MAPPING OF PROJECT MANAGEMENT METHODS AND TECHNIQUES TO SOFTWARE ENGINEERING PROCESSES

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Abbreviations

SEI CMM	Software Engineering Institute's Capability Maturity Model
PMI PMBOK	Project Management Institute's Project Management Body of Knowledge
ISO-9000	International Standards Association, Release 9000
PERT	Program Evaluation and Review Techniques
KPA	Key Process Area of the SEI CMM

Introduction

Request for a well managed software development, the need to accurately predict cost, delivery date and the quality of the software product being developed reached the highest priority in the modern global competitive market. This led to introduction of a set of project management processes, tools and techniques, called Project Management Body of Knowledge by the US Project Management Institute.

PMBOK describes Project Management processes, tools and techniques and provides one set of high level business processes for all industries. Some of those processes often are not applicable or even irrelevant to the Software Development industry. Yet, critical detailed processes are missing from the document.

In order to fill in the gap, several years ago the Software Engineering Institute, a research facility of the Carnegie Mellon University developed industry specific versions of SEI CMM. SEI CMM provides guidance in principles and practices underlying the Organizational Capability and the Maturity of their processes in the Software Engineering. SEI CMM recently came in place of the earlier ISO-9000 and became a leading edge of the Software Engineering methodology. Most US software developing companies embraced CMM.

Two above mentioned major institutions did considerable research and provided significant contribution in their respected areas. However, PMBOK and CMM look at the different aspects of the product development and provide two areas of knowledge that seemingly do not have much of an intersection. None of them ever mentions the other. Yet, they often speak of similar goals to provide a high quality, timely and the cost efficient solution to industry problems.

For example, CMM speaks about Software Project Planning processes without mentioning specific methodologies for project estimating described in PMBOK. In

another example, while CMM describes process of the Software Project Tracking, the PMBOK speaks about Time Management, Cost Management or Quality Management. In fact, the Software Project Tracking process provides foundation of the Time, Cost or Quality tracking. It assures that time, cost and quality are managed correctly and allows the corrective actions taken if variances between plan and actual are detected.

It appears, that a new Business Process Model is long overdue in the Software Engineering field. Business Process Model is a structured collection of the business process elements that describe elements of effective processes. Capability Maturity Model is also a Business Process Model for a specific industry in the enterprise-wide environment. As a minimum, it must also be a repeatable process model adjusted to that environment. That means, if we want to manage a Software Development project using the same set of CMM processes, we should expect the same result. For example, if we use specific task estimating process on a specific project and get the accuracy of +-10%, we should get the same accuracy for other projects as well. However, in order to achieve this, we must use estimating methods like PERT and others, described in details in PMBOK.

Basic key process areas of CMM level II

KPA1: Requirement Management

KPA1 establishes documented understanding of requirements, deliverables and activities between customer and the team. This is the negotiated, signed and approved document describing above activities.

KPA2: Project Planning

KPA1 establishes rules and methods to create work breakdown structure, task dependencies, estimate project size and effort, assign resources, produce a schedule, assess risks, develop quality plan and communicate.

KPA3: Project Tracking and Oversight

KPA3 provides visibility into the project progress. It allows to track the status of the project and take immediate actions when necessary, managing project time, cost and quality.

KPA4: Subcontract Management

KPA4 allows management of the acquisition of products from suppliers for which there exists a formal agreement.

KPA5: Quality Assurance

KPA5 establishes processes of planning and running QA reviews during the project development.

It will ensure that quality is built in, not inspected in and that the delivered products meet the documented customer expectations.

KPA6: Configuration Management

KPA6 provides control of all work products and deliverables at any given time, control changes and traceability and integrity of all project components.

It will also prevent unauthorized changes to the project content and to the project scope.

PMBOK Structure

PMBOK has nine knowledge areas, each divided into five process groups.

	Initiation	Planning	Execution	Controlling	Closing
Integration Mgmt					
Scope Mgmt					
Time Mgmt					
Cost Mgmt					
Quality Mgmt		**Main Processes, Facilitating Processes**			
Human Resource Management		**plus Tools and Techniques**			
Communication Management					
Risk Management					
Procurement Management					

Integration Management

Set of coordinated activities to plan and deliver in accordance with user requirements, on time and within the budget. It includes all nine knowledge areas and all associated with them tools and techniques. The relevant to SEI CMM tools and techniques will be mapped as indicated in the knowledge areas below.[1]

Scope Management

Methods, techniques and activities to ensure that all work and only the work required is completed.[2]

Mapping of some relevant to SEI CMM activities, tools and techniques:

PMI PMBOK	SEI CMM Key Process Areas
Benefit/cost Analysis	KPA1
Work Breakdown Structure templates	KPA2
Work Decomposition	KPA2
Inspection	KPA5, KPA6
Scope Change Control	KPA1, KPA4
Performance Measurements	KPA3
Project Plan	KPA2

Time Management

Methods, techniques and activities to ensure the timely completion of the project.

