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Measuring Project Management Maturity - A framework for better and efficient Projects delivery

Master of Science Thesis in the Master's Programme International Project Management

Muhammad Mateen

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Division of Construction Management
CHALMERS UNIVERSITY OF TECHNOLOGY
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Master's Thesis 2015: 136

MASTER'S THESIS 2015:136

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Examensarbete 2015: 136 / Institutionen för bygg- och miljöteknik,

Chalmers tekniska högskola 2015

Department of Civil and Environmental Engineering
Division of *Construction* Management
Chalmers University of Technology
SE-412 96 Göteborg
Sweden
Telephone: + 46 (0)31-772 1000

Chalmers University of Technology/Department of Civil and Environmental Engineering Göteborg, Sweden 2015

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Abstract

In organizations, maturity refers to a state that provides perfect condition to achieve organization's objectives. Project management maturity provides a path and framework which enable firms to achieve excellence in project management. Project management maturity has direct impact on project performance. In order to evaluate impact of project management maturity on project performance, a case study has been conducted in a multinational company in Pakistan. Survey questionnaires were used to perform project management maturity assessment of two different departments. In total, five project management team member of both departments participated in survey questionnaire. Apart from survey questionnaire, company internal documents were also studied to better understand project management processes. Indirect and informal mode of participation observation was also used. The results of case indicate that project management maturity has a direct impact on project performance. A high value of project management maturity ensures high performance for delivering projects whereas project performance will be low for less mature project management processes. A couple of other contributing factors were also found to have impact on project performance. These factors include project management team competency, organizational structure, culture and organization support to project management. Overall company is found to have average project management maturity for both departments but improvements can still be implemented to further increase project management maturity.

Keywords: Project management, project management maturity, project performance

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1. Introduction

In recent years, projects have played major and important role for organizations because projects provide competitive edge to organization. Projects make organizations leader in their respective field (Rad and Levin, 2006). Organizations are striving to deliver projects effectively and successfully because of the fact that project management has become dominant way for accomplishing work (Grant and Pennypacker, 2006). Measure of project management maturity enables organizations to identify on how to improve project performance (Brookes et al., 2014). Hillson (2003) suggested that to deliver project with effectiveness and increased performance, it is important that organizations continuously evaluate their projects results for finding areas of improvement to increase project management maturity. These improvement efforts for delivering projects must have purposeful approach. This is done by measuring where organization stands for its project management and where it wants to go (Grant and Pennypacker, 2006). Project management maturity assessment enables organization to further improve its project management structure (Albrecht and Spang, 2014). Project Management Maturity Models (PMMMs) provide structured framework for measuring, benchmarking and strategy to improve project management practices (Yazici, 2009).

PWC (Pricewaterhouse Cooperrs) conducted a survey in 2004 to evaluate impact of project management maturity on project performance. This survey included 200 respondents across 30 countries. PWC (2004) found that increase in project management maturity level results in increased project performance. Similar findings were concluded by PWC for its second survey in 2007 and third survey in 2012. Most of researchers identified that use of project management maturity assessment is related to project performance. This thesis work will focus on using project management maturity model for assessing project management practices of large multi-national company in Pakistan. The findings of thesis will provide insight to project management practices and recommendations to improve these practices.

1.1 Research Aim

The research aim of this project is to perform project management maturity assessment of two departments in selected organization. It will provide the basis to understand how project management maturity model can be used to improve project management process. The research output would include:

- Provide clear understanding of Project Management Maturity Model

- A comprehensive literature review on Project Management Maturity (PM3) levels
- Measuring and evaluating project management maturity level in selected organization
- Suggesting improvements based on measured PM3 for better and efficient projects delivery

1.2 Research Questions

For accomplishing the research objectives of this thesis, below mentioned questions were inquired:

1) How projects are performed and what is current level of maturity for projects in organization?
   a. Which maturity model is best for measuring maturity of selected organization based on what criteria?
2) What are the gaps in project management practices based on project management maturity assessment?
   a. What are recommendations to improve desired knowledge are of project management practices?

1.3 Limitations

The limitation of this thesis work was finding a company to carry out research work and it took lot of time in the beginning to approach and find the company. The difficulty in finding company reduced available time of research work. Thesis wok is conducted by only one person in short and specified time period which has limited the research work to one organization in Pakistan. It would have been better to include more organizations for carrying out research of thesis project. Participation of more than one organization would have allowed collecting data from various industry sectors and generalizing finding of project management maturity assessment in Pakistan. Furthermore, thesis work is focusing on large MNC (Multi National Company) in Pakistan. The findings of thesis work can be extended, either partially or fully, to other organizations in Pakistan with similar structure.

2 Methodology

Methodology section describes framework that is used to conduct research for thesis work. This framework is described in terms of research method, research design, data collection and data analysis.

2.1 Research design

Bryman (2012) has defined research design as *"framework for collection and analysis of data"*. Bryman (2012) described five research design types. These include: i) Experimental design, ii) Cross-sectional design, iii) Longitudinal design, iv) Case study design and v) Comparative design

In order to perform assessment for maturity of projects in selected organization, case study design is chosen as research design. Therefore, more explanation about case study research design is provided here out of five research design types.

Case study research design uses intensive and detailed analysis of single case with intentions of understanding real life phenomenon. Single case includes study of one person, one group, one organization or one project (Bryman, 2012). Case study research design can also involve study of specific issue or unit within an organization (Noor, 2008). Case study research design can be based on either qualitative or quantitative research. Use of qualitative research strategy makes case sturdy research design as inductive approach whereas if quantitative research strategy is implied for conducting case study research then it refers to deductive approach (Bryman, 2012).

The reason behind selecting case study research design for thesis research is that thesis aim to capture practices of people who are involved in project management processes for selected organization in Pakistan. Bryman (2012) referred case study research design as typical or representative case when circumstances of everyday routine are studied.

