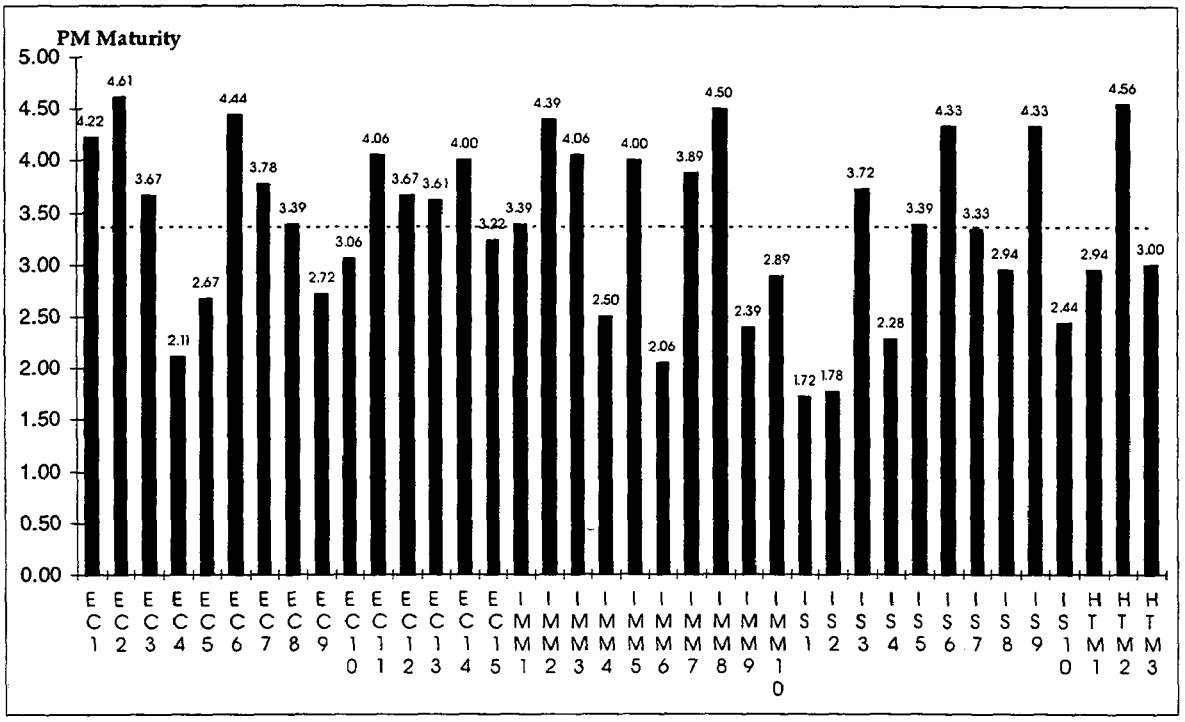

Figure 2-9. Time Management (All 38 organizations)

Again engineering and construction scored the highest, and information systems scored the lowest. Conversely, engineering and construction's time management maturity has the smallest standard deviation, and information systems' has the largest. A favorable time management index should help organizations deliver projects closer to the delivery dates promised to the client.

Project Cost Management

Project cost management assures that the project is completed within the approved budget. It consists of resource planning, cost estimating, budgeting, and control. The primary concern of cost management is dealing with the cost of resources needed to complete project activities. Figures 2-11 and 2-12 and Table 2-7 show the results of benchmarking cost management maturity.

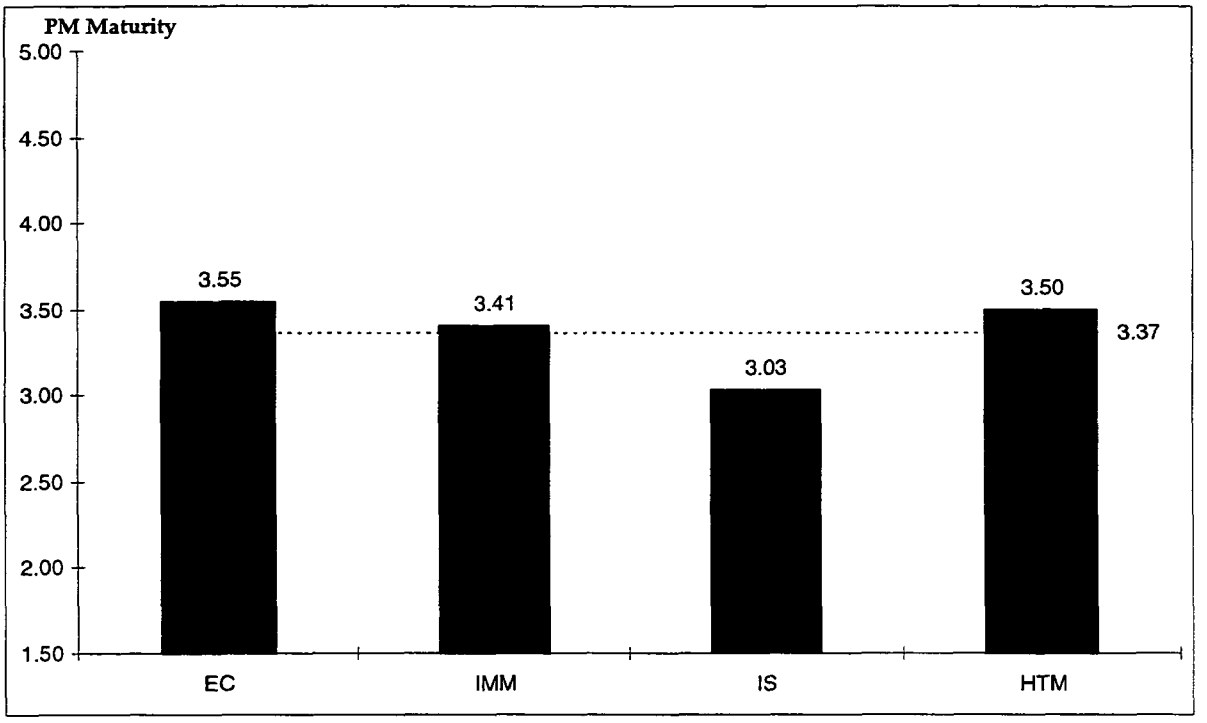

Figure 2-10. Time Management (4 industries)

The cost management area had the highest project management maturity levels. It seems that all four industries and application areas are very concerned about cost. High-tech manufacturing received the highest score in cost management maturity. The rise of new management practices such as lean production and activity-based costing may have contributed to this high maturity level.

Cost management maturity of information systems and information management and movement was relatively low compared to engineering and construction and high-tech manufacturing. The interpretation of this result is that cost management may not be as important as the other project management knowledge areas. This is probably because cost management makes money not from finishing within budget but, rather, by completing the project quickly and selling it to potential customers.

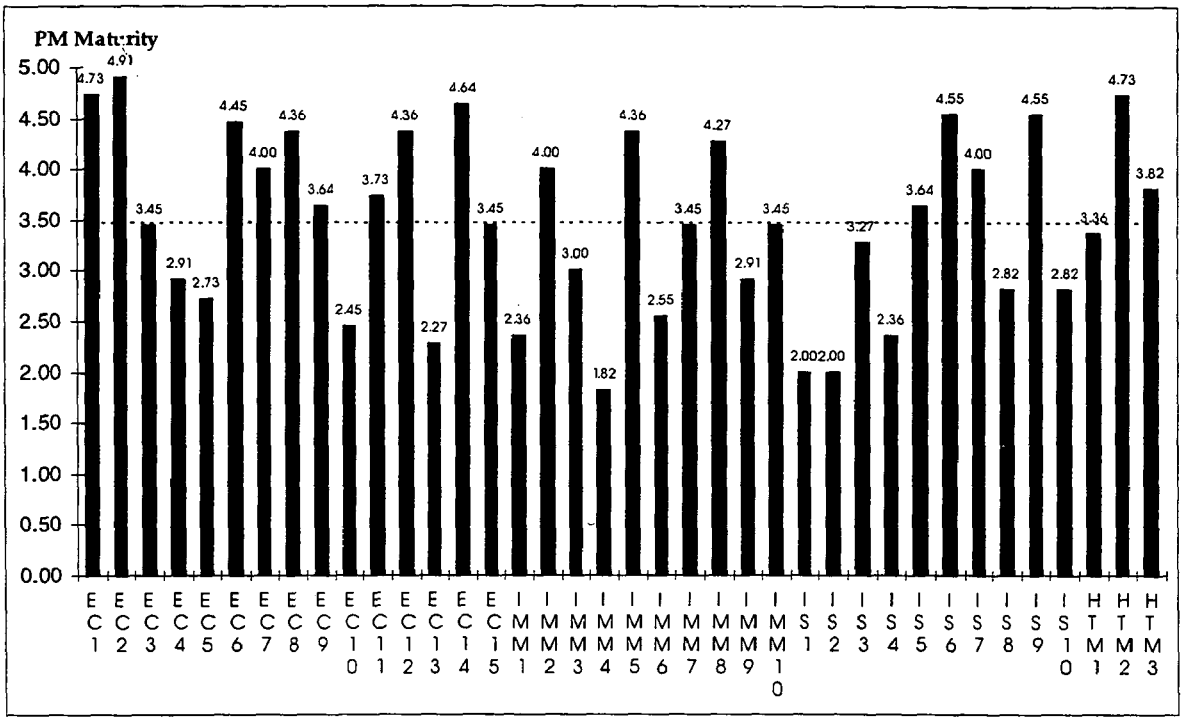

Figure 2-11. Cost Management Maturity (All 38 organizations)

	E-C	IMM	IS	HTM	All 38 Companies
Cost Maturity	3.74	3.22	3.20	3.97	3.48
Standard Deviation	0.85	0.85	0.96	0.69	0.89

Table 2-7. Cost Management Maturity

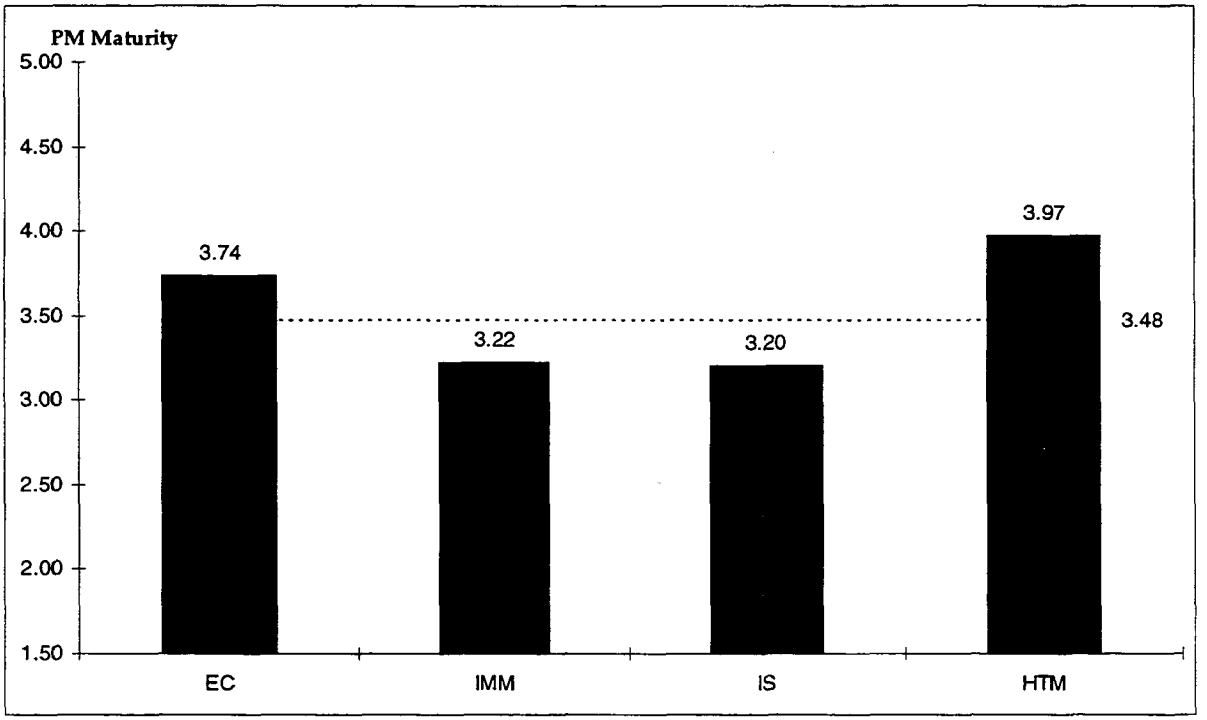

Figure 2-12. Cost Management Maturity (4 industries)

Project Quality Management

Project quality management satisfies the ability of the project to meet or exceed the needs of the client. It includes all activities of the overall management function that determine the quality policy, objectives, and responsibilities. It also implements them by such means as quality planning, quality control, quality assurance, and quality improvement within the quality system. Table 2-8 and Figures 2-13 and 2-14 show the benchmarking result of the quality management maturity.

	E-C	IMM	IS	HTM	All 38 Companies
Quality Maturity	2.91	3.22	2.88	3.26	3.06
Standard Deviation	1.36	1.10	1.60	2.00	1.37

Table 2-8. Quality Management Maturity

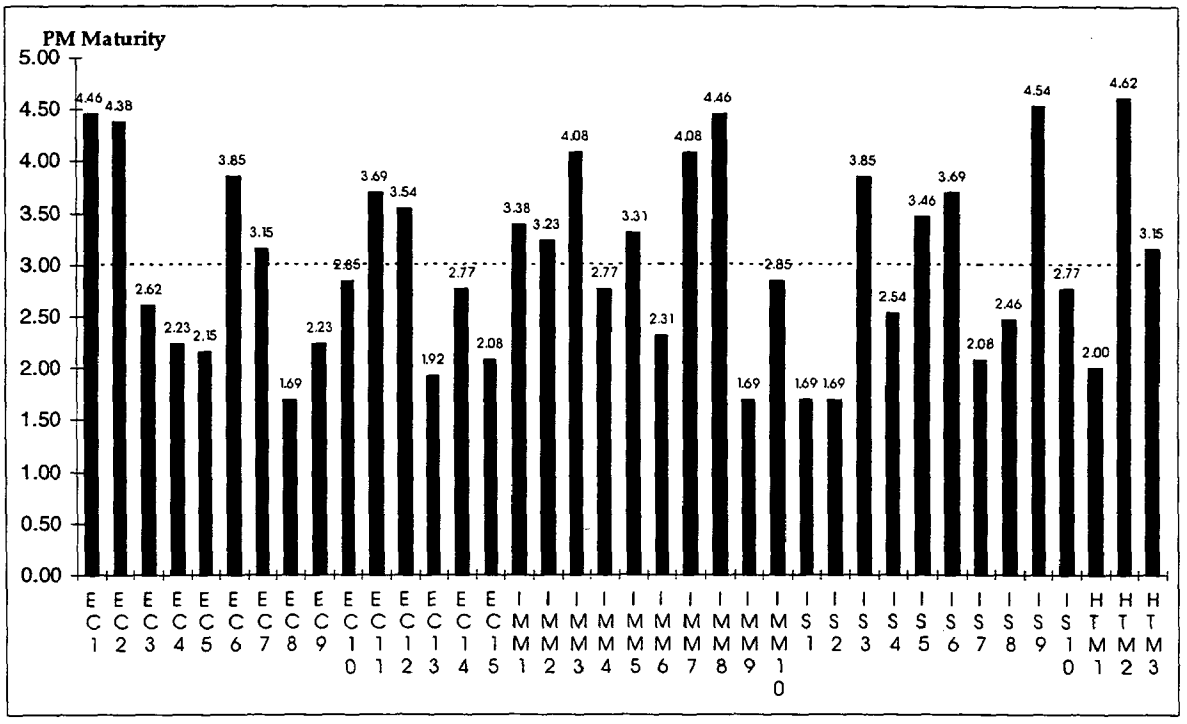

Figure 2-13. Quality Management (All 38 organizations)

Quality management's project management maturity level had the highest standard deviation of all project management knowledge areas, indicating a very high dispersion among companies. Engineering and construction and information systems organizations consistently had low levels of quality management maturity. High-tech manufacturing companies, which scored the highest in quality maturity, also scored highest in standard deviation. The standard deviation values implies that information management and movement (SD= 1.10) is relatively consistent compared to high-tech manufacturing (SD= 2.00), which shows inconsistency.