Mapping of some relevant to SEI CMM activities, tools and techniques:

[1] Project Planning, Scheduling and Control by James P. Lewis, 1999
[2] The New Project Management by Frame, Davidson. 1998

PMI PMBOK	SEI CMM Key Process Areas
Task Decomposition	KPA2
Precedence Diagramming Method	KPA2
Analogous Estimating	KPA2
Schedule Simulation	KPA2
Duration crashing and compressing	KPA2
Resource Leveling Heuristics	KPA2
Change Control System	KPA1
Performance Measurements	KPA3
Project Management Software	KPA2, KPA3
Project Plan	KPA2

Cost Management

Methods, techniques and activities to ensure that the project is completed within the approved budget.[3]

Mapping of some relevant to SEI CMM activities, tools and techniques:

PMI PMBOK	SEI CMM Key Process Areas
Parametric Modeling	KPA2
Bottom Up estimating	KPA2
Analogous Estimating	KPA2
PERT Estimating Techniques	KPA2
Computerized tools	KPA2
Change Control System	KPA1
Performance Measurements	KPA3
Project Management Software	KPA2, KPA3
Earned Value Analysis	KPA2
Project Plan	KPA2

Quality Management

Methods, techniques and activities to ensure that project will fit the stated purpose.

Mapping of some relevant to SEI CMM activities, tools and techniques:[4]

PMI PMBOK	SEI CMM Key Process Areas
Benefit/cost Analysis	KPA1
Benchmarking	KPA5
Quality Audits	KPA5
Inspection	KPA5, KPA6
Pareto Diagram	KPA5
Checklists	KPA5, KPA6
Quality Plan	KPA5

[3] PMP Challenge. ESI, 2001
[4] Quality Management for Projects and Programs. Lewis R. Ireland, 1998

Human Resource Management

Methods, techniques and activities to ensure the most effective use of the project human resources.[5]

Mapping of some relevant to SEI CMM activities, tools and techniques:

PMI PMBOK	SEI CMM Key Process Areas
Human Resource Practices	KPA3, KPA4
Organizational Theory	KPA3
Team Building Activities	KPA3
Rewards and Recognition System	KPA3
Training	KPA2
Staff Management Plan	KPA2

Communication Management

Methods, techniques and activities to ensure that project information is collected, generated, stored and distributed in a timely manner.[6]

Mapping of some relevant to SEI CMM activities, tools and techniques:

PMI PMBOK	SEI CMM Key Process Areas
Stakeholder Analysis	KPA1
Communication Skills	KPA1, KPA3
Status Reviews	KPA3
Variance Analysis	KPA3
Performance Reporting Tools and Techniques	KPA3
Document Distribution System	All KPAs
Reporting Forms and Tools	All KPAs

Risk Management

Methods, techniques and activities to ensure that project risks are identified, quantified and the risk response plan is developed.[7]

PMI PMBOK	SEI CMM Key Process Areas
Expected Monetary Value Analysis	KPA2
Decision Trees	KPA2
Alternative Strategies	KPA2
Insurance	KPA2
Risk Management Plan	KPA2, KPA3

Procurement Management

Methods, techniques and activities to ensure acquisition of goods and services from outside of the performing organization.[8]

[5] Human Resource Skills for the Project Manager. Vijay K. Verma, 1999
[6] PMBOK Q&A. PMI, 1999
[7] Organizing Projects for Success. Vijay K. Verma, 2000

PMI PMBOK	SEI CMM Key Process Areas
Make or Buy Analysis	KPA2
Contract Type Selection	KPA4
Bidders Conference	KPA4
Advertising	KPA4
Screening	KPA4
Independent Estimates	KPA2
Contract Change Control System	KPA1
Status Reporting	KPA3
Payment System	KPA4
Procurement Audits	KPA4

Resulting Summary Mapping Table

	Req. Mgmt	Project Planning	Project Tracking	Subcontr. Mgmt	Quality Assurance	Config. Mgmt
Integration Mgmt	**X**	**X**	**X**	**X**	**X**	**X**
Scope Mgmt	**X**	**X**	**X**	**X**	**X**	**X**
Time Mgmt	**X**	**X**	**X**			
Cost Mgmt	**X**	**X**	**X**			
Quality Mgmt	**X**				**X**	**X**
Human Resource Management		**X**	**X**	**X**		
Communication Management	**X**	**X**	**X**	**X**	**X**	**X**
Risk Management		**X**	**X**			
Procurement Mgmt	**X**	**X**	**X**	**X**		

LITERATURE

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