

Advocating Project Management Process Maturity

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The purpose of this paper is to present a comprehensive model (Berkeley Project Management Process Maturity (PM)² Model) to determine and position an organization's relative Project Management levels with other organizations. The model follows a systematic and incremental approach that evolves from an unsophisticated level to a sophisticated PM maturity level. Each maturity level consists of major PM characteristics, factors, and processes. The Berkeley (PM)² model provides an orderly, disciplined process to achieve higher levels of PM process maturity.

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I. Introduction

1. Motivation

Project Management (PM) tools, techniques, and processes have become a professional management discipline to initiate, plan, and control one-of-a-kind endeavors. As a result, corporate organizations are in favor of PM tools and practices which are well suitable for today's rapidly changing business environment. Moreover, the level of PM maturity that assesses an organization's current tools and practices has become grown in sophistication over the years.

Despite the broad usage of PM tools and practices across different industries, organizations

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are still often confused, uncertain, and had difficulties positioning their current application of PM. In 1997 the authors proposed a 5-Level PM Process Maturity (PM)² Model to assess and improve an organization's current PM maturity level (Ibbs and Kwak 1997a)(Kwak 1997). The primary use of this model was as a reference point for an organization applying PM tools and processes. However, this conceptual model was by no means comprehensive when it was first introduced. It lacked complete and detailed definition.

The purpose of this paper is to present a comprehensive (PM)² Model that can be used to determine and position an organization's relative PM levels with other organizations. The model follows a systematic and incremental approach that evolves from an unsophisticated level to a sophisticated PM maturity level. Each maturity level consists of major PM characteristics, factors, and processes.

2. Background

The Berkeley (PM)² Maturity Model aims to integrate previous PM practices, PM processes, and PM maturity models in such a way as to improve PM effectiveness in the organization. A literature review was conducted to capture the different aspects of maturity concept, plus discussions and thought with numerous other PM professionals.

Quality management theories and practices influenced the fundamental idea of the Berkeley (PM)² Maturity Framework. Crosby presented the five incremental maturity stages for adopting the quality concept in the organization (Crosby 1979). In addition, Deming introduced continuous process improvement practices for better quality management in the organization (Deming 1986).

The Software Engineering Institute (SEI) has conducted extensive research on improving the quality of the software development process. As a result the Capability Maturity Model (CMM) was developed as a progressive standard to help an organization continuously improve its software process (Paulk et al. 1993a, 1993b). In the engineering and construction industry, technology maturity model scenarios have been proposed, adapting the CMM approach to explain the incremental use of information technology (Hinks et al. 1997).

Similar project management maturity models have been introduced to improve organizations PM effectiveness. The maturity map concept was presented for implementing project management skill and process improvement in the organization (McCauley 1993). A PM Maturity Model developed by Microframe Technologies proposed a framework for analyzing project management capability (Remy 1997). Another PM Maturity Model classified maturity by using 9 Project Management Body of Knowledge areas (PMI 1996) to provide conceptual guideline for assessing an organizational maturity level (Fincher and Levin 1997).

More recently, by correlating PM maturity with project performance in various organizations (Kwak and Ibbs 2000a) proposed a PM Return on Investment (PM/ROI) calculation methodology. Quantitative benchmarking of various organizational PM process maturity levels provided solid and comparative analysis on PM practices across industries and companies within industries (Kwak and Ibbs 1997)(Ibbs and Kwak 2000).

3. Use of the Berkeley (PM)² Model

This manuscript develops and applies the 5-Level Berkeley (PM)² Model to better understand an organization's levels of PM sophistication. The objective of developing the Berkeley (PM)² Model is to use this model as a basis to evaluate and position an organization's current PM Maturity level.

This Model can be used to determine and position an organization's relative PM level with other organizations. This Model can help organization to suggest an organization's PM application expertise and its use of technology. It can also provide and guide necessary processes and requirements for what is needed to achieve a higher PM level.