Application of quality assurance, quality control, and total quality management (TQM) principles might increase the quality management maturity.

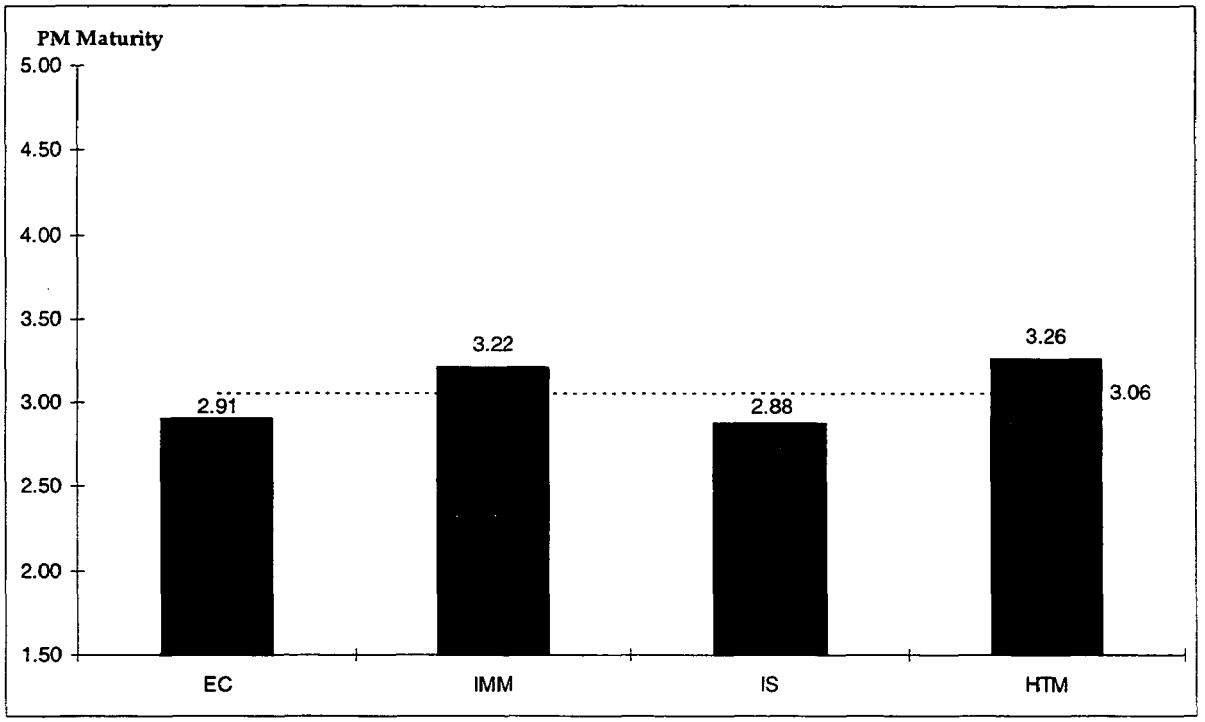

Figure 2-14. Quality Management (4 industries)

Project Human Resource Management

The purpose of project human resource (H/R) management is to make effective use of the people involved with the project. It includes all the project stakeholders—sponsors, customers, individual contributors, project team members—training, and personnel assignment. Human resource management consists of organizational planning, staff acquisition, and team development. Table 2-9 and Figures 2-15 and 2-16 show the details.

	E-C	IMM	IS	HTM	All 38 Companies
Human Resource Maturity	3.18	3.20	2.93	3.18	3.12
Standard Deviation	0.58	0.75	0.82	0.79	0.69

Table 2-9. Human Resource Management Maturity

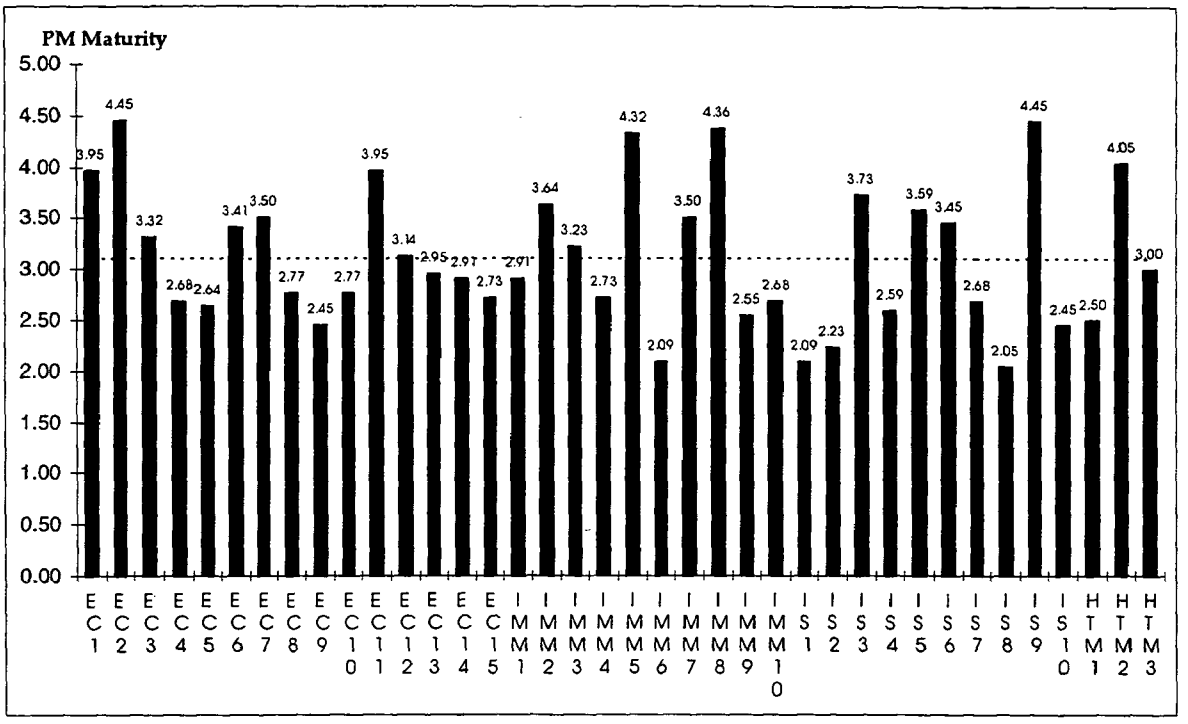

Figure 2-15. Human Resource Management (All 38 organizations)

On the whole, human resource management (and risk management) had the lowest standard deviation of all eight knowledge areas. Engineering and construction companies were extremely consistent in terms of their human resource maturity. Industries should put more emphasis on managing and dealing with project personnel and teams because these people are intensively involved from the beginning to the end of the entire project.

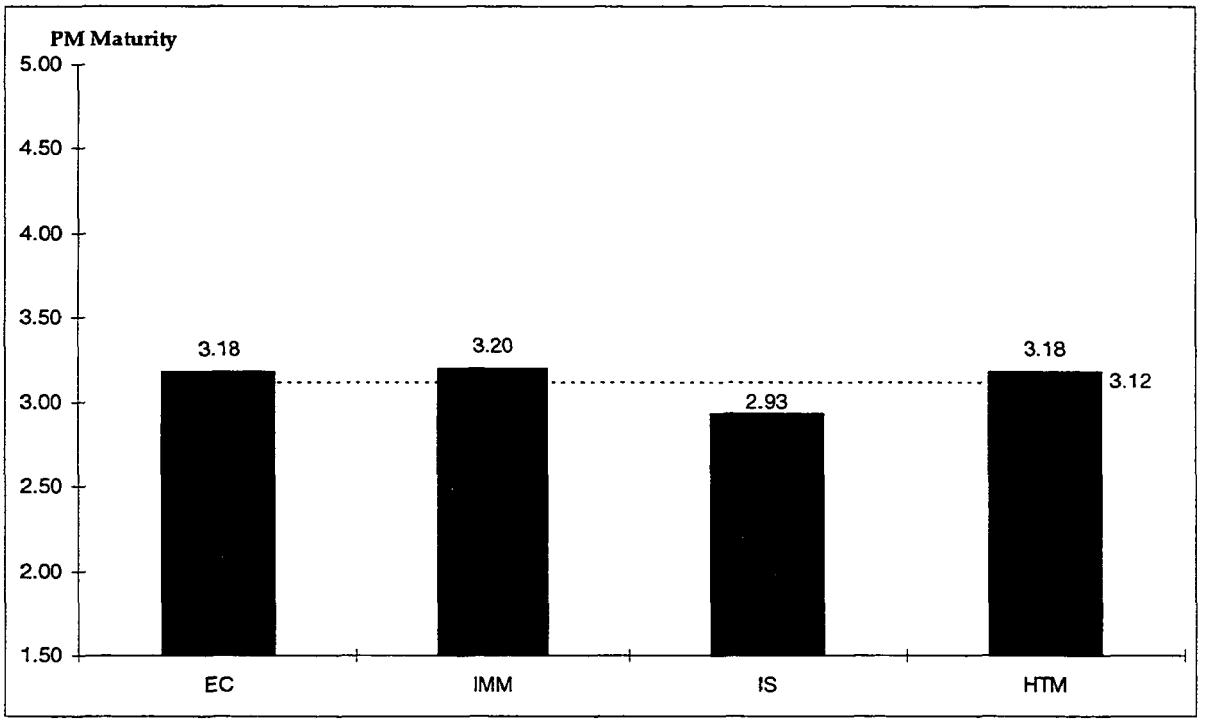

Figure 2-16. Human Resource Management (4 industries)

Project Communications Management

Project communications management attempts to ensure the punctual and appropriate generation, collection, storage, and ultimate disposition of project information. It provides the critical link among people, ideas, and information that are necessary for success. Communication management includes communications planning, information distribution, performance reporting, and administrative closure. Figures 2-17 and 2-18 and Table 2-10 contain the details for communication management maturity.

	E-C	IMM	IS	HTM	All 38 Companies
Communications Maturity	3.53	3.53	3.21	3.48	3.44
Standard Deviation	0.72	0.76	0.97	1.04	0.80

Table 2-10. Communications Management Maturity

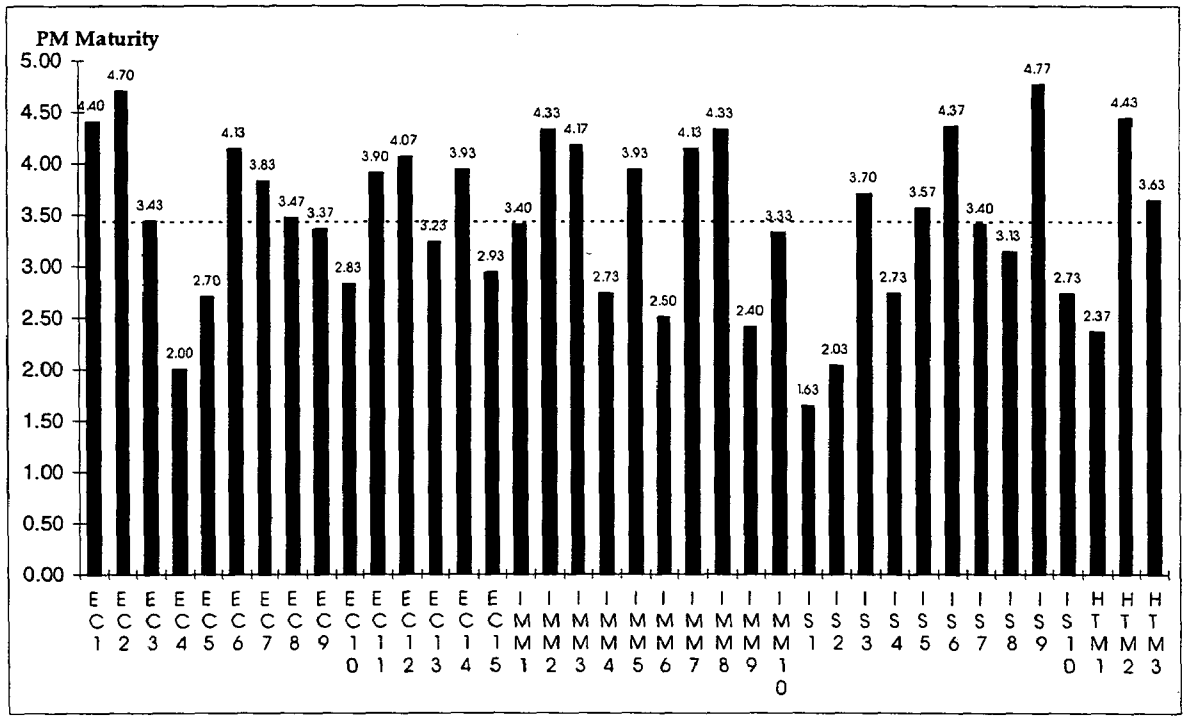

Figure 2-17. Communications Management (All 38 organizations)

Communications management maturity for all thirty-eight companies was very high, ranking second only to cost management among the eight project management knowledge areas. Engineering and construction scored the highest communications maturity with tight consistency among four industries. Since most engineering and construction projects are conducted by many subcontractors and suppliers, communication flow seems to be better established than in other industries.

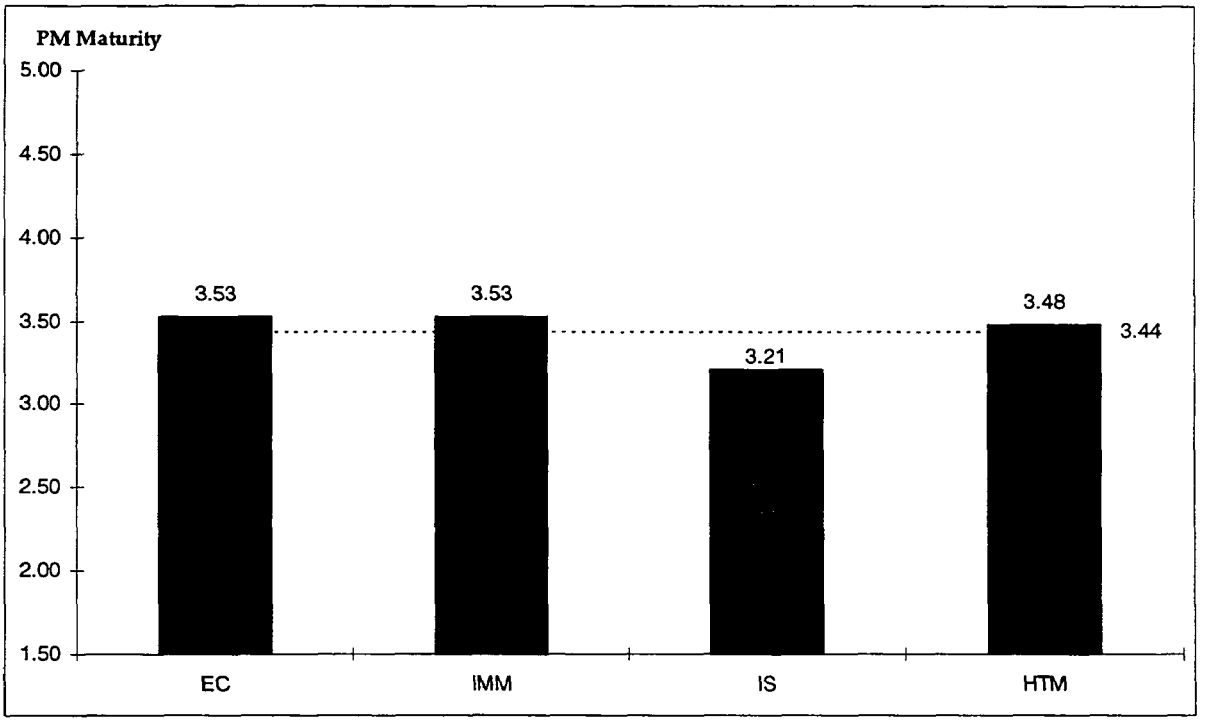

Figure 2-18. Communications Management (4 industries)

Project Risk Management

Project risk management is a process that seeks to maximize the results of positive events and to minimize the consequences of adverse events. It should identify, analyze, and respond to project risk. Risk identification, quantification, response development, and response control are included in this knowledge area. Table 2-11 and Figures 2-19 and 2-20 contain the details.