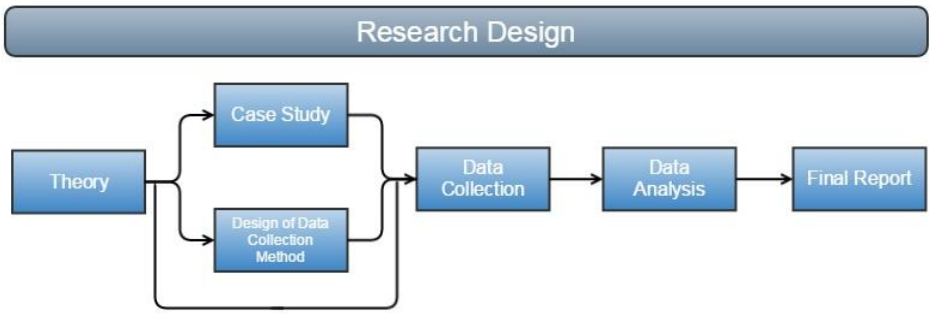

Figure2.1: Case study research design (Adopted from Bryman, 2012)

2.2 Research method

Bryman (2012) has defined research method as a technique for collection of data. This is characterized with use of specific instrument such as structured interviews or use of self-completion questionnaire for collection of data (Bryman, 2012).

The aim of this thesis is to find out project management practices in selected organization by performing maturity assessment and provide improvement recommendations. For this purpose, initially relevant literature study is done. Literature study provided base for compiling survey questionnaire to collect data in selected organization. The reason behind selecting survey questionnaire is distance between researcher and selected organization and time availability issue for participants from organization. Survey is shared with only selected participants in organization. The selection of participants is done based on criteria which are defined in later section.

2.3 Data collection

Data was collected during visits to Multi-national Company (MNC) in Pakistan. Seven persons were involved for collecting data using survey questionnaires. The participants were involved in projects for their respective departments within company. The two departments perform projects for external customers. Indirect and informal observations were also a source of collecting data for this thesis.

2.3.1 Surveys

Bryman (2012) has discussed several ways to collect data for case study research. This includes surveys, structured interviews, direct observation, document analysis, and use of surveys either supervised, postal or via internet. The research for this thesis focused on gathering data by using supervised self-completion questionnaire format of surveys and internal document study. Also, direct rather informal observation was done while meeting and discussion sessions with participants of company.

Two sets of survey questionnaire were used to carry out research for thesis work. First of all, a small survey was sent to project management team of both departments within selected company. The response of this small survey questionnaire was used to support selection criteria of Project Management Maturity Model for selected company.

For second round, link to closed ended survey questionnaire was sent to selected participants of two departments. The researcher was present with each participant while filling out survey.

The reason behind sitting with participant while filling of survey was to support and provide clarity incase if any understanding is required about any particular question. Total of five persons participated for collection of data. In order to maintain anonymity of company internal data, one department is coded as D1 whereas other department is coded as D2. Three respondents were from D1 whereas two respondents were from D2.

Following characteristics were used to select respondents for collection of data:

- Each respondent have personal knowledge of project management
- Each respondent does not get influenced by other respondent's answer
- Each respondent must have knowledge of project management standards for respective department of company

In closed questions, respondents may interpret questions in different context (Bryman, 2012). In order to avoid this issue, researcher was present with respondents while they were filling survey. It provided the benefit of instantly clarifying any issue raised by respondents for filling survey.

2.3.2 Document study

The researcher has also used company internal documents for understanding project management processes of both departments. Due to requirement of company for keeping data anonymous, researcher articulated related information using own words for this thesis. In case of ambiguity in any process, concerned person was contacted to develop better understanding of processes.

2.3.3 Participants observation

The research method used in this research work involved sending out survey to selected participants in organization. The researcher was present with respondents when they were responding to survey questionnaire. This helped in performing project management maturity assessment. Also, researcher made participants observation to better understand project management standards and practices used by participants while dealing project activities. Participant observation proved to be of great help for understanding and interpreting the use of project management standards in selected company. Participant observation was made by attending project status meetings and customer site visits.

2.4 Data analysis

The analysis of data is performed, based on initial literature review. Literature review explains framework to answer research question about practices and maturity of project management in selected organization. The data analysis was performed based on logical sequence of literature review and result of data analysis answered research question.

3 Theory

3.1 Project Management

3.1.1 What is Project?

Project has been defined by different organizations in different way. A few of definitions are explained below:

APM Body of Knowledge (2012) defines project as:

"Project is a unique, transient endeavor undertaken to achieve planned objectives, which could be defined in terms of outputs, outcomes or benefits"

Another definition of Project in PMBOK (2013) is:

"A project is a temporary endeavor undertaken to create a unique product, service or result. The temporary nature of projects indicates that project has a definite beginning and end."

A comparison of these definitions gives common features of projects as unique, temporary and task focused (Maylor, 2010).

3.1.2 What is Project Management?

A clear definition of project management will enable to understand difference between project management and project.

APM Body of Knowledge (2012) defines project management as:

"Project management is the application of processes, methods, knowledge, skills and experience to achieve the project objectives."

PMBOK (2013) defines project management as:

"Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements."

3.2 Program Management

According to PMBOK (2013), Program Management is defined as:

"Program management is the application of knowledge, skills, tools, and techniques to a program in order to meet the program requirements and to obtain benefits and control not available by managing projects individually."

APM Body of Knowledge (2012) defines Program Management as:

"Program Management is coordinated management of projects and change management activities to achieve beneficial change."

Based on definition by two different standards program management can be summarized as efforts to get benefits from overall projects of organization.

3.3 Portfolio Management

According to PMBOK (2013), Portfolio Management is defined as:

"Portfolio management refers to the centralized management of one or more portfolios (projects, programs and sub-portfolios managed as group) to achieve strategic objectives."

APM Body of Knowledge (2012) defines Portfolio Management as:

"Portfolio management is selection, prioritization and control of an organization's projects and programs in line with its strategic objectives and capacity to deliver."

The two definitions give common feature of Portfolio Management as overall effort of an organization to deal with projects and program in alignment with its strategic goals.

3.4 Project Management Maturity Model

The trend of using maturity models for increasing organization's performance have been increased in recent years (Crawford, 2006). Maturity models provide framework to organizations for improving their performance across different business areas (Brookes *et al.*, 2014). Maturity in organizational context is a state that creates perfect condition for organization to achieve its desired objectives. Thus maturity, when applied to projects of organization, provides perfect condition to handle projects (Andersen & Jessen, 2003).