II. Integrating Previous Research Approach

The Berkeley (PM)² Model is developed by adapting (Crosby 1979)(Deming 1986)

(Fincher and Levin 1997)(Hinks et al. 1997)(Ibbs and Kwak 1997b)(Kwak 1997)(Mcauley1993)(Paulk et al. 1993a, 1993b)(Remy 1997). This (PM)² Model measures the PM level of different companies and industries. It illustrates a series of steps to help an organization incrementally improve its overall PM effectiveness.

Each level of Berkeley (PM)² Model breaks PM processes and practices into nine PM Knowledge Areas and five PM Processes following the Project Management Body of Knowledge by Project Management Institute (PMI 2000). The model allows an organization to determine PM strengths and weaknesses effectively and to focus on the weak PM practices to achieve higher PM maturity. The goal of the Berkeley (PM)² Model is to motivate organizations and people to accomplish higher and more sophisticated PM maturity by a systematic and incremental approach. The Berkeley (PM)² Model evolves from a functionally driven organization to a project-driven organization. Figure 1 presents an overview of the 5-Level Berkeley (PM)² Model.

Each PM maturity level contains key PM processes, organization's characteristics, and

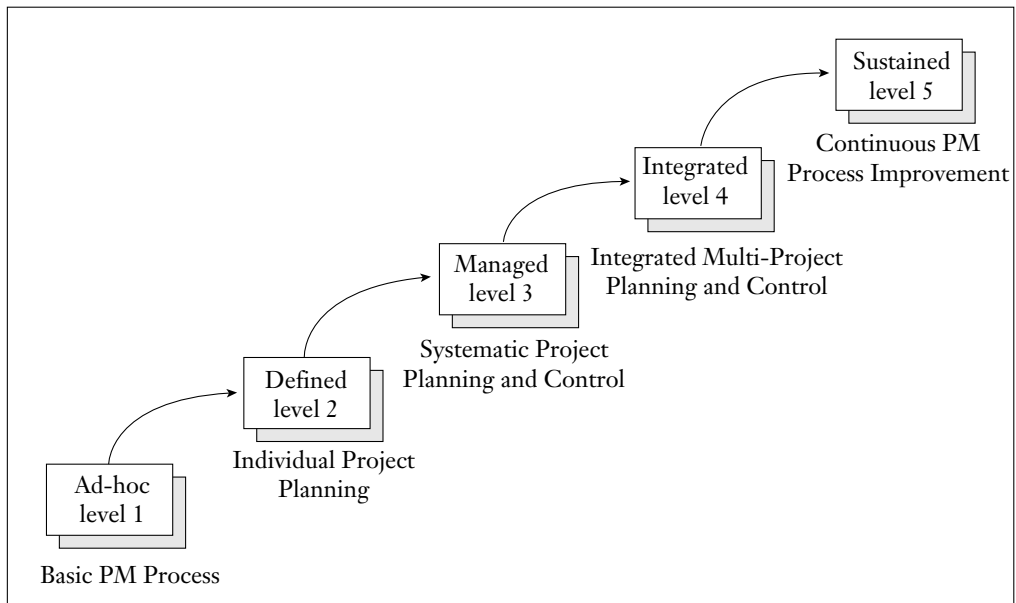


Figure 1. The Berkeley Project Management Process Maturity (PM)² Model

Table 1. Key PM Processes of Berkeley (PM)² Model

Maturity Level	Key PM Processes
Level 5 (Sustained Stage)	PM processes are continuously improved PM processes are fully understand PM data are optimized and sustained
Level 4 (Integrated Stage)	Multiple Project Management (Program Management) PM data and processes are integrated PM processes data are quantitatively analyzed, measured, and stored
Level 3 (Managed Stage)	Formal project planning and control system is managed Formal PM data are managed
Level 2 (Defined Stage)	Informal PM processes are defined Informal PM problems are identified Informal PM data are collected
Level 1 (Ad-hoc Stage)	No PM processes or practices are consistently available No PM data are consistently collected or analyzed

Table 2. Major Organizational Characteristics of Berkeley (PM)² Model

Maturity Level	Major Organizational Characteristics
Level 5 (Sustained Stage)	Project-driven organization Dynamic, energetic, and fluid organization Continuous improvement of PM processes and practices
Level 4 (Integrated Stage)	Strong Teamwork Formal PM training for project team
Level 3 (Managed Stage)	Team oriented (medium) Informal training of PM skills and practices
Level 2 (Defined Stage)	Team oriented (weak) Organizations posses strengths in doing similar work
Level 1 (Ad-hoc Stage)	Functionally isolated Lack of senior management support Project success depends on individual efforts

focus areas. Tables 1 to 3 summarize the overview of Berkeley (PM)² Model (Kwak and Ibbs 2000b).