	E-C	IMM	IS	HTM	All 38 Companies
Risk Maturity	2.93	2.87	2.75	2.76	2.85
Standard Deviation	0.68	0.82	1.09	0.95	0.69

Table 2-11. Risk Management Maturity

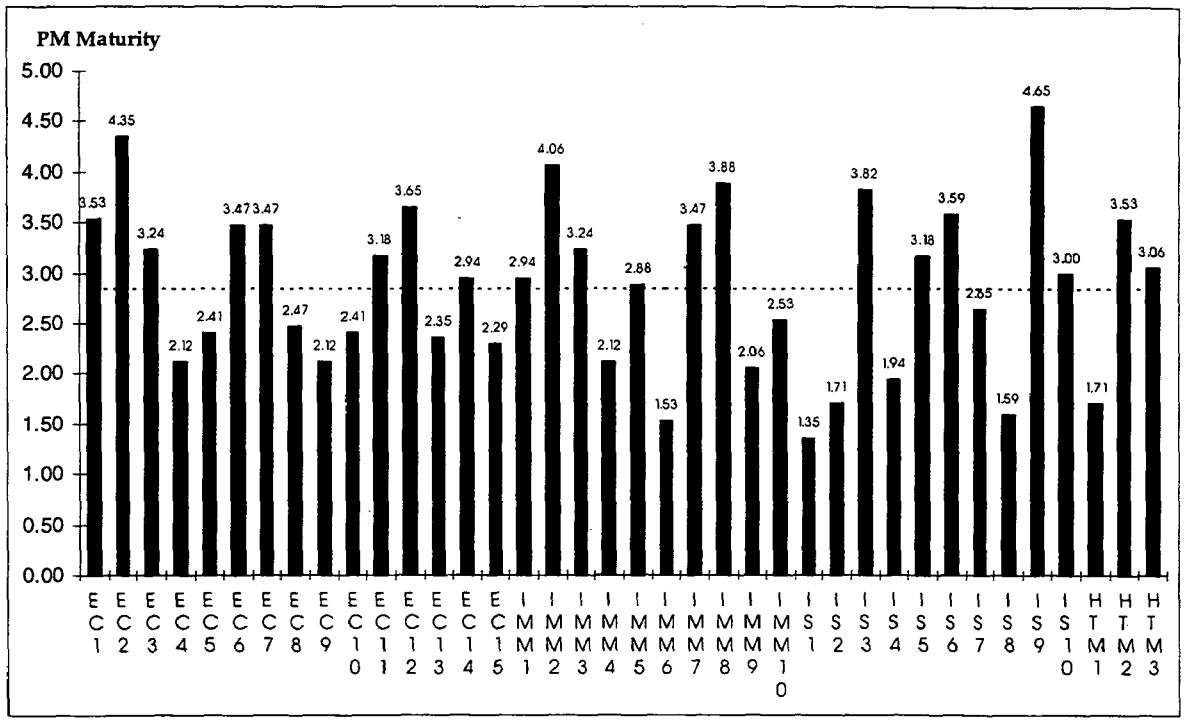

Figure 2-19. Risk Management (All 38 organizations)

Risk management's project management maturity level was the lowest among all eight knowledge areas. Risk management was the only knowledge area in which the overall project management maturity rating was below three. Consequently, companies should put more effort into the risk management area. This area has potential for substantial improvement.

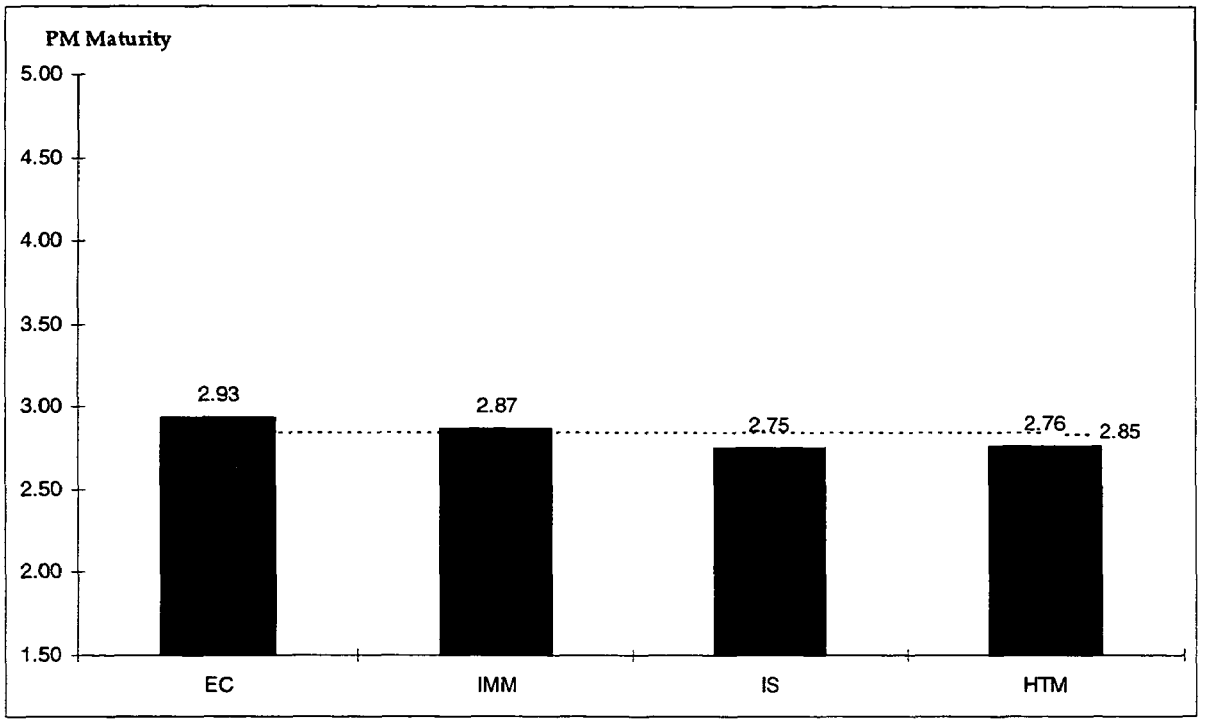

Figure 2-20. Risk Management (4 industries)

Project Procurement Management

Project procurement management is required to acquire goods and services from outside the performing organization. It consists of procurement planning, solicitation planning, solicitation, source selection, contract administration, and contract close out. Figures 2-21 and 2-22 and Table 2-12 contain the details.

	E-C	IMM	IS	HTM	All 38 Companies
Procurement Maturity	3.33	3.01	2.91	3.33	3.14
Standard Deviation	0.90	1.26	1.00	0.84	1.01

Table 2-12. Procurement Management Maturity

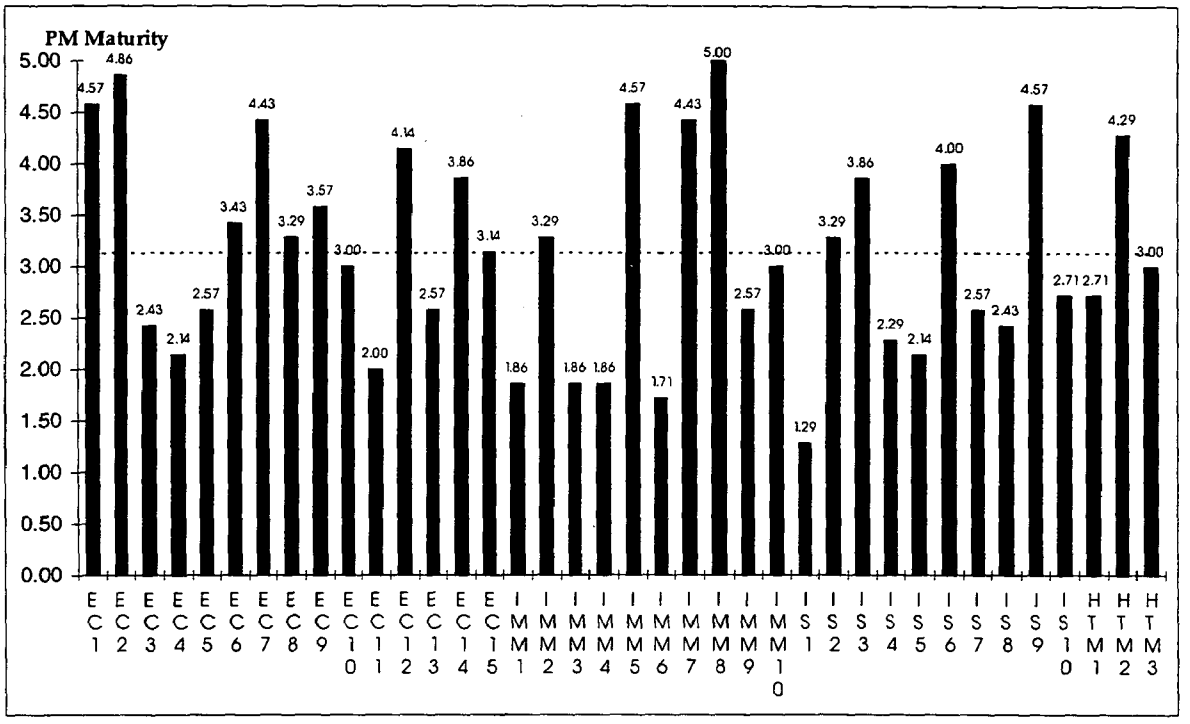

Figure 2-21. Procurement Management (All 38 organizations)

Both engineering and construction and high-tech manufacturing scored the highest among the four industries. This is understandable since supplying and buying materials and services are such major parts of their businesses. On the other hand, information management and movement and information systems scored low on procurement maturity.

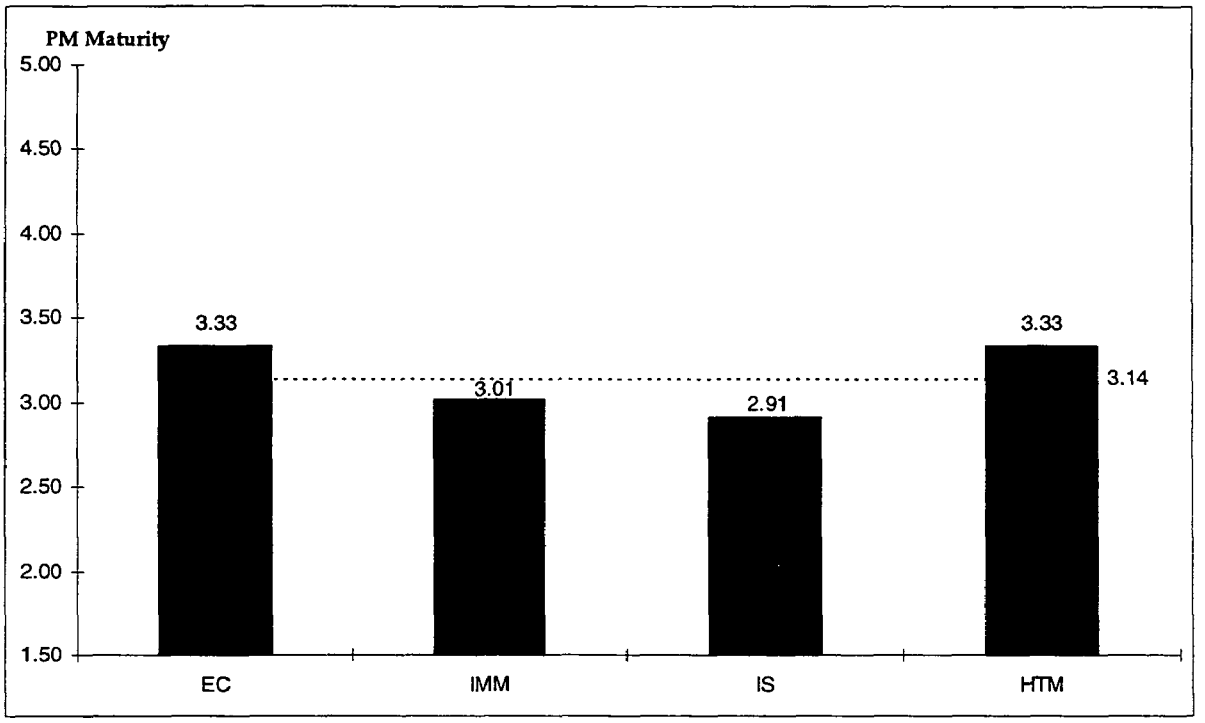

Figure 2-22. Procurement Management (4 industries)

Benchmarking Six Project Management Processes Levels

This research also investigated the details of how companies, industries, and application areas compared with the maturity of six project management processes. This analysis reveals which processes among the six project management processes are the industries' strengths and weaknesses. The project management maturity result of each of the six project management processes are contained in Table 2-13.

PM Processes	E-C	IMM	IS	HTM	All 38 Companies
Initiating Maturity	3.25	3.34	3.57	3.60	3.39
Planning Maturity	3.61	3.49	3.43	3.55	3.53
Executing Maturity	3.31	3.27	2.90	3.32	3.19
Controlling Maturity	3.55	3.31	2.98	3.25	3.31
Closing Maturity	3.28	3.43	2.90	3.05	3.2
Project-driven Org. Environment Maturity	3.14	2.99	2.73	3.25	3.00
Overall Average PM Processes Maturity	3.36	3.31	3.09	3.34	3.28

Table 2-13. Six Project Management Processes Maturity

Again, information systems had the lowest project management maturity rating, and engineering and construction and high-tech manufacturing had the highest. Note that high-tech manufacturing only had three companies; therefore, the result may be de-emphasized. The details are summarized in the following sections.

Initiating Processes

The goal of the initiating processes is to develop a proposal for a potential project efficiently and effectively. It analyzes the feasibility and staging of the project. These processes examine the possibility of applying a systematic approach for project planning and managing.

Figures 2-23 and 2-24 and Table 2-14 contain the details for initiating processes maturity.

	E-C	IMM	IS	HTM	All 38 Companies
Initiating Maturity	3.25	3.34	3.57	3.60	3.39
Standard Deviation	1.31	1.02	1.02	0.69	1.09

Table 2-14. Initiating Processes Maturity

For initiating projects, high-tech manufacturing had the highest maturity index, and engineering and construction scored the lowest. Conversely, they had the lowest and highest standard deviations respectively. One interpretation of this is that high-tech manufacturing and information systems are very sensitive and proactive to

market needs, whereas the competitive bid nature of engineering and construction encourages a more reactive response to client needs, especially during the initiating processes.

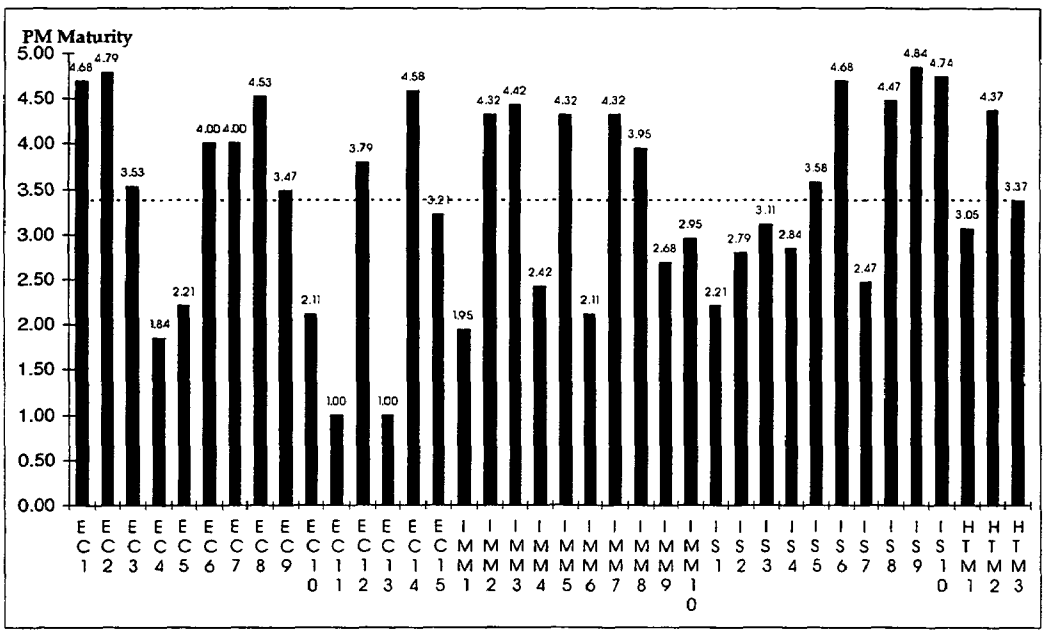

Figure 2-23. Initiating Processes (All 38 organizations)

Planning Processes

The planning processes stage defines a project and organizes the project team clearly. It also establishes a project framework within which a team can work most efficiently.