According to Mullaly (2014), framework provided by maturity model enables organizations to access and improve its processes. Rad et al. (2006) argues that project maturity provides a path and framework which enables firms to achieve excellence in project management. Project management maturity models (PMMM) provides best practices and road map to improve project portfolio practices. Brookes et al. (2014) also argued that PMMM, if utilized successfully, provides framework on how to improve performance for projects repeatedly and systematically. Backlund, Chronéer, and Sundqvist (2015) also that successful implementation of improvement requires identification of strengths and weakness in project management capabilities. Ibbs and Kwak (2000) also described PMMM as a mode using which organization identifies its area of strength and weakness. Once these areas are identified then improvements are implemented to achieve excellence.

PMMM comprises of structured components for adaptation and implementation in organization. The components of PMMM include Maturity levels, Best practices for project management, Assessment model for project management practices and process improvement plan. A typical approach for measuring project management maturity begins with measurement and assessment of existing project management practices. Next step involves benchmarking of measured maturity model with best practices standard of project management maturity. Benchmarking provides comparison of project management capabilities. Finally, project management capabilities are improved to higher levels of maturity (Jamaluddin, Chin and Lee, 2010).

3.5 Different Project Management Maturity Models

This section includes introduction and characteristics of different PMMMs. After introduction, a criteria is established which is used to select most appropriate PMMM for carrying out research for this thesis. For this thesis work, efforts are made to compile list of maturity models which have been developed so far by different organizations and individuals. This list of maturity models includes:

- Capability Maturity Model Integrated presented by Carnegie Mellon University's Software Engineering Institute
- Organizational Project Management Maturity Model presented by Project Management Institute
- Project Portfolio Management Maturity Model presented by PM solutions
- Project Management Maturity Model presented by PM solutions
- Project Management Maturity Model presented by KRL consulting
- Kerzner Project Management Maturity Model presented by International Institute for Learning (IIL) H. Kerzner
- Project, Program, Portfolio Management Maturity Model presented by Office of Government Commerce (OGC)
- Project & Program Management for Enterprise Innovation presented by Project Management Association of Japan (PMAJ)
- Maturity Increments IN Controlled Environments presented by MINCE2 Foundation

Grant and Pennypacker (2006) conducted a survey on project management maturity assessment. In this survey, questions about 42 components of project management maturity were asked to 126 participants from different organizations. Grant and Pennypacker (2006) used following criteria to select project management maturity model for their survey: 1.

alignment of project maturity model with organization's project management methodology, 2. Scope covered by project maturity model, 3. Number of publications about specific project maturity model, 4. Independency from industry/organization's type. 5. Ease and comfort ability to use and 5.Years of existence. Man (2007) summarized criteria for selection of maturity model as: a). Structure, b). Applicability and c). Usage. Based on this critera, Nenni et al. (2014) shortlisted following project maturity models.

1. Organizational Project Management Maturity Model (OPM3)
2. Capability Maturity Model Integration (CMMI)
3. Kerzner Project Management Maturity Model (K-PMMM)
4. Project, Program, Portfolio Management Maturity Model (P3M3)
5. Maturity Increments IN Controlled Environments (MINCE)

For this thesis work, an initial shortlisted maturity models by Nenni et al. (2014) are used to make comparison for this thesis. These five shortlisted project maturity models are explained for better understanding and then comparison of these five is made.

3.5.1 Organizational Project Management Maturity Model

Organizational Project Management Maturity Model (OPM3) was first defined by PMI (Project Management Institute) in 1998. Since 1998 OPM3 has evolved over time. This thesis report refers to third edition of OPM3 as presented by PMI in 2013. OPM3 – third edition explains all the guidelines which are used for improving organizational project management maturity (PMI-OPM3, 2013).

Organizational project management provides a framework that integrates project, program and portfolio management of organization for all the best practices. The integration defined by organizational project management includes (PMI-OPM3, 2013):

I. Knowledge (of the portfolio, program, and project processes)
II. Organizational strategy (mission, vision, objectives, and goals)
III. People (having competent resources), and
IV. Processes (the application of the stages of process improvement)

Organizations may have high maturity level for project management practices but does not necessarily have to excel in portfolio or program management as well. The maturity of portfolio and program is measured against portfolio and program management practices. OPM3 provides flexibility in terms of organization's size and type, size and complexity of projects and geographical locations of projects (PMI-OPM3, 2013).

3.5.1.1 OPM3 self-assessment

OPM3 self-assessment questionnaire contains 151 questions. Organization can be used to assess its current level of project management for comparison with best practice standard of OPM3. It provides high level assessment about organization's project management maturity. Self-assessment questionnaire can be scored on two different methods as mentioned below for evaluation of project management maturity (PMI-OPM3, 2013).

Binary Scoring – involves use of binary numbers for performing assessment. Digit 1 is given to an outcome if it exists to full extent in the organization otherwise it is awarded digit 0 if full existence is not found. Apart from being simple scoring method, it also has drawback that it does not take into account practices with partial existence (PMI-OPM3, 2013).

Variable Measure – measures existence of best practice using questions like how much and how often a best practice exists. Variable measurement method also takes into account those practices which have partial existence (PMI-OPM3, 2013).

Score	Description
0	Not implemented for outcome of best practice
1	Partially implemented for outcome of best practice
2	Fully implemented, not consistently, for outcome of best practice
3	Fully implemented, consistently, for outcomes of best practice

Table 3.1: Maturity levels for OPM3 (PMI-OPM3, 2013)

3.5.1.2 OPM3 Maturity Levels

PMI-OPM3 (2013) has defined five maturity levels for performing maturity assessment of Project, Program or Portfolio Management either collective or individual. The use of maturity assessment is not compulsory in all the three areas to find improvement opportunity (PMI-OPM3, 2013). Description of maturity levels for OPM3 is explained below:

Level 1: None – no such practice exist

Level 2: Standardize – a standardized process of doing projects have been documented and communicated within organization. This practice is not used by all the projects but only few.

Level 3: Measure – Standardized process is used by all the projects within organization and processes are measured to evaluate effectiveness for organization.

Level 4: Control – measured process is corrected for poor application of the standardized practice. Upper and lower limits are established and process is analyzed.

Level 5: Improve – Continuous improvement of process becomes a practice for outcome of Best Practice standard.

3.5.2 How OPM3 works?

It is necessary to build an understanding of how OPM3 assessment works before performing assessment. In this section, assessment steps for OPM3 are explained.