Table 3. Key Focus Areas of Berkeley (PM)² Model

Maturity Level	Key Focus Areas
Level 5 (Sustained Stage)	Innovative ideas to improve PM processes and practices
Level 4 (Integrated Stage)	Planning and controlling multiple projects in a professional matter
Level 3 (Managed Stage)	Systematic and structured project planning and control for individual project
Level 2 (Defined Stage)	Individual project planning
Level 1 (Ad-hoc Stage)	Understand and establish basic PM processes

The primary use of Berkeley (PM)² Model is as a reference point or yardstick for an organization applying PM practices and processes. The Model will be continuously improved by adapting and incorporating new PM research and practices. In other words, the Berkeley (PM)² Model will grow and mature itself overtime.

III. PM Knowledge Areas (PM)² Level

1. Project Integration Management

Project Integration Management is the process to ensure that various elements of the project are properly coordinated. Project and organizational success relies on integrating effective PM strategies with proper utilization of PM techniques at different maturity levels. Issues such as project management integration, applications, process, organization, and project life cycle phases are included in this area. At Level 1 project plans are not prepared in structured format and no project management information system is established. With Level 2 organizations, informal PM tools and practices including basic project plan and project organizational structure are defined. At Level 3 formal PM methodology is established and managed. Also, PM information system is managed to collect, review, and distribute necessary data. An organization at Level 4 has project control processes that are integrated and coordinated across different knowledge areas and across the project. Multiple project

managers and the manager of project managers integrate the PM information system for the use on multiple projects and. Project control processes are also integrated to minimize the risk of scope, cost, schedule, and quality management. At Level 5 the entire process of integration management is planned, optimized, and sustained for continuous PM process improvement.

2. Project Scope Management

Project Scope Management is the process to ensure that all the factors and variables for defining and controlling the project are included. This includes project planning and cost control, trade-off analysis, project charter preparation, the kickoff meeting, a scope of work statement, validation of the project scope, and initiation of a change control process.

At Level 1 project managers are assigned on an ad-hoc basis and there is no methodology to initiate and control the project. At Level 2 an informal work breakdown structure and scope change control process is defined and available. Also, the project management team informally agrees to initiate the project. At Level 3 a formal project charter, project manager and project manager role are established. Also, a scope planning, definition, and verification process is managed. At Level 4 product and scope management are integrated to ensure the project success. Scope change control and verification process are documented and integrated. At Level 5 the entire process of scope management is planned, optimized, and sustained for continuous PM process improvement.

3. Project Time Management

Project Time Management ensures completing project on time that is one of the major challenges for project managers. It includes activity definition and sequencing, duration estimation, schedule development and schedule control. Bar charts, the CPM/PERT technique, resource allocation and leveling, network crashing and fast tracking of projects are used to effectively manage schedule.

At Level 1 there are no standardize templates for project schedules. Schedule developments is unrealistic and often out of sequence. A Level 2 organization develops informal schedules for planning and tracking. Activity lists and work breakdown structure templates are defined. At Level 3 a variety of scheduling tools and techniques are available and managed for effective schedule control. Formal schedule control processes and practices are integrated at Level 4. At Level 5 formal project time management tools are optimized and sustained for continuous PM process improvement.

3. Project Cost Management

Project Cost Management ensures the project is completed within the approved budget. Cost overruns are a frequent and serious problem during project execution so cost management is crucial. It includes resource planning, cost estimating, cost budgeting, cost control, understanding earned value analysis, and depreciation and capital budgeting. There is no cost estimating process available at Level 1. The result of estimated cost is poor which often exceeds the original budget. At Level 2 informal cost estimating tools and techniques are available. Cost baseline, resource requirements, and work breakdown structure are defined. At Level 3, resources planning and cost estimating are well coordinated and life cycle costing is used and managed for effective cost management. Formal resource planning, cost estimating, and budgeting process are integrated at Level 4. Project stakeholders have wide perspective of different project cost metrics. Level 5 organizations have formal cost estimating tools and techniques that are optimized and sustained for continuous PM process improvement.