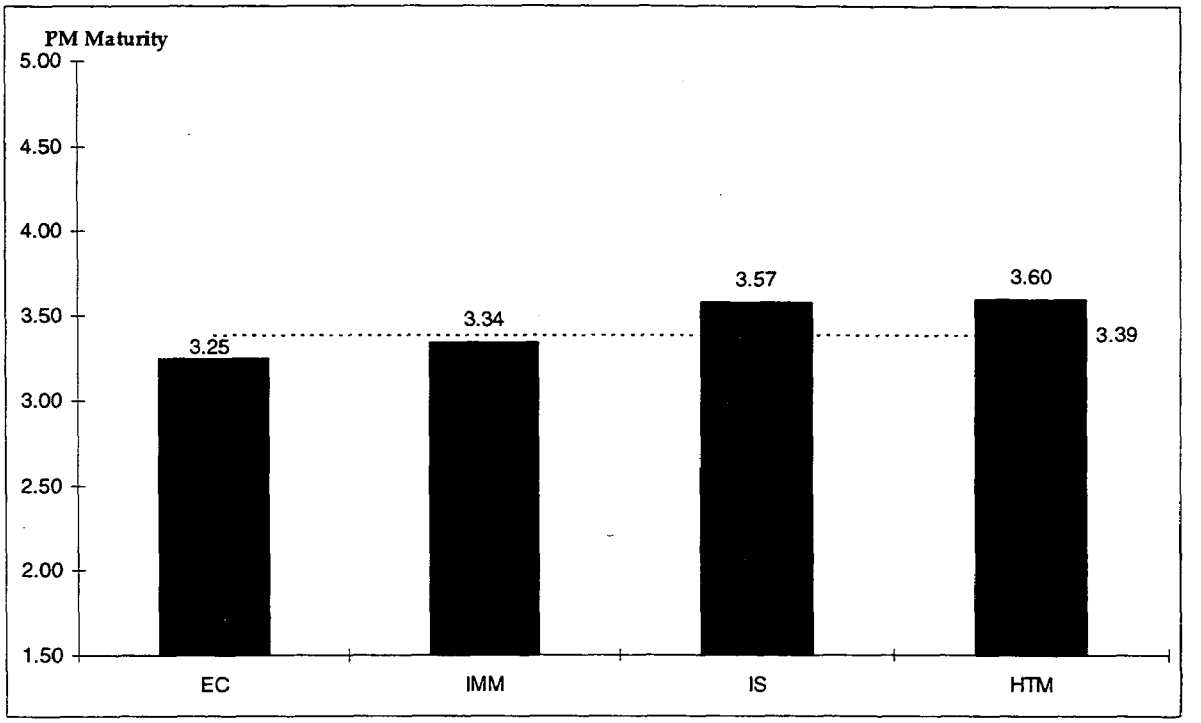

Figure 2-24. Initiating Processes (All 38 organizations)

Table 2-15 and Figures 2-25 and 2-26 contain the details for planning processes maturity.

	E-C	IMM	IS	HTM	All 38 Companies
Planning Maturity	3.61	3.49	3.43	3.55	3.53
Standard Deviation	0.74	0.80	1.00	0.73	0.80

Table 2-15. Planning Processes Maturity

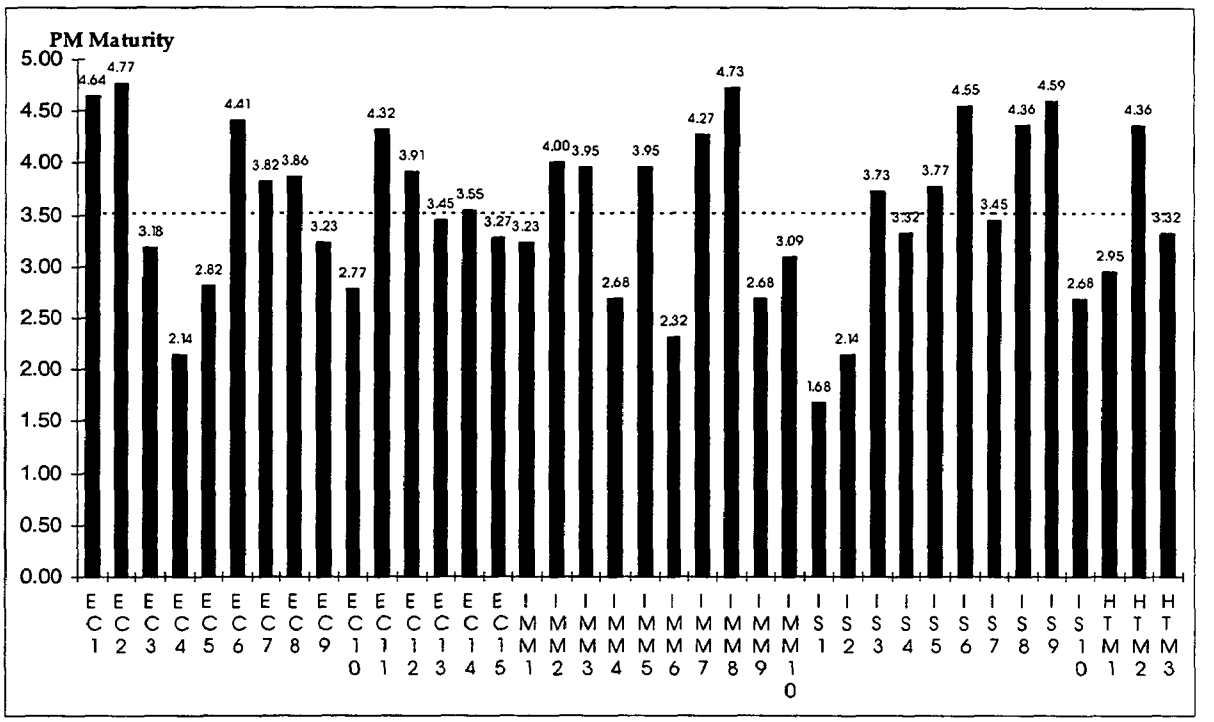

Figure 2-25. Planning Processes (All 38 organizations)

Planning processes scored the highest among the six project management processes and had one of the lowest standard deviations. Companies evidently are convinced that this is important in the project's execution and correspondingly devote substantial attention to this step.

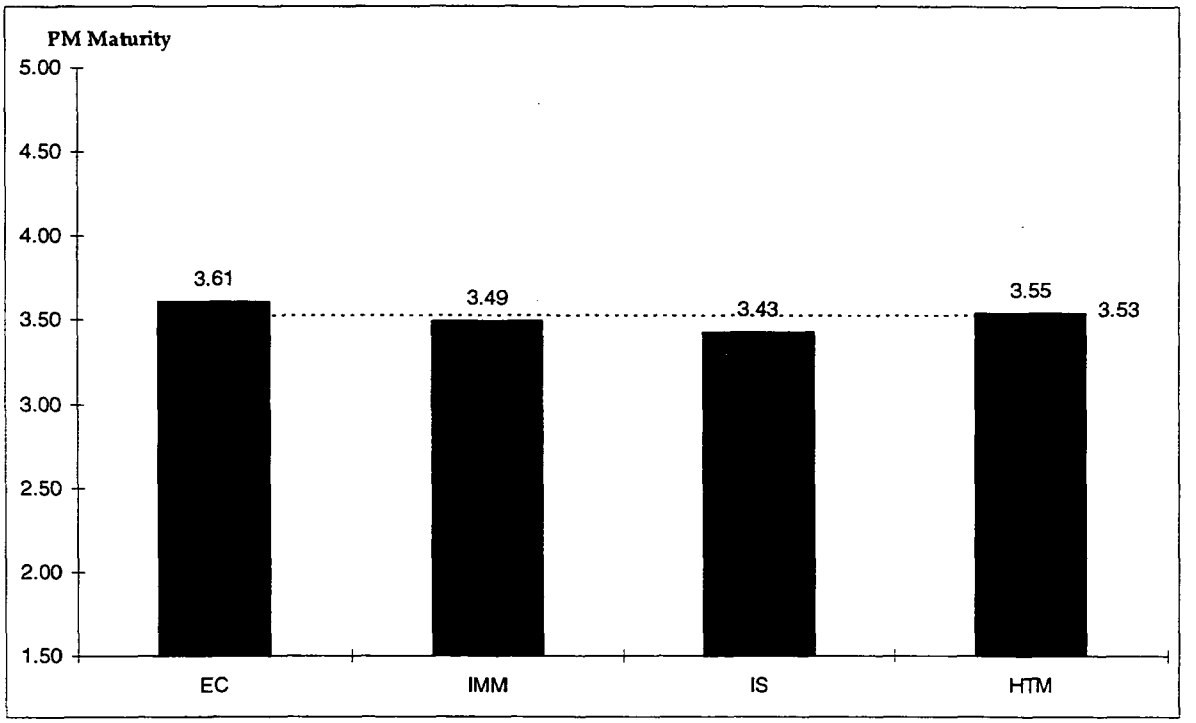

Figure 2-26. Planning Processes (4 industries)

Executing Processes

This section deals with effectively and thoroughly planning the project from the bottom up. The executing processes include defining the scope, establishing a schedule, and estimating resources and costs. It covers all the essential steps to develop an achievable and realistic plan. Table 2-16 and Figures 2-27 and 2-28 contain the details.

	E-C	IMM	IS	HTM	All 38 Companies
Executing Maturity	3.31	3.27	2.90	3.32	3.19
Standard Deviation	0.69	0.84	0.98	0.83	0.81

Table 2-16. Executing Processes Maturity

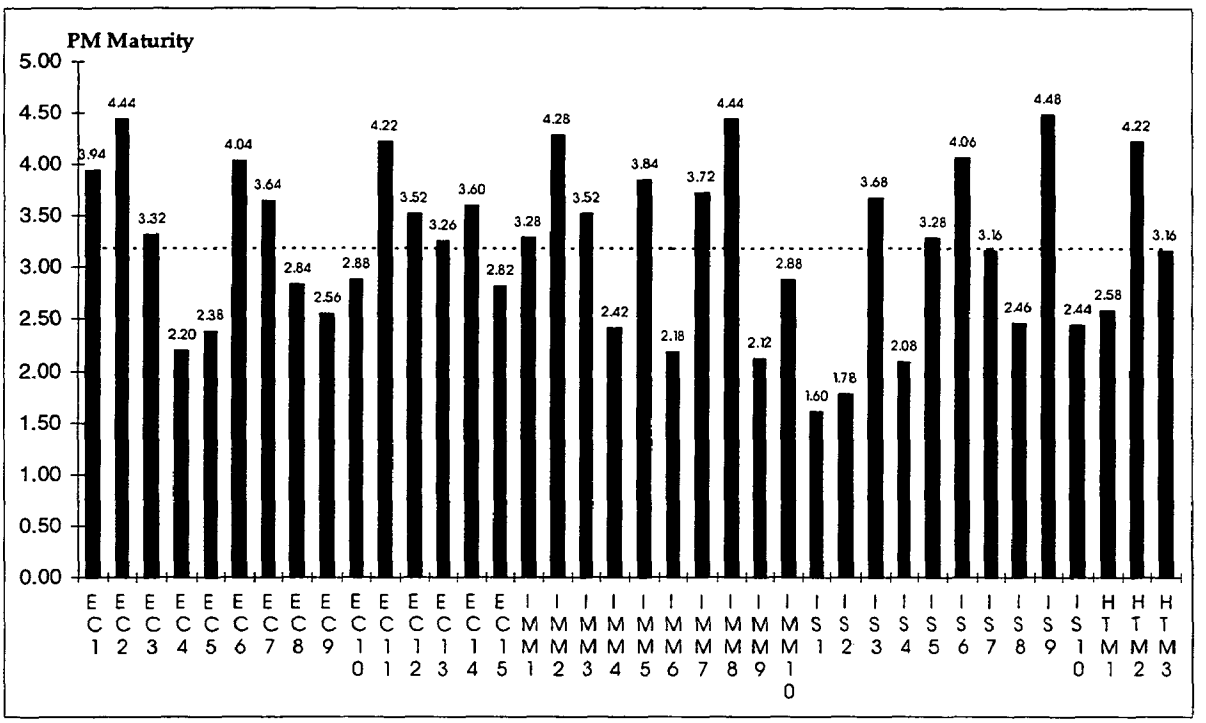

Figure 2-27. Executing Processes (All 38 organizations)

High-tech manufacturing and engineering and construction have a comparatively strong degree of project management maturity. Engineering and construction had a high executing maturity because generally construction projects are very complicated and require thorough planning to allocate necessary resources. On the contrary, information systems companies have a relatively low executing maturity. This is frequently exhibited by numerous software development projects, which have late releases.

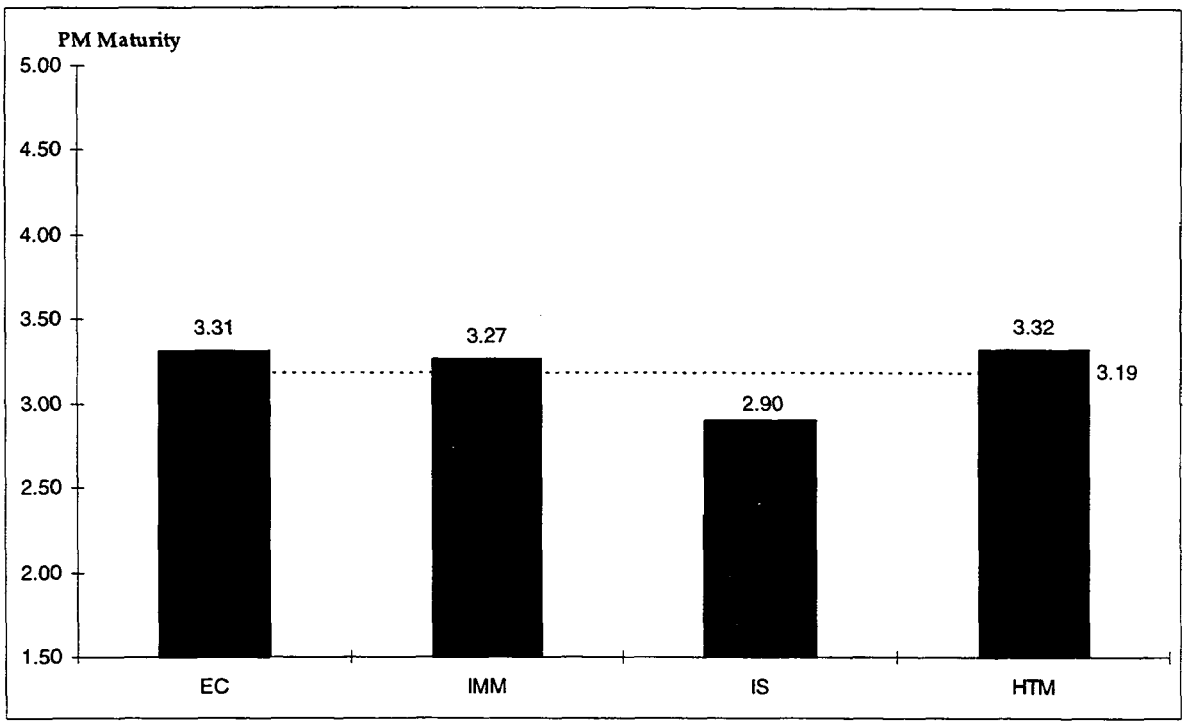

Figure 2-28. Executing Processes (4 industries)

Controlling Processes

The controlling processes include collecting, reporting, and analyzing current project status information and taking necessary corrective action. Ideally, the main purpose is to track and manage the project proactively. Figures 2-29 and 2-30 and Table 2-17 contain the details.