OPM3 framework cycle constitutes following steps for measuring maturity:

- Acquire Knowledge.
- Perform Assessment.
- Manage Improvements.
- Repeat the process.
- **Acquire Knowledge** – this component of OPM3 cycle requires preparation for assessment of project management maturity. A good understanding of OPM3 contents is developed before carrying out assessment. Also, understanding of organization for project management practices is developed (PMI-OPM3, 2013).
- **Perform Assessment** – involves gathering all the data required for measurement of maturity assessment. The results of data are formulated in form of graph which depicts organization's maturity level for project, program and portfolio management (PMI-OPM3, 2013).

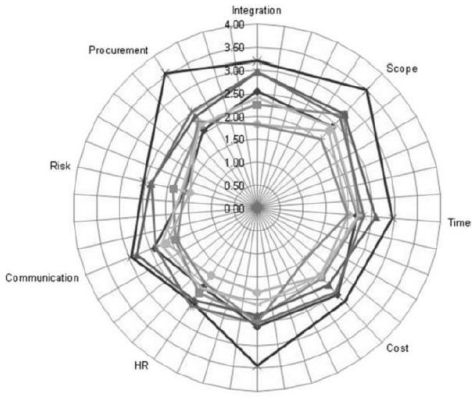

Figure3.1: Example of Maturity Assessment Graph (Brookes *et al.*, 2014)

- **Manage Improvements** – the results from perform assessment stage are compared against best practices standard of project, program and portfolio management. Because of the fact that project management practices may vary from organization to organization, a set of best practices have been defined by PMI (2013) for the comparison and improvement. This best practice standard provides basis of improvement. The outcome of comparison between existing practices and best practices allows recommendation for improvement. The initiative and implementation of recommendation involves change management strategies (PMI-OPM3, 2013).

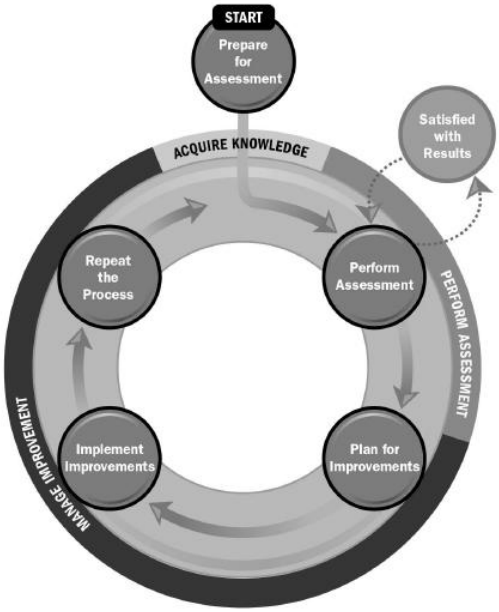

Figure3.2: OPM3 Framework. Source – (PMI-OPM3, 2013)

OPM3 framework cycle can be used in three different ways to perform maturity assessment of project management practices. The three different ways are: i) Comparative model ii) Design Model iii) Improvement Model

i.) Comparative Model

Comparative Model is best to use as assessed organization has already implemented organizational project management either fully or partially according to its needs. This model follows the approach of assessing and comparing against OMP3 best practice standard. The purpose of comparison is to evaluate the extent of project management standards implementation at step one i.e. acquire knowledge. Based on comparison, organization

decides to proceed for further OPM3 framework steps and determine steps to implement for improvement purposed. Finally, OPM3 framework cycle is repeated according to needs (PMI-OPM3, 2013).

ii.) Design Model

Organizations that are either in process of forming project management practices or newly formed implement design model. Design Model allows designing and implementing organizational project management approach using Best Practice Standard. In this model, organizations enter Manage Improvement step after acquire knowledge step (PMI-OPM3, 2013).

iii) Improvement Model

In this model, organizations use Best Practice Standard to determine what practices are required for organization's strategy execution. In this model, OMP3 framework cycle starts at Manage Improvement step (PMI-OPM3, 2013).

3.5.3 Capability Maturity Model Integration (CMMI)

The first ever version 1.0 of Capability Maturity Model (CMM) was first presented by Software Engineering Institute (SEI) division of Carnegie Mellon University in 1991. This model targeted at software organizations. CMM does not explains steps on how to improve rather it helps in determining and analyzing current level of process maturity which identifies the issue to overcome for achieving maturity. The identified issues are then used to guide software organization in determining process improvements strategies (Paulk et al., 1993).

3.5.3.1 CMM Approach

CMM framework provides two different approaches for improving project management processes. These approaches are termed as "model representation" (Constantinescu and Iacob, 2007). These approaches consist of:

Continuous Representation – focuses on organization's processes. It provides framework to evaluate and improve processes. It allows room for improvement related to individual process. The improvement progress is measured against capability levels (Constantinescu and Iacob, 2007). These levels are described in below table:

Capability Level	Description
0	Incomplete
1	Performed
2	Managed
3	Defined
4	Quantitatively Managed
5	Optimizing

Table 3.2: Capability Levels for CMM (Constantinescu and Iacob, 2007)

Staged Representation – provides overall view of organization. It measure maturity at organizations level compared to continuous representation which measures maturity at process level. It is easily understandable and less detailed compared to continuous representation. The framework of staged representation provides standardized value of organization's maturity (Constantinescu and Iacob, 2007).

Similar to process capability levels, staged representation is measured as organization's maturity levels. The detail of these maturity levels is shown in below table:

Maturity Level	Description
1	Initial
2	Managed
3	Defined
4	Quantitatively Managed
5	Optimizing

Table 3.3: Maturity Levels for CMM (Constantinescu and Iacob, 2007)

The stage representation of CMM model is represented as:

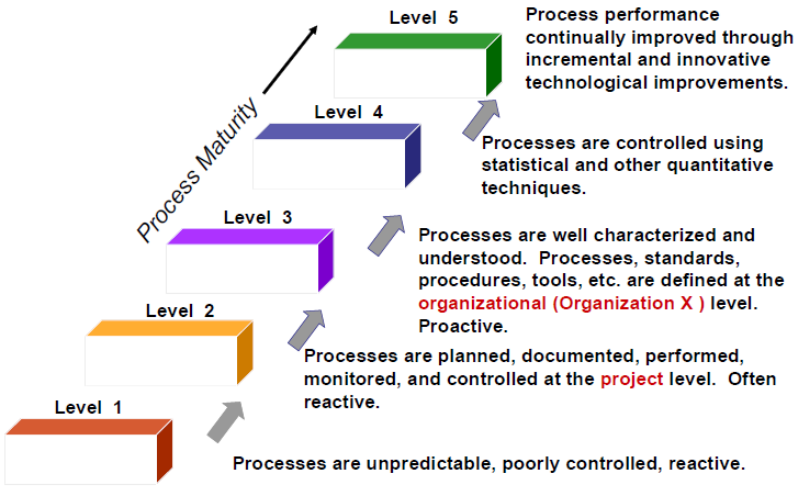

Figure3.3: Maturity Levels for CMMI staged Representation (Kaur, 2014)

Constantinescu and Iacob (2007) claimed that apart from facet that CMMI was initially focused on product and service engineering by collaborating between system engineering and software engineering, the framework of CMMI is also applicable towards other disciplines and organization's type.