4. Project Quality Management

Project Quality Management ensures that the project will meet or exceed all activities of the overall management function. It includes an overview of quality concepts, the cost of quality, statistical process control, variation and measurement and quality improvement. At

Level 1 project overruns and reworks are common and expected. There are no quality audits, quality assurance, or quality control process. Only on-site inspection is conducted for quality checkup. Level 2 organizations have informal quality management systems. Noncompliance issues are addressed through inspection and audits only if it is mandatory by project contract. At Level 3 formal quality policy and standards are established. Quality planning and assurance activities are managed and conducted to find quality problems. At Level 4 the objective to achieve high quality of project management process and project quality is integrated. Progress toward accomplishing project quality is quantified, implemented, and integrated. The quality management system is optimized and sustained for continuous PM process improvement at Level 5.

5. Project Human Resource Management

Project Human Resource Management ensures to make the most effective use of the people involved with the project. It is to manage, motivate, and organize people effectively. It includes assigning project roles, responsibilities, reporting organizational relationship, staffing, motivation, leadership, team development and conflict resolution. At Level 1 organization struggles with the concept of project-driven organization so that conflict occurs between functional managers and project managers. As a result, project managers hardly complete project successfully. At Level 2 an informal organizational chart and staffing management plan are defined. At Level 3 customers and suppliers are often included as project members to receive team building activities and training together. A Level 4 organization is rewarded and recognized by project-oriented teams. Improvements in both individual skills and team capabilities are integrated to perform project effectively. At Level 5 the human resource management system is optimized and sustained for continuous PM process improvement.

6. Project Communications Management

Project Communication Management ensures timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project information. Open and clear communications are required among planners, implementers, and all levels in the organization for project success. It includes having a communication plan, information distribution path, progress reporting, and information sharing for management and customers.

Level 1 organizations have no formal project performance reporting systems. The project performance review is often limited to basic status reporting. A project review is only held if requested by a contract. At Level 2 information retrieval and distribution system is defined and informal performance report and reviews are conducted. At Level 3 project data are maintained in a structured format. Project performance are regularly analyzed, reviewed, and revised for project assessment. At Level 4 information on scope, schedule, cost, risk, quality, human resource, and procurement are integrated in project performance reporting. Also, communication management process and techniques are integrated with an organizational structure. A Level 5 organization has a communications management system that is optimized and sustained for continuous PM process improvement.

7. Project Risk Management

Project Risk Management ensures identifying, analyzing, and responding to project risk. It includes defining, identifying and quantifying risk, formulating risk mitigation strategies, and developing appropriate risk response and control process. Level 1 organizations do not have processes for identifying project risk. Risks are identified after the event rather than beforehand. No formal risk management plan is available. At Level 2 project risks are informally identified and analyzed. Level 3 organizations have formal risk management tools and techniques. Risk management becomes a continuous task throughout the project

lifecycle. At Level 4 an organization uses lessons learned information for risk response identification and control. Also, potential risk sources are prepared and reviewed for use of other PM knowledge areas. Furthermore, risk identification, quantification and response plan are integrated across multiple projects to minimize risk. At Level 5 the risk management system is optimized and sustained for continuous PM process improvement.

8. Project Procurement Management

Project Procurement Management ensures to acquire goods and services from outside the performing organization. It includes contract administration, contract risk, contract negotiations, configuration management, and contract termination. At Level 1, their procurement or solicitation plans are not prepared in conjunction with a market condition analysis. In Level 2 organizations, informal communications are available with various suppliers. An organization defines informal project procurement management process. At Level 3 formal procurement management tools and techniques are managed and procurement data are analyzed and documented. Project managers work in partnership with multiple suppliers. Procurement audits are integrated to the entire procurement process that buyer and supplier relationship exists at multiple levels and each phase of the project at Level 4. In addition, long-term relationships are established with suppliers for consistent quality of the project. At Level 5 a procurement management system is optimized and sustained for continuous PM process improvement.