	E-C	IMM	IS	HTM	All 38 Companies
Controlling Maturity	3.55	3.31	2.98	3.25	3.31
Standard Deviation	0.68	0.70	1.19	1.10	0.87

Table 2-17. Controlling Processes Maturity

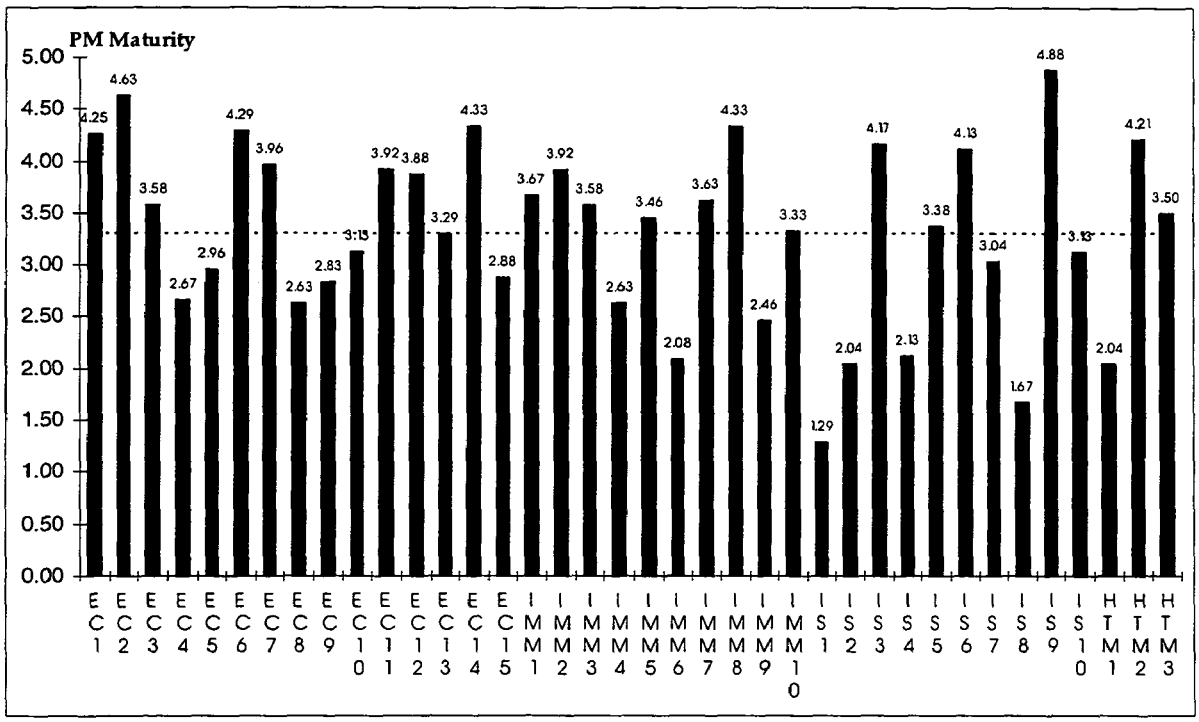

Figure 2-29. Controlling Processes (All 38 organizations)

Again, engineering and construction has a high project management maturity for this specific process, and information systems has a low index. Standard deviation of information systems was also quite high, and engineering and construction's was low. This result is not surprising since controlling processes has been a forte of the engineering and construction industry for a number of years.

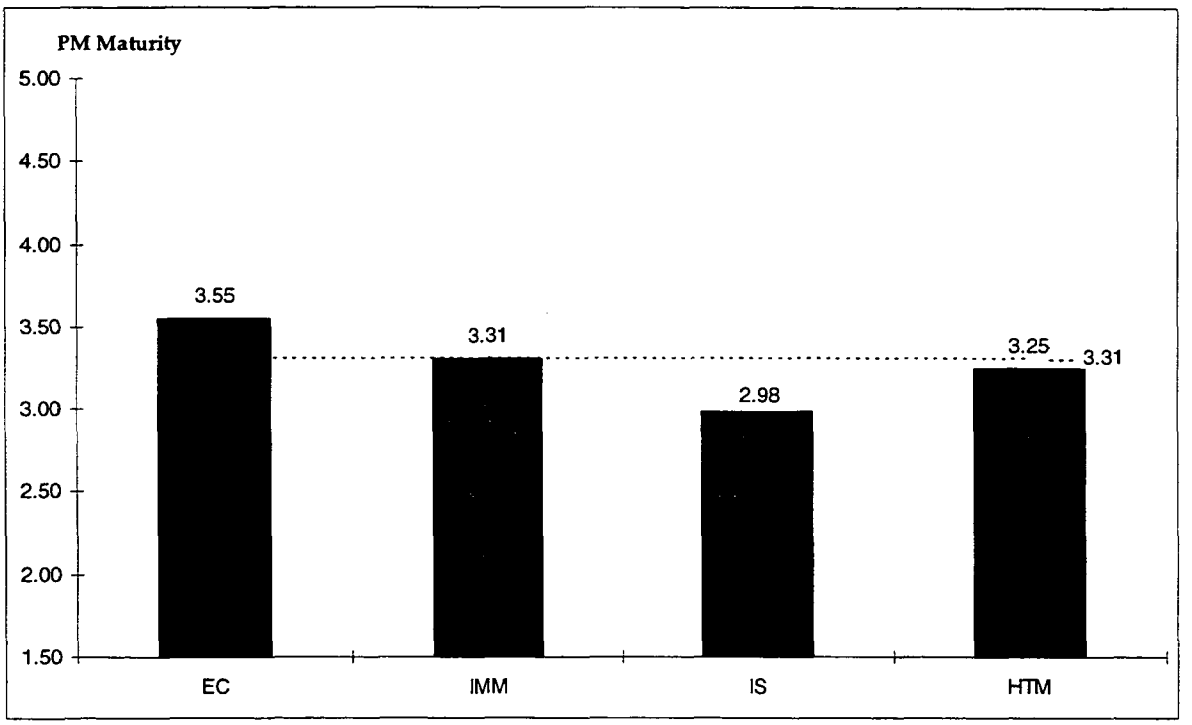

Figure 2-30. Controlling Processes (4 industries)

Closing Processes

The closing processes ensure that projects are finished promptly and that they are not left open for an extended period of time, which could result in delays and confusion for the organization. Table 2-18 and Figures 2-31 and 2-32 contain the details.

	E-C	IMM	IS	HTM	All 38 Companies
Closing Maturity	3.28	3.43	2.90	3.05	3.20
Standard Deviation	0.92	0.95	1.02	1.09	0.95

Table 2-18. Closing Processes Maturity

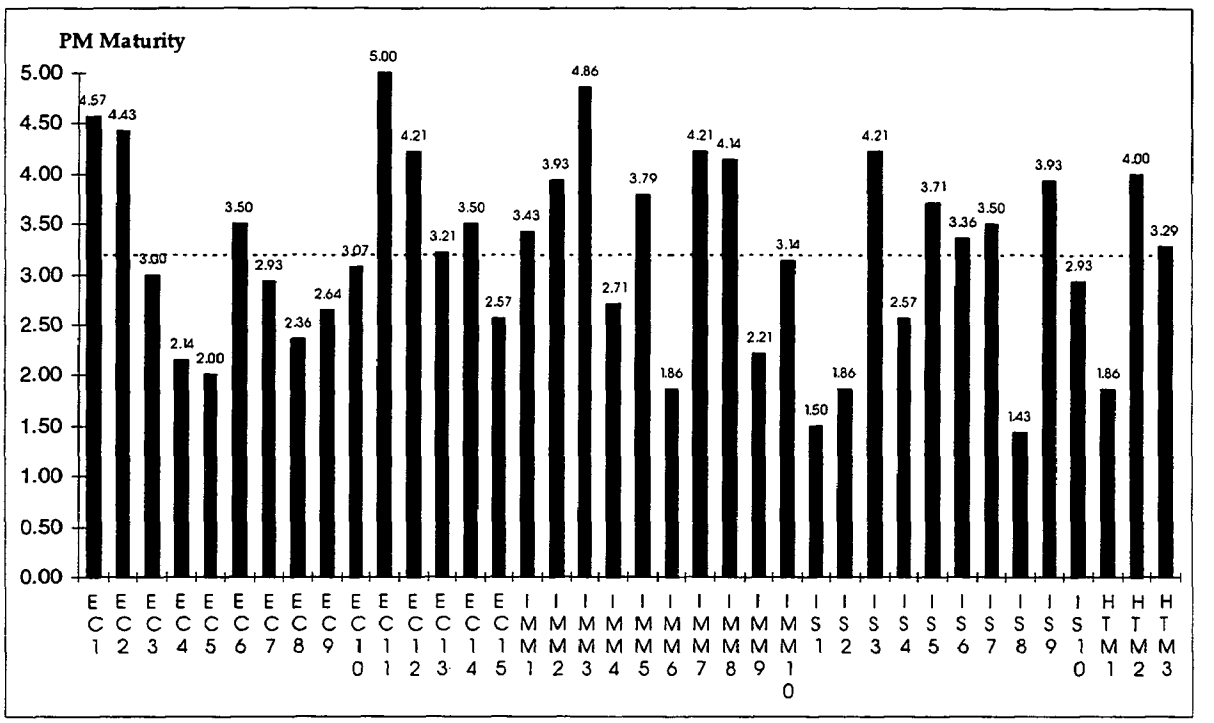

Figure 2-31. Closing Processes (All 38 organizations)

In general, information management and movement is very strong in this regard; however, information systems needs improvement. Information management and movement is strong because competition is high, and time-to-market is very important. Information systems scored low. Again, numerous software development projects have late releases deviating from the authorized schedule. This explains low project management maturity in the closing processes. Another interpretation is that only a few major software development companies dominate the whole information systems application area. Consequently, they are not really concerned about project delays or high competition.

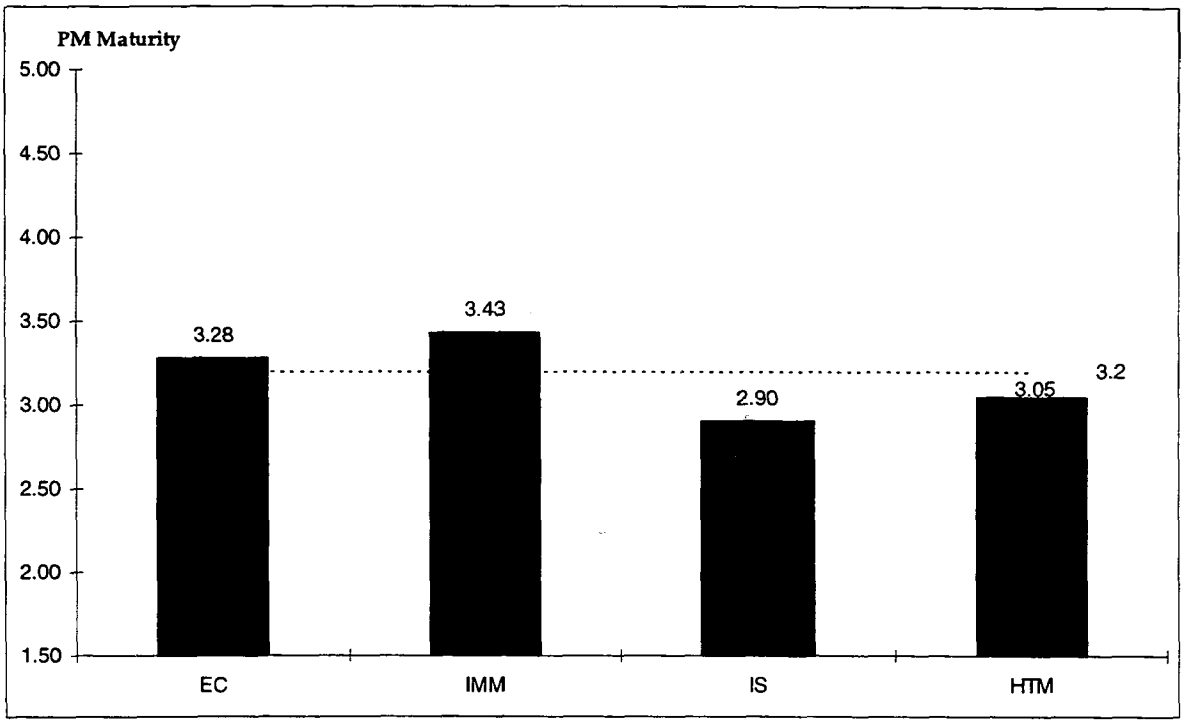

Figure 2-32. Closing Processes (4 industries)

Project-Driven Organization Environment Processes

The project-driven organization environment processes attempt to sustain a project-oriented organization. They deal with compensating project managers and project teams, developing project relationships with suppliers and subcontractors, planning for career advancement of project personnel, budgeting for project, and supporting project management processes in the organization. Table 2-19 and Figures 2-33 and 2-34 contain the details.

	E-C	IMM	IS	HTM	All 38 Companies
Project-Driven Org. Environment	3.14	2.99	2.73	3.25	3.00
Standard Deviation	0.66	0.84	0.93	1.02	0.80

Table 2-19. Project-Driven Organization Environment Maturity

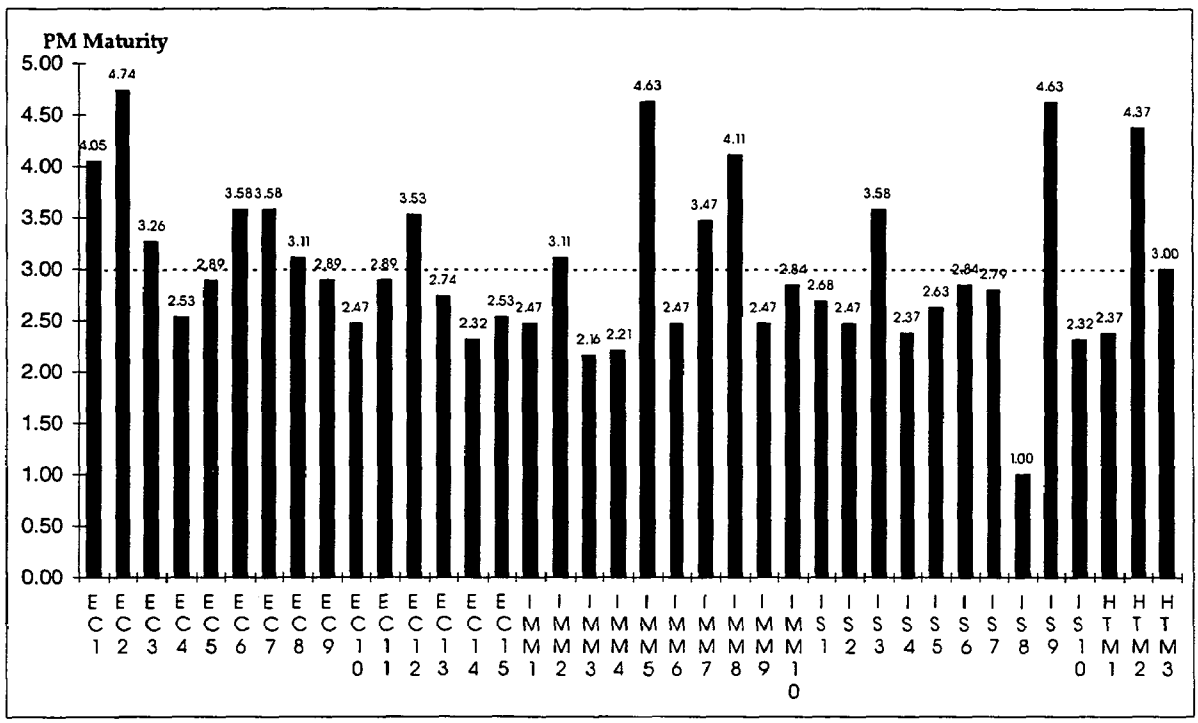

Figure 2-33. Project-Driven Organization Environment Processes (All 38 organizations)

The project-driven organization environment processes are, for all companies together, the least mature processes. Because they have the lowest standard deviation of all the processes, the data suggests that all the companies in all the industries have substantial room for improvement.