3.5.4 Kerzner Project Management Maturity Model (K-PMMM)

Kerzner put-forth his Project Management Maturity model in 2002 based on knowledge areas of PMBOK. K-PMMM accesses Project Management Maturity of organization using PMBOK guide and provides five levels of maturity (Kerzner, 2002). These levels are measured in stage as show in figure below:

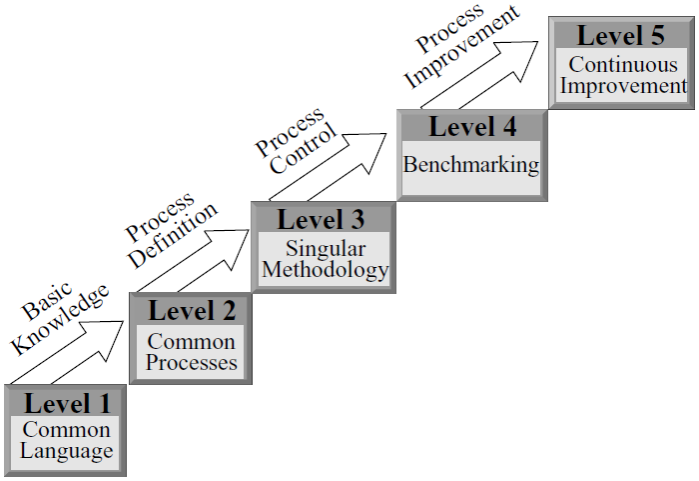

Figure 3.4: Five Levels of K-PMMM (Kerzner, 2002)

- Level 1 — Common language: *"In this level, the organization recognizes the importance of project management and the need for a good understanding of the basic knowledge on project management and the accompanying language/terminology (Kerzner, 2002)".*
- Level 2 — Common processes: "*In this level, the organization recognizes that common processes need to be defined and developed such that successes on one project can be repeated on other projects. Also included in this level is the recognition of the application and support of the project management principles to other methodologies employed by the company (Kerzner, 2002)".*
- Level 3 — Singular methodology: *"In this level, the organization recognizes the synergistic effect of combining all corporate methodologies into a singular methodology, the center of which is project management. The synergistic effects also make process control easier with a single methodology than with multiple methodologies (Kerzner, 2002)*".
- Level 4 — "Benchmarking: *This level contains the recognition that process improvement is necessary to maintain a competitive advantage. Benchmarking must be performed on a continuous basis. The company must decide whom to benchmark and what to benchmark (Kerzner, 2002)*".
- Level 5 — Continuous improvement: "*In this level, the organization evaluates the information obtained through benchmarking and must then decides whether or not this information will enhance the singular methodology (Kerzner, 2002)".*

3.5.5 Project, Program and Portfolio Management Maturity Model (P3M3)

The Project, Program and Portfolio Management Maturity Model (P3M3) was first presented by Office of Government Commerce (OGC) in 2006. In June 2010, OGC came under custody of UK government due to reorganization P3M3 maturity levels are derived from CMMI model. P3M3 has presented three different sub-maturity models (OGC, 2011). . These maturity models are:

I. Portfolio Management (PfM3)
II. Program Management (PgM3)
III. Project Management (PjM3)

These three models can be used either separately or collectively to access relationship between organization's project, program and portfolio management maturity (OGC, 2011). P3M3

measures organization's performance for each of its sub-maturity model against following seven key areas.

- Organizational governance
- Management control
- Benefits management
- Risk management
- Stakeholder management
- Finance management
- Resource management.

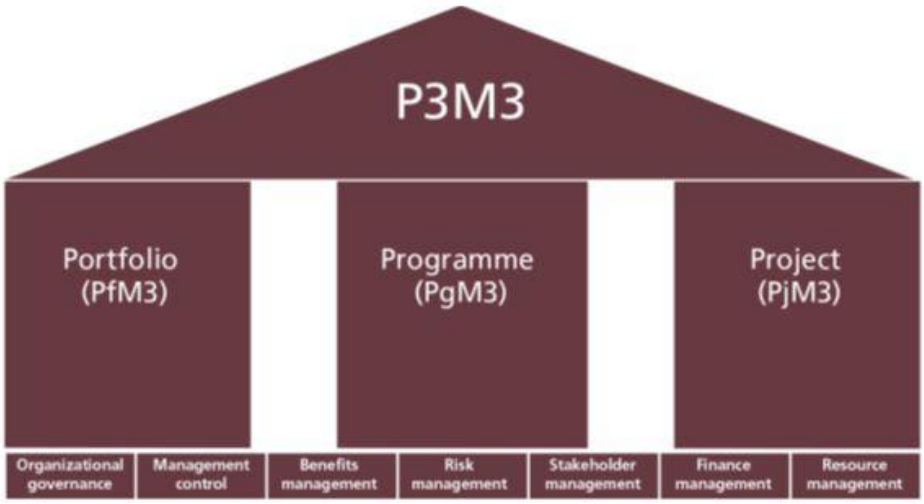

Figure 3.5: Project, Program and Portfolio Management Maturity Model (OGC, 2011)

Each of seven key areas for sub models has five levels maturity levels. These levels as defined by OGC (2011) are:

- Level 1 – awareness of process: Projects are recognized in organizations but structured approach does not exist for handling projects, programs and portfolios (OGC, 2011).
- Level 2 – repeatable process: Basic standard for project management exist but not used consistently across organization (OGC, 2011).
- Level 3 – defined process: Use of standards for projects is consistent across organization (OGC, 2011).
- Level 4 – managed process: enables organization to measure and monitor projects performance (OGC, 2011).