IV. PM Processel (PM)² Level

1. Initiating Process

The Initiating Process recognizes that a project or phase should begin and committed to do so. It includes developing a proposal for potential project and analyzes and validates

feasibility of the project. At Level 1 there are no initiating plan or process available to develop a project proposal. As a result, proposal commitment and approval are not received from the participating organization. Level 2 organizations have an informal project proposal plan is defined and evaluated for approval of participating organization. At Level 3 any project proposal is formally reviewed and evaluated for approval. At Level 4 the project proposal development process is integrated for multiple projects. An initiating process is optimized and sustained for continuous PM process improvement in Level 5 organizations.

2. Planning Process

A Project Planning Process leads to the development and maintenance of a workable scheme to accomplish the business needs for the project. It includes defining overall scope, identifying planning strategy, developing the work breakdown structure for cost and schedule, refining estimates and analyzing commitments, optimizing the project plan, developing risk management plan, and organizing project team to establish a project-driven organization environment. At Level 1 no formal planning session is conducted. Scope, schedule, cost, quality, human resource, communications, risk, and procurement plan is oftentimes not available. At Level 2 an informal schedule is developed and cost estimating process is defined. An organization is informally trained to develop and plan key PM practices areas. Level 3 planning is managed by using formal project management tools and techniques. Project teams are actively engaged to provide reviews and inputs to the planning process. In Level 4 organizations, key project management knowledge areas are integrated into the planning process. At Level 5 the planning process is optimized and sustained for continuous PM process improvement.

3. Executing Process

The Executing Process coordinates an organization and other resources to carry out the project effectively. At Level 1 a project plan execution process is not available. Project scope is

not verified and project team is not formally developed and organized . Level 2 organizations have a process where informal project execution plans are defined. Also, the contract administration and information distribution processes are informally defined. At Level 3, a quality assurance process manages project execution. Project teams are actively engaged to provide reviews and inputs to the execution process. At Level 4 the project plan, scope verification, team development, quality assurance information distribution, and contract administration processes are integrated into the execution process. At Level 5 the executing process is optimized and sustained for continuous PM process improvement.

4. Controlling Process

A Controlling Process ensures that project objectives are met by measuring progress and taking corrective action when necessary. It includes collecting project progress status, analyzing variances, and communicating project status. At Level 1 the project controlling process is not defined or well established. A change control system is not available, and project progress status is not collected and updated. At Level 2 an informal project change controlling process is defined. Variances are informally identified to determine the cause and impact of the overall project performance. At Level 3, project performance is controlled by plan and adaptive action. Project teams actively participate to provide actions and corrections to the controlling process. At Level 4, project performance data collection, variance analysis, and status updates are integrated. Project status communication of each key PM knowledge area is integrated. At Level 5 the controlling process is optimized and sustained for continuous PM process improvement.

5. Closing Process

A Closing Process ensures formalizing acceptance of the project or phase and bringing it to an orderly end. It includes contract close out, the lessons learned documentation, and administrative closure. In Level 1 organizations there is no formal closing process that

ensures closing all deliverables and contracts. Project file records are not consolidated or stored. At Level 2 an informal closing process is defined. Key technical learning and quality of overall PM process is informally reviewed. All closing activities are completed and the project file is stored and managed at Level 3. Project team members actively participate to suggest and document best PM practices. At Level 4 contract close out, administrative closure, and documentation of project file are integrated. The Level 5 organization has a closing process that is optimized and sustained for continuous PM process improvement.

V. Discussions and Conclusions

1. Discussion of the Berkeley (PM)² Model

With the Berkeley (PM)² Model, an organization evolves from a less PM-sophisticated organization to a highly project-oriented organization. This does not mean that an organization at Level N+1 always uses Level N characteristics on a project. Rather, at Level N+1 an organization has a capability to choose selectively the proper and eligible PM practices or tools that are suitable for a given project.