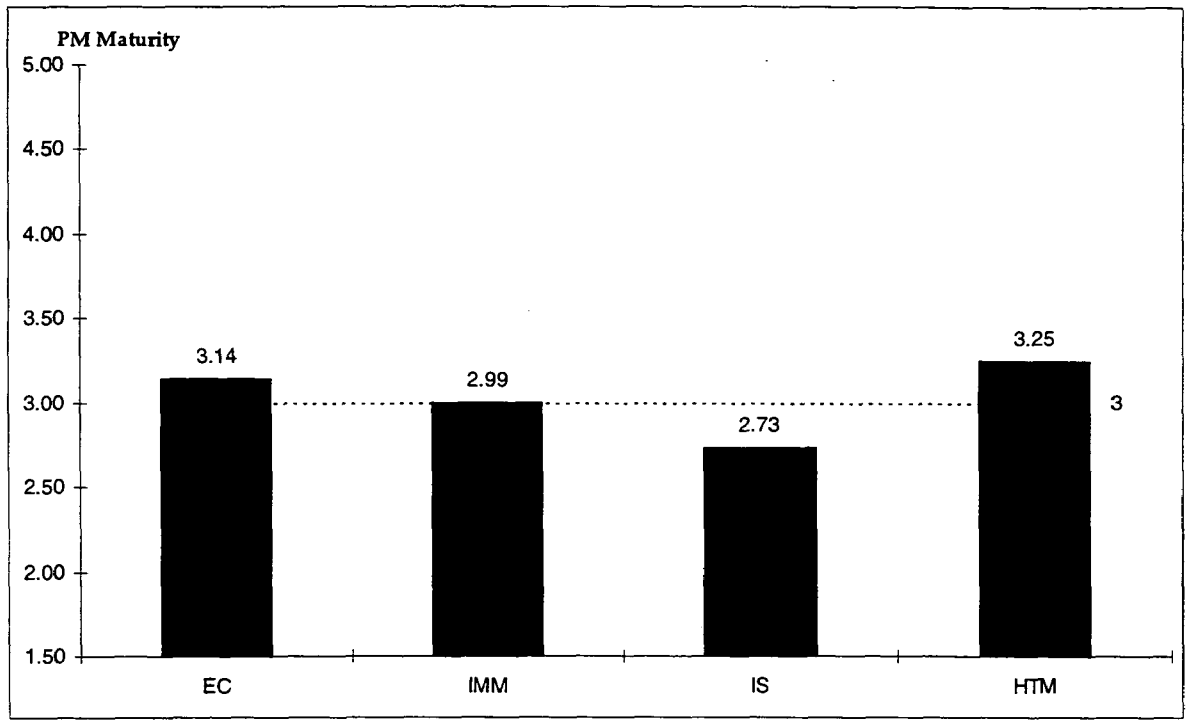

Figure 2-34. Project-Driven Organization Environment Processes (4 industries)

Commentary on the Data Analysis

To complement (and, in some cases, to substantiate) analysis of the benchmarking data, a series of lengthy, detailed interviews were conducted with several representatives of the organizations that participated in the study. Generally, those people interviewed were senior "managers of project managers." Only five companies were interviewed because of time and cost constraints. Also, some of the company representatives were not available.

Company EC-1

Company EC-1 had strong process maturity ratings according to the benchmarking applied tests. What was noteworthy about this firm, though, was its indifference toward formal project management processes and, especially, toward project management professional (PMP) certification. In the words of the contact person, "We really don't need PMP testing because we're above the norm." This comment and the attitude of the company have major implications for the Project Management Institute and the project management professional certification process. They are not uncharacteristic of the attitudes of many companies.

Company EC-2

Company EC-2 is an owner organization that works regularly with engineering-construction companies to build consumer products manufacturing plants around the world. It is a storied company with a well-regarded management philosophy and a keen emphasis on time-to-market for its consumer products.

A project manager is assigned to oversee the project after the business unit has completed its market studies. This presents a problem in the opinion of the person interviewed in this study. Much of the project scope has been formalized by this time, particularly in terms of product definition and the manufacturing technology. The company parent to this project management organization has been very active in developing alliances and partnerships with suppliers, and many of the process technologies that will be used in the manufacturing process have already been selected and locked-in by the time the project manager is assigned.

Company IMM-6

Company IMM-6 is an information management and movement company that has struggled to implement formalized project management procedures over the past four years. The manager leading this effort is still trying to finalize his charter, which, as currently written, is too customer-oriented, in his opinion. It did not surprise this manager that his department's overall project management maturity score was significantly below average: 2.18 versus 3.26.

Project management training is performed with an outside consultant. Another consultant was used until recently, but that company was too software development-oriented for this company's needs, which are more inclined toward system integration. The project management training is more "employee-pull, than supervisor-push"; i.e., the employee, not the employer, chooses which of eight modules to study and when. There are sixty people in his group who are dispersed throughout the United States and Canada, complicating communication between the members and the lessons learned.

Risk management was not well conducted according to the benchmarking analysis, so a large portion of the interview focused on this project management knowledge area. Essentially this group's approach to risk management is to make extensive use of technology partners and alliances, i.e., contract the risk to other parties. Disaster recovery groups are also used; however, normally these are formed after the problem has arisen, which is too late.

The company's main focus is time management because of the company's overall emphasis on time-to-market. Nevertheless, this group's project management maturity score for time management was not good, and a large part of this is attributable to weak scope management.

Procurement management is weak for a variety of reasons, including the fact that many times the project management group is brought into the project after the customer has essentially selected which products/services will be supplied by outsider entities. This, in turn, often dictates or limits the range of procurement options for the project manager because of standard industry practices in these different areas. Sometimes the customer may even have already selected the technology partner, further limiting procurement options.

As a manager, his goal is to have his project managers billable at least 60 percent of the time. It was especially difficult for this manager to calculate his cost of project management services because very frequently his personnel do not get to finish a project. The customer may cancel the project in midstream, or she may decide that she can finish it with her own personnel.

Company IMM-10

Company IMM-10 is distinguished by having a progressive Project Management Center of Excellence (PMCoE); yet, it is clearly understaffed (two full-time equivalent people to support forty plus project managers). The distinguishing trait is its coaching program, which has established a formal mentoring program for its program managers.

The key facet is the ongoing oversight role that the center of excellence provides to the several dozen project managers it supports. Oversight gives those project managers a clearer indication of their long-range career paths and offers them incentives. The PMCoE resource people each have more than ten years with the company and a cumulative thirty years of project management experience. The mentoring involves a proactive interaction with project managers rather than reactive meetings at times of crisis. (The coaching manifesto is outlined in the appendix of this report.)

Company HTM-3

Company HTM-3 is a high-tech manufacturing company that has used formalized project management concepts for several years. This firm has a formal introductory project management training course utilizing an outside training firm, but it is more employee-pull, than supervisor-push. There is no advanced project management training course for more experienced personnel seeking a refresher course.

Like Company IMM-6, this company's project management personnel are frequently pulled off projects before they are finished, making it difficult to measure the percentage of project revenues spent on project management services.

There is extensive emphasis placed on the project's budgeting and cost control, so this company's above-average rating on cost management is understandable. A strategic planning unit has been formed within this company's project management group, and two of its key functions are to develop better screening criteria for assessing the likelihood of project success before the project passes the budget authorization stage and to improve the lessons learned during the feedback cycle.

Customer service and quality are important to this company, and one-third of corporate executive bonuses are based on customer service and quality measures. Most of the communication measures used in this company are based on the quantity of information passed and the number of messages sent, not the effectiveness or timeliness of that information. This company does not have a project management center of excellence.

Chapter Summary

This chapter presents the findings of the project management process maturity benchmarking. A total of thirty-eight companies and application areas participated in this study: fifteen engineering and construction companies, ten information management and movement companies, ten information systems companies, and three high-tech manufacturing companies.

Based on the collected data, the average number of years that organizations have actively applied project management practices and processes is 10.7 years. The data analysis also revealed that the average organization spends 6 percent of project value on total project management costs.

The one (lowest) to five (highest) scale was used to measure and benchmark the relative project management maturity level of each area. The overall average project management maturity of the information systems area (3.06) lags substantially behind the other industries studied in this research. Engineering and construction (3.36), high-tech manufacturing (3.34), and information management and movement (3.30), on the other hand, are relatively mature, yet even they have substantial room for improvement. The project management maturity analysis result related to

high-tech manufacturing should be less emphasized since only three of these companies participated in this research.

Project management strengths and weaknesses of participating industries and organizations are further discussed to find the consequences based on each knowledge area and project management process.

The current areas of strength in the analysis of knowledge areas are cost (3.48), communications (3.44), scope (3.42), and time management(3.37). Human resource (3.12), procurement (3.14), quality (3.06), and risk management (2.85) are the current areas of weakness. It is suggested that risk management has potential for substantial improvement.

The assessment result of the project management processes show that the planning (3.53), initiating (3.39), and controlling (3.31) processes are the current areas of strength. Closing (3.20), executing (3.19), and the project-driven organization environment processes (3.00) are the current areas of weakness.

Finally, to complement and to substantiate analysis of the benchmarking data, a series of interviews were conducted with several representatives of the organizations that participated in the study.

CHAPTER THREE
Project Management/Return on Investment Calculations

Introduction

One of the main purposes of this research is to examine the relationship between project management maturity and actual project performance. Previous research studies on project management simply advocate project management practices without showing any relationship between levels of project management practices and project performance. There was no solid foundation to support these research results. This chapter shows that higher project management maturity leads to better project performance.

This chapter also provides a series of steps for calculating an organization's return on project management practices and processes investment (project management/return on investment) on an order of magnitude basis. The study develops this methodology for assessing the financial return using the organization's *total* investment in project management tools, processes, and practices. The relationship between project management maturity and project cost and schedule indexes is used for this project management/return on investment computation. This project management/return on investment calculation step provides a systematic approach for the organization to estimate potential benefits of investing project management.

Project Cost and Schedule Data Collection

Project cost and schedule data are collected from the project management benchmarking questionnaire. A performance data collection sheet is developed to collect accurate project cost and schedule data.

Project cost is broken down into two parts: direct cost and indirect cost. Direct cost is the cost of resources required to conduct a project. It includes labor, material, and equipment cost. Indirect cost consists of overhead costs associated with completing a project. It includes clerical, utility, administrative, and miscellaneous

expenses. The total cost of authorized budget and actual cost were used to calculate the cost index described in the next section, Project Cost and Schedule Indexes. Table 3-1 shows a project cost data collection sheet.

Category (in dollars)	Direct Cost (col. 1)	Indirect Cost (col. 2)	Total Cost (col.3)=(col.1+col.2)
Estimated cost when project started (Authorized Budget)			
Total cost actually spent on project completion (Actual Project Cost)			

Table 3-1. Project Cost Data Collection Sheet

Project schedule data is collected by providing a data collection sheet that requests authorized project duration and the current duration forecast. Table 3-2 is an example of a project schedule data collection sheet.

Percent Complete	Authorized Project Duration (Estimated) (in days)	Actual Project Duration (in days)
100%		

Table 3-2. Project Schedule Data Collection Sheet

Project Cost and Schedule Indexes

Generally, project performance is measured by the cost or the schedule of the project. To evaluate an organization's project performance effectively, the cost index (CI) and schedule index (SI) are developed as follows:

$$\text{Cost Index, CI} = \frac{\textit{Actual Project Costs}}{\textit{Authorized Budget}}$$

$$\text{Schedule Index, SI} = \frac{\textit{Actual Project Duration}}{\textit{Authorized Project Duration}}$$

Note that cost index and schedule index are different from the *PMBOK Exposure Draft's* cost performance index (CPI) and the schedule performance index (SPI) (1994). In this study, if the project is finished under budget or ahead of schedule, the cost index or schedule index is below one. If the project is finished over budget or behind schedule, the cost index or schedule index is above one. Therefore, **the smaller the cost index and schedule index, the better the project performance.** Also, it is assumed that the estimation of cost index and schedule index are accurate.

Not all thirty-eight participating organizations provided useful project performance data. Some companies would not disclose information because they treat the data as confidential. Others stated that they do not collect and store schedule and cost information in the form that was requested for this study.

As a result, only seventeen organizations provided cost information. Only fifteen organizations provided schedule information. The small sample size impeded the data analysis. However, the cost index versus project management maturity and the schedule index versus project management maturity analyses show results that tend to support the research hypothesis that project management maturity and project performance are positively correlated.

Statistical Regression Analysis

In this study, a regression analysis is conducted to find the best fit line between an organization's project management maturity and actual project performance. The motivation for using a regression line is to show any tendencies and trends by analyzing the factors between project management maturity and project cost and schedule performance. This best-fit line becomes a foundation for interpolating and calculating an organization's unique order-of-magnitude estimates of project management/return on investment.

Microsoft Excel allows one to analyze and choose a best-fit regression line among linear, logarithmic, power, and exponential functions. In this study the highest R^2 regression model was selected from among these four different functions to find a best-fit regression line. R^2 is the coefficient of determination, which is a measure of the goodness fit of a regression model. It measures the strength of the correlation between the given data and the regression. A value of 1.00 indicates that they correlate completely; a value of zero indicates that they don't correlate at all. In other words, R^2 measures the strength of the relationship between variables. Generally, a higher R^2 value implies that a stronger correlation exists between two variables.

Project Management Maturity versus Cost Index

Figure 3-1 portrays the statistical relationship between the overall project management maturity for seventeen organizations and the cost index that these companies reported for a selected representative project. In this analysis, project management maturity is an independent variable, and cost index is the dependent variable. The heavier line is the best-fit regression equation, and the two lighter-colored lines are the plus/minus 10 percent control limits. Although this does not show a strong relationship (the R^2 value is low), possibly because of the small sample size, it is still interesting and useful.

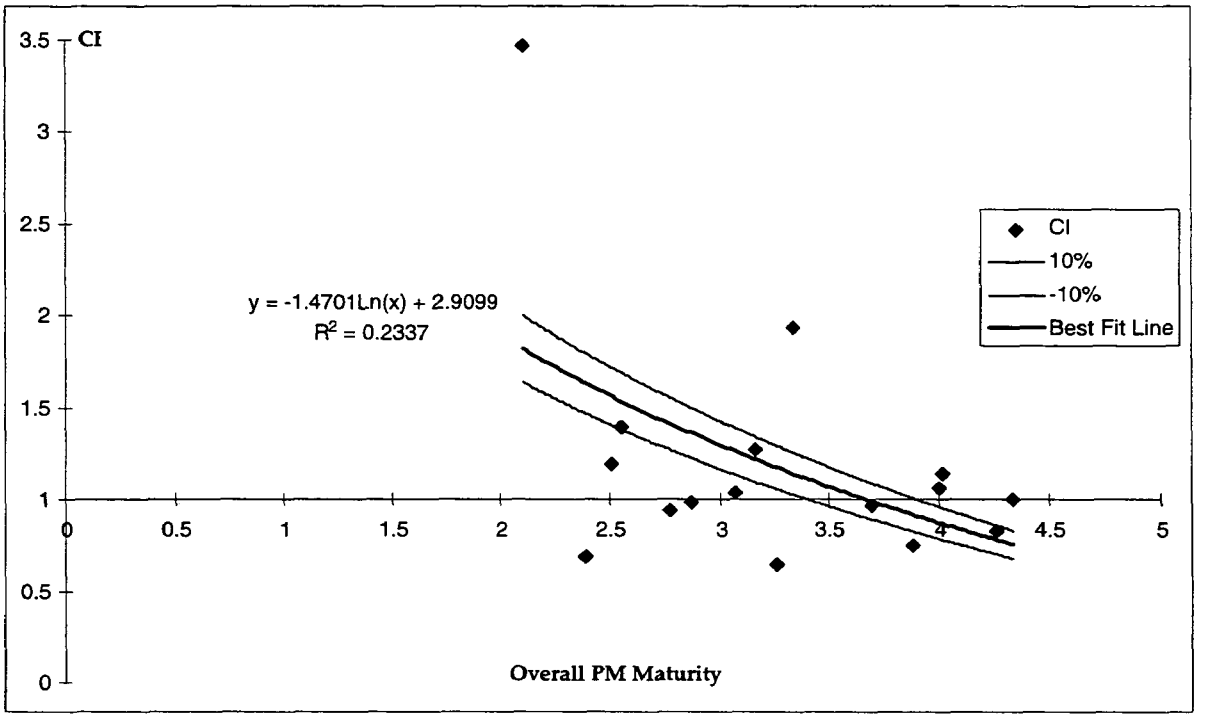

Figure 3-1. Project Management Maturity versus Cost Index, CI (n=17)

First, the slope of the curve indicates that higher levels of project management maturity were associated with better cost performance on projects. This encourages an ever-increasing projectizing of operations, and it also encourages the maturity of

project management teams. Even if outlying data points are excluded, a nonlinear downward-sloping curve is still the best fit, thus reaffirming this key point.