- Level 5 – optimized process: At this level of maturity, all the processes for handling projects, programs and portfolios are optimized and continuous improvement is evident in organization (OGC, 2011).

3.5.6 Maturity Increments IN Controlled Environments (MINCE)

Maturity Increments in Controlled Environments Model (MINCE) was presented by MINCE2 Foundation in 2007. The focus of MINCE maturity model is towards organization's ability to adapt to environmental and market changes. The use of MINCE maturity model provides following insights in organization (Meisner, 2007):

- Maturity of organization
- Skill levels of organization's staff
- Effectiveness of organization's projects
- Ability to adapt to change
- How does organization benefit from past lessons?

The framework of MINCE uses six towers to measure organizational maturity (MINCE Foundation, 2007). These towers are:

I. People – it considers focus of people and also how people tend to close gaps that naturally exist in organization (MINCE Foundation, 2007).
II. Methods and Techniques – it provides structure needed in order to focus the organization for optimized results (MINCE Foundation, 2007)
III. Customer – it includes focus of customers on performance of organization (MINCE Foundation, 2007).
IV. Realization – It measures how effectively organization comes to results and how difficulties are overcome to achieve the results (MINCE Foundation, 2007).
V. Knowledge – it measure extent of actual knowledge available to people working in organization (MINCE Foundation, 2007)
VI. Supporting services – it measures how does organization support its people. It also measures the focus of organization for achieving excellence in projects (MINCE Foundation, 2007).

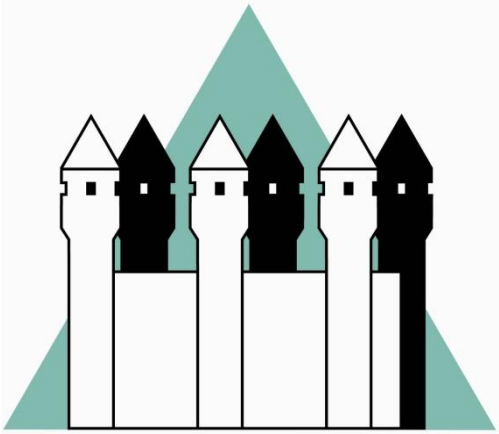

Figure3.6: MINCE Maturity Towers (MINCE2 Foundation, 2007)

According to MINCE Foundations (2007), each tower has five maturity levels as:

Level 1 – Activities:

Level 2 – Processes:

Level 3 – Systems:

Level 4 - Supply Chain:

Level 5 – Quality:

3.6 Comparison of Project Management Maturity Models

The purpose of using any maturity model is always to find improvements by assessing existing practices of project management. Khoshgoftar and Osman (2009) describes that maturity model differs with each other in terms of their characteristics, factors and structure to achieve desired purpose. This section provides a comparison of maturity model with the aim of finding best maturity model. For the purpose of comparison, five maturity models as explained in previous section have been taken as reference.

OPM3 enables organization to narrow down the gap between its strategic objectives and projects (PMI-OPM3, 2013). It has characteristic of being multi-dimensional in full context. It provides framework to measure project, program and portfolio management with wide spread of best practice standards (Khoshgoftar and Osman, 2009). OPM3 also provides framework for organization to determine what capability it possesses. OPM3 also enables organization to prioritize and plan improvements for outcome of improved project maturity levels (APM, 2007). OPM3 does not follow stage model representation for improvement purposes. Rather, best

practice standard are measured and assessed using Standardize, Measure, Control and Continuously Improve levels for improvement purpose (PMI-OPM3, 2013).

CMMI provides best practice model for system and software engineering. CMMI does not provide framework for improvement in strategy, portfolio or service delivery. It only focuses on improvement areas for project life cycle only (APM, 2007). The stage model of CMMI follows that a higher level can only be achieved if requirements for lower levels are fulfilled (Constantinescu and Iacob, 2007).

K-PMMM measures maturity of project management processes only. K-PMMM is based on knowledge areas of PMBOK. K-PMMM does not measure maturity for program and portfolio management. It also follows orthodox of stage representation for maturity levels. K-PMMM Kerzner derived his maturity levels from CMMI stage-model maturity levels (Kerzner, 2002)

P3M3 enables organization to evaluate its existing capabilities and identify specific areas for improvement. It enables organization to perform maturity assessment of project, program and portfolio management across seven different domains OGC (2011). It measures maturity of projects using five maturity levels. These maturity levels are derived from CMMI stage-model and follow stage representation (APM, 2007). P3M3 model is based on PRINCE2^{TM} and MSP standards (APM, 2007; OGC, 2011)

MINCE maturity model is derived from EFQM (European Foundation for Quality Management) (Meisner, 2007). It does not provide framework to measure maturity of program and portfolio management. Rather it uses a different concept of measuring six pillars in any organization for maturity. Each pillar is measured for maturity using five levels (MINCE Foundation, 2007). The detail about MINCE maturity model is extracted from MINCE website and chapter of book written by Meisner in 2007. In-depth detail of this model is unavailable due to limited access to chapters of book by Meisner (2007).

A map is drawn to help understand origin of maturity models that shows how these maturity models are related to each other.