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

2. Conclusions

The Berkeley (PM)² Model provides a means for identifying and measuring different PM

levels by analyzing nine PM knowledge areas with five project processes under a quantified scheme. It is specifically suited to assess an organizational (PM)² level. Furthermore, the Berkeley (PM)² model provides an orderly, disciplined process to achieve higher levels of PM process maturity. The Berkeley (PM)² Model should be continuously refined to reflect advances in our PM knowledge base. This refined (PM)² Model could further determine and evaluate an organizational PM maturity level more effectively.

Also, the (PM)² Model should be applied to other industries and companies to further our understanding of PM in the future. By collecting and sharing this information all PM organizations can benefit and continuously improve their PM practices. Some impartial, neutral organization should conduct benchmarking so that the PM/ROI and other important information can be reported to the PM community at large. This information would be very helpful to managers who are struggling to calculate a budget to improve an organization's overall PM practices. Future research will continue to focus on understanding the PM maturity and its benefits of PM knowledge areas and processes more thoroughly.

References

- Crosby, P.B. (1979), *Quality is Free: The Art of Making Quality Certain*. New York: Penguin.
- Deming, W.E. (1986), *Out of Crisis*. Cambridge: MIT-CAES.
- Fincher, A. and Levin (1997), G., *Project Management Maturity Model*, PMI 28th Annual Seminars and Symposium, Chicago, IL, Sept 29 to Oct 1, pp. 48-55.
- Hinks, J., Aouad, G., Cooper, R., Sheath, D., Kagioglou, M., and Sexton. M. (1997), "IT and The Design and Construction Process: A Conceptual Model of Co-Maturation." *The International Journal of Construction Information Technology*, Vol 5, No 1, pp. 1-25.
- Ibbs, C. W. and Kwak, Y. H. (1997a), *The Benefits of Project Management-Financial and Organizational Rewards to Corporations*, Project Management Institute Publications, ISBN: 1-880410-32-X., Sept, 90 pp.

- Ibbs, C. W. and Kwak, Y.H. (1997b), A Study of The Financial and Organizational Benefits of Project Management: (PM)² Questionnaire, version 2.0, Sept..
- Ibbs, C.W. and Kwak, Y.H. (2000). "Assessing Project Management Maturity." Project Management Journal, v31 (1), pp. 32-43.
- Kwak, Y. H. (1997), A Systematic Approach to Evaluate Quantitative Impacts of Project Management (PM), Ph.D. Dissertation, Department of Civil Engineering, University of California, Berkeley. May.
- Kwak, Y. H. and Ibbs, C. W. (1997). Quantitative Benchmarking of Project Management Processes, Proceedings of ASCE Construction Congress V, Minneapolis, Minnesota, Oct. 5-9, pp. 980-987.
- Kwak, Y.H. and Ibbs, C.W. (2000a). "Calculating Project Management's Return on Investment." Project Management Journal, v31 (2), pp. 38-47.
- Kwak, Y.H. and Ibbs, C.W. (2000b). "Berkeley Project Management Maturity Model: Measuring the Value of Project Management." 2000 IEEE EMS International Engineering Management Conference, Albuquerque, New Mexico, Aug 13-15, pp.1-5.
- McCauley, Mike (1993), Developing a Project-Driven Organization, PM Network, Sept, pp. 26-30.
- Paulk, M.C., Curtis, B., Chrissis, M.B., and Weber, C.V. (1993a), Capability Maturity Model for Software, Version 1.1 (CMU/SEI-93-TR-24, ADA263403). Pittsburgh, PA. Software Engineering Institute, Carnegie Mellon University, 1993.
- Paulk, M.C., Weber, C.V., Garcia, S., Chrissis, M.B., and Bush, M. (1993b), Key Practices of the Capability Maturity Model, Version 1.1 (CMU/SEI-93-TR-25, ADA263432). Pittsburgh, PA. Software Engineering Institute, Carnegie Mellon University.
- PMI Standard Committee (1996), A Guide to The Project Management Body of Knowledge., PMI Publications, 1996.
- Remy, Ron (1997), Adding Focus to Improvement Efforts with PM3, PMNetwork, July, pp. 43-47.