Second, the best-fit nonlinear function [y = -1.4701Ln(x) + 2.9099] indicates that there is a diminishing return on higher levels of project management maturity; i.e., the payoff for moving to higher levels of project management from a low starting point is greater than the payoff for moving from a higher starting point.

These figures clearly show that there is somewhat of a positive tendency between higher project management maturity levels and better cost performance.

Project Management Maturity versus Schedule Index

Figure 3-2 portrays the statistical relationship between the overall project management maturity for fifteen organizations and the schedule index that these companies reported for a project they selected as representative. The heavier line is the best-fit regression equation, and the two lighter-colored lines are the plus/minus 10 percent control limits. This relationship is somewhat higher than that for the cost index and, although it does not show strong relationship (the R^2 is too low), it too is still interesting and useful.

As with the schedule index data, the slope of the curve indicates that higher levels of project management maturity are associated with better schedule performance on projects. Once again, even if outlying data points are excluded, a nonlinear downward-sloping curve is the best fit thus reaffirming this key point [$y = 7.5992 x^{-1.5494}$]. The nonlinear function indicates that there is a diminishing return on higher levels of project management maturity; i.e., the payoff for moving to higher levels of project management from a low starting point is greater than the payoff for moving from a higher starting point.

The R^2 was not high enough to declare that there is a strong relationship between project management maturity and schedule index. However, these figures clearly show that there is somewhat of a positive association between higher project management maturity levels and better schedule performance on projects.

Financial Impact on Project Management Investment

Benefits of Calculating Project Management/Return on Investment

Managers are increasingly being asked to justify the investment before undertaking the necessary changes needed to implement or improve their project management processes. Unfortunately, previous research into the question of project management's return on investment has been largely anecdotal and speculative.

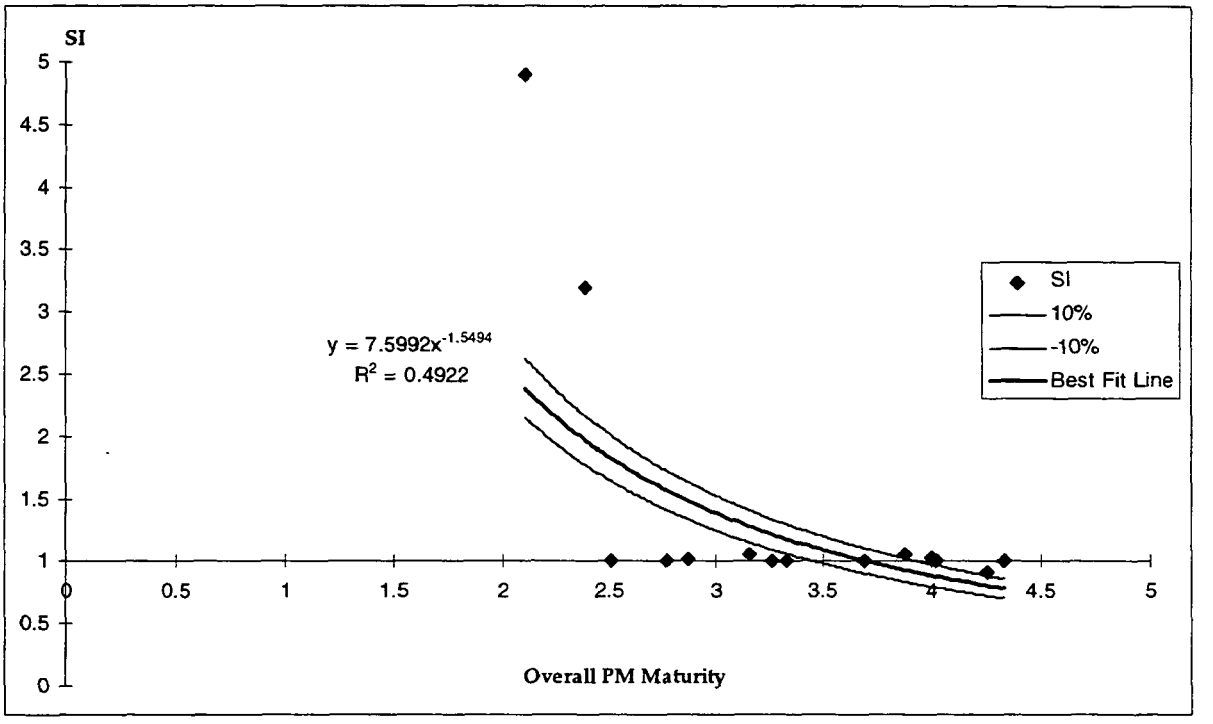

Figure 3-2. Project Management Maturity versus Schedule Index (n=15)

This research develops a process to measure the project management/return on investment. This study has shown that a positive tendency exits between organizations with higher project management maturities and favorable cost and schedule performances. The result of this regression analysis is used as a basis to develop curves to forecast predicted cost and schedule performance levels for a specific project management maturity level.

This project management/return on investment calculation will assist managers to better understand and respond to queries from top managers about the cost effectiveness of project management. The methodology presented makes it possible for managers to measure the potential benefits of projectizing an organization or improving a company's relative level of project management sophistication. This, in turn, helps managers make more prudent project management investment decisions.

Project Management/Return on Investment Calculations Steps

The steps for an organization wishing to calculate its project management/return on investment start with the relationships conveyed in the previous sections on Project Maturity versus Cost Index and Project Maturity versus Schedule Index. The mechanics of the project management/return on investment calculation are described in Figure 3-1, using project management maturity versus the cost index graph as an example. The steps for an organization wishing to calculate its project management/return on investment are as follows:

1. The organization first identifies its current project cost index, $CI_{current}$, and its current profit margin, $P\%_{current}$, from an analysis of its recent projects, and its current project management maturity, $PM_{current}$, from the benchmarking procedure described in Chapter 2. As an aside, the organization can use this information to compare its own performance against that of its peers by referring to Figure 3-1.

2. Next, the organization should select a target project management maturity level to which it seeks to shift, $PM_{desired}$.

3. At that targeted project management maturity level, $PM_{desired}$, the organization would use the curve in Figure 3-1 to identify what $CI_{forecast}$ might be realized.

4. From $CI_{forecast}$, the organization can calculate a new estimated project profit return, $P\%_{predicted}$, using the following formula:

$$P\%_{predicted} = \frac{CI_{current} \times P\%_{current}}{CI_{forecast}}$$

NOTE: The above equation does not work for negative values of $P\%_{current}$. It would indicate that a company that improves its cost index actually loses more money, which is inconsistent with logical expectations.

5. This is the estimated new profit margin (in percent) that can be achieved by moving to a different project management maturity level. To estimate the project management/return on investment, multiply this $P\%_{predicted}$ by the annual sales derived by the organization from projectized operations and then divide by the estimated costs of moving from $PM_{current}$ to $Pm_{desired}$.

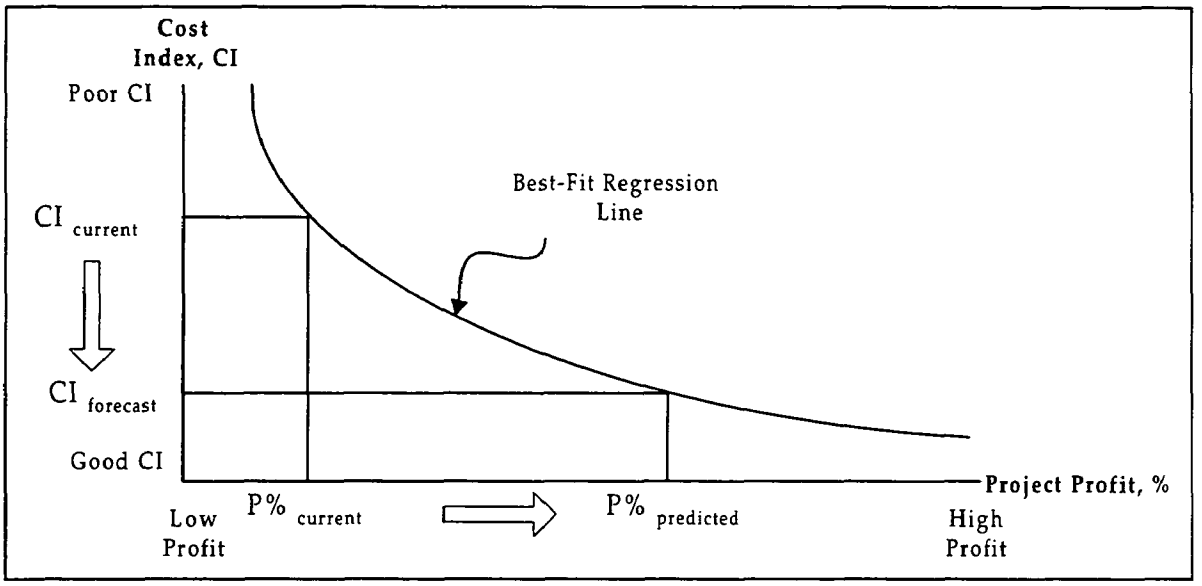

Figure 3-3. Cost Index versus Project Profit (%)

6. To forecast the annual project management/return on investment, multiply ($P\%_{predicted} - P\%_{current}$) by the annual sales derived by the organization from projectized operations. Then divide by the estimated annualized project management expenditures of moving from $PM_{current}$ to $PM_{desired}$.

$$\textbf{PM/ROI} = \frac{(P\%_{predicted} - P\%_{current}) \times \textit{Annual Project Revenues}}{\textit{Annualized PM Expenditures}}$$

In a similar fashion, the schedule index of an organization can be estimated using project management maturity versus schedule index graph (Figure 3-2). Because many companies today are more time-driven than cost-driven, this second type of analysis may actually be more appropriate to their project management investment decisions.

Example of Project Management/Return on Investment Calculations

This section provides a step by step scenario for calculating an order-of-magnitude project management/return on investment estimate.

Consider the scenario where an organization wants to improve project management maturity from $PM_{current}$ = 2.1 to $PM_{desired}$ = 3.3. In this case, we'll assume that the organization currently achieves a profit margin of $P\%_{current}$ = 5%.

Next, we use the regression line from the project management maturity versus cost index graph in Figure 3-1 as a basis. If $PM_{current}$ = 2.1 for this organization, then its estimated $CI_{current}$ = 1.6. (If the organization has reliable project records it may be able to calculate its own, typical cost index value and substitute that in place of $CI_{current}$.)

The next step is to compute a $CI_{forecast}$ from Figure 3-1. In this case, given a desired shift to $PM_{desired}$ = 3.3, the $CI_{forecast}$ = 1.3.

Then the new $P\%_{predicted}$ would be calculated from the following equation:

$$P\%_{predicted} = \frac{CI_{current} \times P\%_{current}}{CI_{forecast}}$$

$$P\%_{predicted} = (1.6 \times 0.05)/1.3 = 6.2\%$$

The project management/return on investment realized by upgrading from $PM_{current}$ to $PM_{desired}$ is:

$$\textbf{PM/ROI} = \frac{(P\%_{predicted} - P\%_{current}) \times \textit{Annual Project Revenues}}{\textit{Annualized PM Expenditures}}$$

Consider that the organization has $10,000,000 in annual project revenues and that the annualized cost to upgrade from $PM_{current}$ = 2.1 to $PM_{desired}$ = 3.3 would be $400,000.

Then the project management/return on investment realized by upgrading from $PM_{current}$ to $PM_{desired}$ is:

$$\text{PM/ROI} = \frac{(6.2\% - 5.0\%) \times \$10,000,000}{\$400,000}$$

$$\textbf{PM/ROI} = \textbf{30\%}$$

Because the data are inexact, we have included plus/minus 10 percent curves in Figure 3-1. Using those upper and lower bounds, this procedure would yield a project management/return on investment ranging between 15 percent and 41 percent.

A Few Caveats

A few caveats need to be mentioned. First, for many organizations, it is difficult to associate with profit and profit margins with project-related operations. Many businesses do not have accounting systems that permit identifying the project-related profits, $P\%_{current}$, the annual project revenues, or the annualized project expenditures. Their accounting systems are still functionally based, which would complicate or impede calculating these quantities.

Secondly, annualized project expenditures are difficult to calculate. In the course of this study, we did not find one organization that measured these expenditures in an effective manner. In fact, many companies had not even attempted to measure them. As a starting point, the following checklist is suggested for the types of costs that might be included in such a computation:

- Salaries and benefits of project management personnel.
- Project management consultant expenses.
- Project management systems, procedures, and tools on an annualized basis.
- Computer hardware and software acquisition, maintenance, and upgrade costs on an annualized basis.
- Support staff, such as clerical, administrative, and technical personnel.
- Project management training on an annualized basis, whether provided by in-house staff or consultants.
- Certification expenses, such as project manager professional and International Standards Organization.
- Recruitment and hiring expenses.
- Travel, meeting, and coordination expenses.
- Supplies and material costs.
- Rent and other facility management expenses.
- Telephone, fax, and networking expenses.
- Moving and storage costs and temporary office expenses.
- Utility expenses.

Another caveat is what is meant by the definition of "profit." Sometimes cost savings are equally important. Any project management/return on investment computations should reflect that management may be just as concerned about cost savings as profit generation.

The non-linearity and the complexity of measuring "profit" must be taken into account as well. The first equation assumes linearity between predicted and current values of cost index and profit margin, and this is rarely the case. Consider the following example:

If a project's selling price is $10 million and the profit margin is 5 percent, the actual cost is (roughly) $9.5 million. For a company with a cost index of 1.6, its estimated cost would be $9.5 million/1.6 = $5.94 million. On the other hand, if that company improves to a cost index of 1.3, it would have an estimated cost of $9.5 million/1.3 = $7.72 million. The new profit would be $2.28 million ($10 million – $7.72 million), or about 30 percent, not the 6 percent computed above. For the same $400,000 investment used in the previous example, the project management/return on investment is 470 percent, which would be highly unusual.

The upshot then is that the project management/return on investment calculation procedure presented in the previous section will yield only an approximate, order of magnitude project management/return on investment estimate. The real world of business is very practical, and it would be unlikely to find a company that consistently had cost indexes of 1.6, or even 1.3, on all its projects, for it would soon be out of business.

Finally, a focus on the project's cost index, using its budget, as was the case in this study, may really be secondary. In other words, the project is only a step toward developing a revenue-generating service or product. Far greater profits can be realized by a telecommunications company developing and eventually selling call waiting, for example, to millions of customers than can be realized from the "profit" of finishing a project economically.

Thus, using the cost index as a measure for the return on investment on a project is not always the best measure; however, there was no other option in the case of this research project. Indeed, an argument can be made that the ideal cost index is 1.00 and that any differences between estimated and actual cost are not a profit but rather a windfall gain achieved through a bad cost estimate rather than through good project management. In fact, it is possible that as an organization matures in its project management processes, the actual and estimated costs of that organization's projects will decrease asymptotically toward 1.00. Such a phenomena is not addressed by our project management/return on investment measurement methodology.

Chapter Summary

The data presented and analyzed in this chapter contain several very important points for managers and organizations.

Cost index and schedule index were developed to measure an organization's project performance. The analysis shows that the organizational project management maturity level and the actual project cost and schedule performance data were moderately correlated. The gains in cost and schedule performance were positive yet gradually diminished as an organization moved toward higher project management

maturity levels. The analysis has shown that companies have substantial and very attractive opportunities for improving their project cost and schedule performance by moving to higher levels of project management maturity.

The regression analysis was used as a basis to measure, estimate, and predict an order-of-magnitude project management/return on investment that is characteristic of the individual organization. The project management maturity versus cost index and schedule index relationships were used to forecast the potential gains made possible by moving to a higher project management maturity level.

The steps for calculating project management/return on investment were presented to derive order-of-magnitude project management/return on investment estimates. An organization should further adjust and tailor this formula to estimate its own project management/return on investment. These data analyses and the project management/return on investment calculation steps could encourage managers to pursue investing in project management as well as to improve these project management processes in very specific and useful ways.