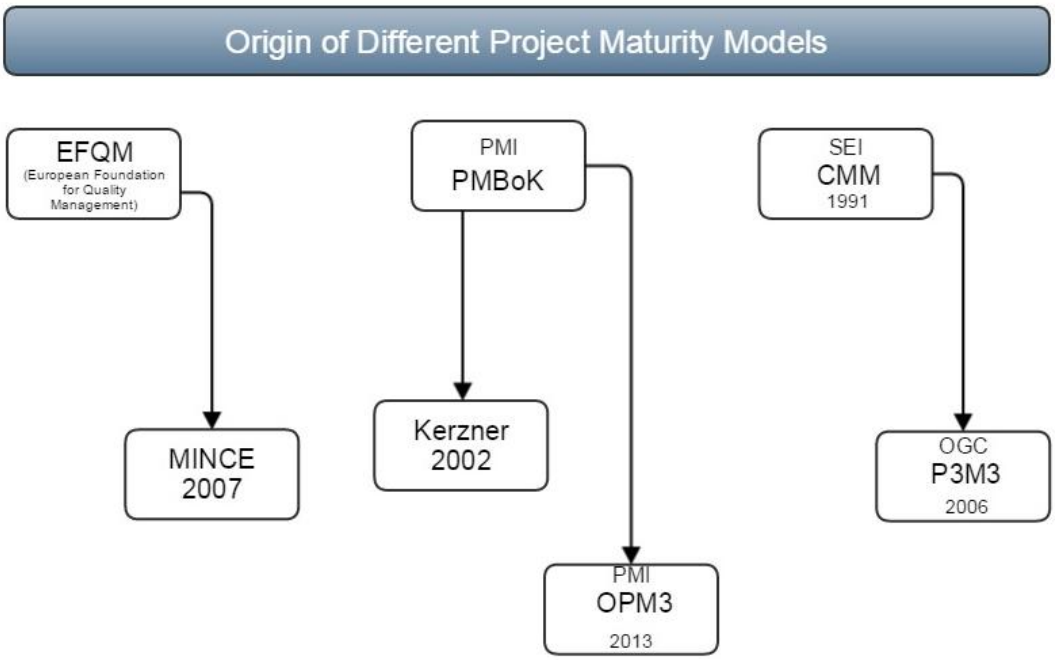

Figure3.7: Origin of different project management maturity models

Farrokh and Mansur (2013) made comparison of different maturity models by using i) Structure ii) Multi-dimensional and iii) Theoretical base iv) KPA/KPI aspects of maturity model as criteria of comparison. The criterion of Farrokh and Mansur (2013) is adopted to make comparison of five shortlisted PMMMs.

Maturity Model	Structure		Multi-dimensional	Theoretical base	Ideology
	Staged	Continuous			
OPM3	No	Yes	Yes	Yes	PMI-PMBOK
CMM	Yes	Yes	No	No	CMM
K-PMMM	Yes	No	No	Yes	PMI-PMBOK
P3M3	Yes	No	Yes, but limited	No	CMM
MINCE	Yes	No	No	No	EFQM

Table 3.4: Comparison of project management maturity models (adopted from Farrokh and Mansur, 2013)

OPM3 is based on PMBOK which covers project, program and portfolio management that makes it capable to assess maturity of organization at any levels. The multidimensional nature of OPM3 provides possibility to assess based on either of project, program and portfolio management domain or combination of these according to needs of organization (Farrokh and

Mansur, 2013). OPM3 provides organization with list of best practice that can be used for achieving excellence in Organizational Project Management (Nenni et al., 2014)

Khoshgoftar and Osman (2009) developed detailed criteria for making comparison of PMMMs. The criterion of Khoshgoftar and Osman (2009) for making comparison of PMMMs included 27 components as shown in figure below:

1. Publisher: The reliable publisher
2. Scope: The cover of the area of model
3. Number of Maturity Level: The quantity of maturity level of model
4. Discrete and Continues: Consisting of the maturity level
5. Details: The amount of the considered factors
6. Date of Issue: The publications from 2000 to 2007 will be taken in to consideration in the study
7. Refer to Standard: Based on which standard the model is designed
8. Definition of Maturity: Definition of maturity
9. Organization Strategic: Considering the organization strategic
10. Project Management Process: The covering project management process
11. Program Management Process: The covering program management process
12. Portfolio Management Process: The covering portfolio management process
13. Coverage Assessment: Identifying the coverage of the model
14. Assessment Difficulty: The extent of difficulties
15. Assessment Cost: Expenditure of assessment
16. Quantitative Results: Showing the quantitative results
17. Tangible of Results: Identifying of the results clearly
18. Identifying weakness and strong points: Indicating weaknesses and strongest of organization
19. Continuous Assessment: Considering continues assessment
20. Training Difficulty: The extent of difficulties in training of the model for staff and assessors
21. Commitment for Continuous Improvement: Considering continues improvement
22. Suggestion of alternative for improvement: To find out the solutions
23. Priority of Improvement: Determining priority of improvement in organization
24. Support by Publisher: Support by publisher
25. New Edition: compatibility with new conditions
26. Easy for Execution: Execution of model easily
27. Simple and Understandable: Simple and understandable

Figure3.8: Criteria for selection of project management maturity models (Khoshgoftar and Osman, 2009)

The criterion of Khoshgoftar and Osman (2009) is used to make comparison of five shortlisted PMMMs as follows:

Criterion	OPM3	CMM	K-PMMM	P3M3	MINCE
Publisher	PMI	SEI	ILL	OGC	Van Haren
Scope	PM	Software	PM	PM	PM
Maturity level	1-5	1-5	1-5	1-5	1-5
Discrete and Continuous	Continuous	Both	Discrete	Discrete	Discrete
Details	Extremely high	High	High	High	Medium
Date of Issue	2013 (3rd Edition)	1922	2006		2007
Refer to Standard	PMBOK	-	PMBOK	MSP	-
Definition of Maturity					
Organization Strategic Project Management process	Yes	Yes	Yes	Yes	Yes
Program Management process	Yes	Yes	No	Yes	No
Portfolio Management Process	Yes	No	NO	Yes	No
Coverage assessment					
Assessment difficulty	Low	High	Low	High	Unknown
Assessment Cost	Low	High	Low	High	Unknown
Quantitative Results	Yes	Unknown	Yes	No	Unknown
Tangible of results	Yes	Yes	Yes	Unknown	Unknown
Identifying weakness and strengths	Yes	Yes	Yes	Unknown	Unknown
Continuous Assessment	Yes	Yes	Yes	Unknown	Unknown
Training Difficulty	Low	High	Medium	Unknown	Unknown
Commitment for Continuous improvement	Yes	Yes	Yes	Yes	Yes
Suggestion of Alternative for improvement	Yes	Yes	Yes	Yes	Unknown
Priority of improvement	Medium	Medium	Medium	Low	Unknown
Support by Publisher	High	High	High	High	High
New Edition	Yes	Yes	Yes	Yes	Unknown
Easy for Execution	Yes	Yes	Yes	Yes	Unknown
Simple and Understandable	Yes	Medium	Yes	Medium	Medium

Table 3.5: Comparison of Project Management Maturity models (Adopted from Khoshgoftar and Osman , 2009)

Khoshgoftar and Osman (2009) concluded from their comparison that OPM3 stands best.