CHAPTER FOUR
The Business Perspective

This chapter is co-authored by Jim McFarlin, Vice President, ABT Corporation, and Dan Ono, PMP, National Project Director, Lucent Technologies-BCS.

Introduction

Today's business environment is increasingly unforgiving in nature. Organizations of all types are aggressively seeking greater competitiveness; increased customer satisfaction; heightened market leadership; reduced time to market; productivity and cost advantage; and many other ingredients of business success in a competitive, global market.

In this environment, the increasing business objective of project management is to improve such financial and organizational results from the application of project management practices, processes, and tools. Hence, the genesis of this study was to begin to identify those project management practices that lead to these types of business and organizational success. **Accordingly, this study addresses not only the practices that make improved business results possible but also the characteristics of organizational project management practices that are successful in leading to business success.**

This study includes not only a rigorous academic perspective but also a thorough assessment based on the experiences, opinions, and objectives driven by a diverse representation of the business community.

On one level, the study seeks to address the business value of improved project management practices, as well as providing guidelines for others to follow. On another level, the study provides an insightful view into the project management practices of a global set of thirty-eight commercial organizations and governmental agencies in a wide variety of project environments.

The analyses presented herein are the first in a series of progressive assessments on the business value of project management. The business perspective seeks to address the evaluation of the business value of project management in such a way as to ensure that, as future studies are conducted, the most current issues and questions of the business and investment communities are addressed.

Business Findings

As one might anticipate, this study discovered new and important information. The data in itself provides a rich mine of knowledge from which to look at project management practices in one of the widest spectrums yet documented and to view those that are of most value. In addition—and perhaps of even greater potential importance—the study generated new questions and additional areas for fruitful future inquiry.

Although participation in the study was purely on a volunteer basis for participants, it is assumed that these organizations have given project management sustained attention and that they believe that competitive advantage has been gained over competition. The study, therefore, probably views information from the upper echelon of project management practices.

A key point, however, is that even the highest scoring industries achieved only *two-thirds* of the total points possible in project management practices. **No single statistic in this study more clearly summarizes, in one concise statement, the opportunity for the best to improve and for the rest to gain mightily.**

Although, in some cases, the difference between companies in absolute scoring was not of statistical significance in most categories of this study, the relative positions within a particular section of the *PMBOK Guide* area is consistent with what the industry is noted for with only a few surprises:

Engineering and construction scored highest in the following areas: scope, time, communications, risk, and procurement.

High-tech manufacturing scored highest in the following areas: cost, quality, and procurement.

Information management and movement scored highest in the following areas: human resources and communications.

Information systems did not score the highest in any of the areas. In fact, in *every* area, this particular set of information systems companies scored the lowest among the four industries and application areas. It is believed that information systems organizations are less mature in the practice of project management for several reasons:

- Information systems project success has not historically been tied to financial success, as has been the case with engineering-construction and other project management mature areas.
- The codification of business practices—which are embodied in aerospace and engineering-construction, for example—has not yet taken place in information systems. Hence, many practices for systems development are redeveloped, over and over again, without full use of best practice repeatability.

Since the engineering and construction industry has been involved with project management for the longest period of time, it would be natural to see them score the highest in many of the areas of the *PMBOK Guide*. Engineering and construction did, in fact, score the highest in scope, time, communications, risk, and procurement management. It is a surprise, however, that high-tech manufacturing scored the highest in the average score.

Another point of interest is that even the highest scoring industries only achieved two thirds of the total points available. This indicates significant room for improvement in even the highest scoring industries. Among the industry scores, even greater opportunities for improvement appear to exist in the lower scoring industries of information management and movement and especially in the information systems areas.

Although, from a third party business point of view, there are numerous questions and areas that need clarification, it is encouraging to note that many interesting correlations have come to light from the information produced to this point.

What Do Corporations Get for Investing Money into Project Management Resources, Training, and Processes?

It appears that the majority of the companies in this study have recognized, at varying levels, the value of project management's ability to facilitate the success of a company. This can be seen in the escalating amount of investment in project management resources and services discovered in this study. The 6 percent of project revenues discovered by this study is anywhere from 20 percent to 100 percent higher than previously understood by the profession to be the average investment.

The lack of strong correlation between the levels of project management investment and the level of project management maturity requires additional investigation. A correlation was found relative to positive impacts on project results and the amount of investment a firm made in project management as reflected in the cost index and schedule index results. However, it is possible that some of these costs are caused by a lack of project management knowledge. This project management knowledge generates the need for additional resources required to recover from the mistakes made during the project and to compensate for the lack of project management maturity in the project management knowledge areas. It is this premise that will need to be further investigated by future study endeavors.

Strategically Important Differentiation

One may notice that the relative maturity levels in the thirty-eight companies reflect a correlation between the highest levels of maturity and the age of the industry. This also reflects the length of time the industry has been practicing project management. In seeking to enhance the status of a company in its industry, it would seem to be a prudent, if not essential, investment for such a company to attempt to leapfrog the natural timetable reflected by this study's results. The company would thus gain a competitive advantage.

The companies included within this study exhibited a low average project management maturity level. Only 62.5 percent of perfection indicates that even within industries there is sufficient opportunity to create a differentiation from the competition in each of those industries. This fact is particularly striking when you consider the recruitment process to recruit the participants for this study.

The recruitment process was entirely voluntary; consequently, it can be concluded that these companies took pride in their existing project management practices and processes. This may, at least, have been part of the motivation for these participating companies. If this assumption is accurate, the opportunity in less mature companies and industries is even greater. They posses a great opportunity to leapfrog out of an industry's typical project management maturity level to create a strategic competitive advantage. The definition of project management career paths, progression ladders, education and training programs, and building experience levels in the project management professions will facilitate the creation of this competitive advantage.

Towards Defining and Identifying "World Class" Project Management

Today, the description "world class" is an overused adjective for corporate organizations. This term is almost as bad as the use of the word "quality" to describe corporate processes. Often, criteria for such a "world class" organization is questionable. Closer inspection reveals that these evaluations are based on vague or nonexistent criteria. Furthermore, these evaluations lack empirical evidence; indeed, these evaluations are often based on various corporate biases.

The study team believes that this study provides the foundation for creating a globally accepted baseline or de facto standard to measure a corporation's project management capabilities. As with Software Engineering Institute's capability maturity model, the benchmarking and assessment processes used in this study can create the de facto standard within project management. Again, similar to the Software

Engineering Institute process, we believe that creating a licensing process for the application and use of the methodology used by the study team can prompt the establishment of a rigorous professional process for assessing true "world class" capability. In fact, this would place some commercial value and meaning on the description "world class." Consequently, the study team is pursuing the possibility of the Project Management Institute's communications publisher acting as the licensing agent for this methodology. It would be this assessment process that would be used to evaluate and select the winner of the study team's proposed "Annual Excellence in Project Management Practices" award.

Conclusion

In today's highly competitive, resource-scarce, Internet-time-based world, project management has truly come into its own as an organizational discipline that must be in top form if the organization is to flourish. Even *Fortune* magazine has identified project management as the "career of the nineties." *In this world, many organizations are reaching out to the 'next level' of project management—that of truly providing demonstrative business value from project management practices, processes, and tools. In this endeavor, some will succeed, but many will fail.*

This study is an enormous first step in articulating and defining the "best of the best" in project management that can lead to business success. The study method provides an invaluable set of tools for corporations to use in identifying areas of opportunity for improvement in project management. In fact, the benchmarking process can lay out a defined path to "world class" project management capability. It can also provide a process to continuously improve a corporation's ability to deliver financial and customer satisfaction benefits from its project management resources.

Although this study provides a major beginning, the true effort to achieve results falls squarely on your organization. Use the information presented to seek out those areas ripe for improvement, focus energies on practices that will yield leveraged results, and capitalize on your organization's unique strengths and competitive advantages in project management.

The continuation of this study into many other unexplored fields, such as multiproject environments, international environments, and other industries, will help the project management community become a fully accepted and recognized profession. Try it. Make project management *all it can be* in producing business value for your organization.

Findings, Recommendations and Summary

Findings

This research provides solid, comparative studies on project management practices across industries and companies within an industry. By comparing and correlating the organizational aspect of project management practices to actual project performance data, this research has discovered the following:

- The quantitative project management maturity benchmarking methodology that was developed for this study works. It provides a means for identifying and measuring different project management maturity levels by combining *PMBOK Guide* knowledge areas with project management processes with quantitative project information. This project management benchmarking process can be easily applied and is adaptable for assessing many different and undiscovered aspects of project management practices in more detail.
- The actual costs of project management—approximately 6 percent of total project cost—are actually higher than previously reported by earlier sources.
- Organizational project management maturity level and actual project cost and schedule performance data were correlated based on the collected information from participating companies. These relationships (see Figures 4-1 and 4-2) can be used to forecast the potential gains possible by moving to a different project management maturity level. These data and experiences should be interpreted to encourage managers to pursue improved project management processes.
- These relationships (shown in Figures 4-1 and 4-2) can be used to predict a project management/return on investment that is characteristic of the individual organization. These data and experiences also can be used to encourage managers to pursue improved project management processes.

Recommendations

This study was a first attempt to truly integrate project management processes and project management knowledge areas against actual project performance data. In

doing so, this study permits a factual and quantitative way to measure project management practices and performance.

- The quantitative project management benchmarking methodology is successful and should be applied to other industries and companies to further understanding of project management. It should also be reapplied to companies that participated in the first year's study to determine the impacts of improvements that have been implemented during this past year. By collecting and sharing this information, even confidentially, all project management organizations can benefit.
- An impartial, neutral organization should conduct this benchmarking so that the project management/return on investment and other important information can be reported to the project management community at large. This information would be very helpful to managers who are struggling to calculate their budgets to improve their organizations' overall project management practices.
- An "Excellence in Project Management Practices" award should be established and awarded on an annual basis. This proposed best project management practices award would focus on and recognize organizations (government, business, non-profit, education, and so on) that have superior project management practices. This award would advance the recognition of project management as an important and timely professional discipline.
- Finally, this study is only the first of many steps in coming to an understanding of the benefits of project management. There is a need for future research to understand project management practices and processes more thoroughly to achieve the project-driven organization environment in the business world.

Summary

This study has demonstrated the value of project management, regardless of the level of sophistication at which it is practiced. It has also illustrated that improved levels of project management maturity yield improved project results.

The five-level project management process maturity and three-part project management benchmarking questionnaire were developed to position and measure an organization's current level of project management practices and processes quantitatively.

The study has also revealed that many of our perceptions and beliefs about project management are not confirmed by the data. That is, we need factual, rationally collected information to properly understand project management and to properly manage our organizations.

APPENDIX A
Project Manager and Team Coaching Program
(From IMM-10)

During the past four-plus years, IMM-10 has been involved in reengineering our key business processes in order to improve the efficiency of our operations and the focus on our customers. One of the many outcomes of our reengineering effort has been an increased awareness of the importance of having a defined and consistent project management discipline in order to develop and implement programs and projects throughout the organization. Many information management and movement functions have embraced the project management discipline, requiring that these project teams follow these principles in order to better assure successful completion of projects.

Since 1993, hundreds of employees have attended the various project management courses offered by IMM-10. Feedback from those attending project management classes indicated that although the project management knowledge gained through classes is valuable, at times it may be too conceptual. What has been recognized is the need for additional assistance in the application of the project management discipline to existing projects beyond the current, classroom-style training session.

In support of the project management discipline, and to address this requirement, the Reengineering Program Management Office (PMO) has developed a project manager and team coaching program designed to help project teams in identifying and clarifying their project mission, charter, and deliverables; managing the expectations of project stakeholders and sponsor; developing an appropriate plan for the project; and on-going management and control of the project.

The project management coaching program package contains a hard copy of the individual program sessions as well as an electronic copy on diskettes . Each session or module is intended to provide information to the project manager and project team in a "just-in-time" manner—at the point in the life cycle of the project when the information is most appropriate. The package has purposely been developed to meet both individual (self-paced) or more formal team training requirements.

The complete coaching program includes text/speaker's notes on the subject matter for each module/session, as well as handouts/overheads for use by the project manager in presenting the information to their project team. Length of each module/session will vary (four to eight hours in most cases) depending upon the size and

complexity of the project and the project management knowledge/expertise of the team. The program is divided into the following sessions:

Session 1: Introduction to Project Management and Teams
- A. Coaching
- B. Project Management Discipline
- C. PMI Standards
- D. Common Vocabulary
- E. Teamwork Overview/Integrated Product Teams (IPTs)

Session 2: Teamwork and Project Definition
- A. Teamwork
- B. Project Definition Statement

Session 3: Project Life Cycle and Process Overviews
- A. Project Life Cycle
- B. Risk and Opportunity: Introduction
- C. Quality Management: Introduction
- D. Contract Management: Introduction

Session 4: Development of Detailed Project Plan
- A. Project Scope
- B. Work Breakdown Structure (WBS)
- C. Responsibility/Accountability Matrix (RAM)

Session 5: WBS to Project Network

Session 6: Working with the Project Network
- A. Critical Path Management
- B. Quality Management
- C. Work Authorization Agreements (WAA)

Session 7: Risk and Opportunity Management

Session 8: Planning, Control, Configuration
- A. Planning and Control
- B. Configuration Management

Session 9: Communications

Session 10: Motivation and Conflicts
- A. Team Motivation
- B. Conflict Management

Session 11: Problems and Successes

Session 12: Project Wrap Up

In addition to the text and overheads, to expand the participants' knowledge and perspective on project management, some of the modules suggest "homework" readings from outside authors on project management or from the *PMBOK Guide*.

This program follows the principles of project management as established by the Project Management Institute (PMI), and is consistent with the project management training courses offered internally through IMM-10's training department.

Appendix B
Project Management Benchmarking Study Team Members
PMI Northern California Chapter (PMI/NCC)

Name	Company/Organization
C. William Ibbs, Ph.D.	University of California at Berkeley
Young-Hoon Kwak, Ph.D.	University of California at Berkeley
Mike McCauley	Integrated Project Systems
Jim McFarlin	ABT Corporation
Paul Nelson	Pacific Gas & Electric (Retired)
Dan Ono	Lucent Technologies
Bill Ruggles	Ruggles & Associates, Inc.
Ahmet Taspinar	MBPNet
Cathy Tonne	Integrated Project Systems
Bob Thompson	MBPNet

APPENDIX C
Project Management Benchmarking Study Company Participants

- ADVANCED GRAPHICS (SWISS)
- AFAG (SWISS)
- AMMANN (SWISS)
- APPLE COMPUTER
- AT&T
- BECHTEL CORPORATIONS
- BELL ATLANTIC
- BELL SOUTH TELECOMMUNICATIONS
- C. OVERAA
- CHEVRON
- CONTRA COSTA ELECTRIC
- DIGITRON AG (SWISS)
- DON TODD ASSOCIATES
- EAST BAY MUNICIPAL UTILITY DISTRICT
- EICHLEY ENGINEERS
- FEDERAL EXPRESS
- GEOWORKS
- GFAI (SWISS)
- GTE
- GREAT PLAINS SOFTWARE
- HEWLETT PACKARD
- INTERNATIONAL BUSINESS MACHINE
- INTERNATIONAL HARVEST
- KODAK
- LUCENT TECHNOLOGIES
- NORTHWESTERN MUTUAL
- NYNEX
- PROCTOR AND GAMBLE
- SAN DIEGO GAS AND ELECTRIC
- SCHINDLER (SWISS)
- SOHARD (SWISS)
- SUN MICROSYSTEMS

The study team would like to thank organizations that participated in this research with valuable information and comments.

Glossary

Benchmarking. Continuous systematic analytical process of searching for and implementing industry best practices that will lead to superior performance.

Cost of Project Management. All direct and indirect costs associated with implementing project management practices. Includes salaries, benefits, software, hardware, clerical, administrative, and so on. (Total Cost of PM = Direct Cost + Indirect Cost)

Project. A temporary endeavor undertaken to create a unique product or service.

Project Management. The application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations.

Project Management Knowledge Areas. A classification of conventional and advanced management practices that are essential to successful project management.

Project Management Maturity. Level of sophistication that indicates an organization's current project management practices and processes.

Project Management Processes. A collection of project phases whose name and number are determined by the control needs of the organization or organizations involved in the project.

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