Characteristics of all five maturity models are summarized below. These characteristics are explained on the basis of selected 27 criteria of Khoshgoftar and Osman (2009)

OPM3

- OPM3 refers to PMBOK that is a worldwide acceptable standard.
- OPM3 publisher PMI has status of being most popular around the world for project management
- OPM3 covers strategic management
- OPM3 covers project, program and portfolio management aspects
- OPM3 follows continuous approach compared to other maturity models which follow staged approach.
- OPM3 provides with list of 586 best practices
- Date of issue for OPM3 shows that it is not old
- OPM3 provides tools for self-assessment and external assessment of project management maturity
- OPM3 identifies strength and weakness and suggest alternatives to improve
- OPM3 provides path to prioritize improvements
- OPM3 is simple and easily understandable
- OPM3 maturity assessment has low cost
- OPM3 is industry independent and can be applied to any industrial sector.

CMM

- CMM is published by Software Engineering Institute (SEI) for software industry
- CMM cover strategic management
- CMM covers project and program management but does not cover portfolio management
- CMM follows staged approach for maturity assessment.
- CMM does not provide best practice list for its practitioner.
- CMM assessment difficulty is high compared to OPM3
- CMM identifies strength and weakness and suggest alternatives to improve
- CMM has medium level of difficulty for understanding and execution
- CMM assessment cost is high
- CMM is software industry dependent.

K-PMMM

- K-PMMM is based on PMBOK.
- K-PMMM covers only strategic project management. It does not cover program and portfolio management
- K-PMMM follows staged approach for maturity assessment. Staged approach for K-PMMM is derived from CMM staged approach.
- K-PMMM does not provide list of best practices.
- K-PMMM has low level of assessment difficulty
- Likewise to OPM3 and CMM, K-PMMM also identifies strength and weakness and provides alternatives to improve
- K-PMMM has low level of difficulty for understanding and execution
- Cost of assessment of K-PMMM is low
- K-PMMM is industry independent.

P3M3

- P3M3 refers to MSP (Managing Successful Programs) standards.
- P3M3 publisher is OGC.
- P3M3 covers project, program and portfolio management.
- P3M3 follows staged approach for maturity assessment.
- P3M3 provides list of best practice
- Assessment difficulty level for P3M3 is high.
- Information about P3M3 on finding strength and weakness in unknown
- P3M3 can be easily implemented but simplicity and understanding level of P3M3 is medium compared to OPM3
- P3M3 is industry independent.

MINCE

The only known information about characteristics of MINCE includes:

- MINCE refers to EFQM (European Foundation for Quality Management).
- MINCE only cover project management. Program and portfolio management are not covered in MINCE scope.
- MINCE also follows staged approach for maturity assessment.
- MINCE is easily understandable for performing maturity assessment.

Based on the comparison of above mentioned characteristics, it is concluded that OPM3 stands best among five project maturity models. OPM3 is the only model that fulfills most of criteria among 27 selected variables. Hence it is concluded that OPM3 is best based on 27 variables.

Issues of Project Management Maturity Models

Apart from benefits of using PMMMs, a number of researchers have also mentioned issues of using PMMMs. Mullaly (2014) argued that level of clarity, degree of certainty and guidance provided by PMMMs for improving project performance is ambiguous. Mullaly (2014) raised critical questions for organizations which are willing to improve project performance using PMMMs. These questions include:

Q. Do Maturity models provide meaningful input and guidance?
Q. Where do maturity models provide value and where do they lose relevance?
Q. What guidance would be relevant that maturity models fail to provide?

Organizations have thrust to improve its practices. Improvement activities require guidance on how to improve and what efforts are required (Mullaly, 2014). Pretorius et al. (2012) identified project success is not only achieved by improving project management practices but there are many other factors which include competency of project manager, skilled level of project team members, organizational culture and support of senior management towards project management activities. Bushuyev and Wagner (2014) argued that processes make important buildings blocks for an organization but projects success require other factors as well to deliver projects efficiently. Mullaly (2014) concluded one of major drawback of using PMMMs that they presume all projects within an organization must be performed and managed in similar way. Andersen and Jessen (2003) pointed out that PMMMs have rigid structure for performing assessment of project management standards and practices.

3.7 Selection Criteria:

A selection criterion is defined to select Project Maturity Model. The selected Project Maturity Model will be used to perform project management maturity assessment for this thesis work. The elements of selection criteria include:

1. The project maturity model must come from independent organization. It should have list of best practices. This list of best practice will be used to compare actual practices of project management with best practice standards. The structure of such project maturity

model is not industry specific and thus can be adopted by any industry for performing project management maturity assessment.

2. The project maturity model should have standards to measure maturity for project, program and portfolio management.
3. The project maturity model has to be in-line with project management methodologies of focused organization for thesis work (A survey will be used to determine trend of project management methodologies and use of any particular project maturity models in selected country to provide the base of selection for this criterion).

In total five persons, involved in project management, were sent link to short survey. Three person from department one (D1) and two persons from department (D2) were part of short survey. The results of short survey are summarized below:

3.7.1 Summary of Survey

Company: Supplier of processing and packaging solution

Company Size: 346 employees

Department 1 (D1)

- All the two participants are part of project management team at D1.
- Participants of D1 do not have knowledge about project management maturity assessment.
- D1 is also following PMBOK for project management activities.
- D1 has never performed maturity assessment using any maturity model.

Department 2 (D2)

- All the three participants are part of project management team at D2
- All the three participants have knowledge about project management maturity assessment
- D2 is following PMBOK for project management activities
- D2 had maturity assessment of around 60 projects in 2014.
- Maturity assessment was performed using OPM3 maturity model
- The reason for selecting OPM3 was that OPM3 is close to PMBOK that's why D2 used OPM3 model for maturity assessment.

The response of survey from both departments shows that PMBOK standards have been implemented in both departments for carrying out project management activities. This finding from survey becomes input to 3rd selection criteria for selecting maturity model to perform assessment in both departments.

Selection Criteria	OPM3	CMMI	K-PMMM	P3M3	MINCE
List of Best Practice	Yes	Yes	NO	Yes	No
Project, Program and Portfolio Management	Yes	No	No	Yes	NO
Alignment with PMI Standard (Response from Survey)	Yes	NO	Yes	No	NO

Table 3.6: Selection criteria for selecting maturity model

Selected organization for this thesis work has already developed and implemented project management standards for handling and delivering projects according to business needs. Comparative Model is best suited to perform project management maturity assessment of selected organization because of already existing project management standards in organization. Project management maturity assessment in later section will follow definition of Comparative Model. First knowledge about OPM3 is garnered in literature review. Knowledge about organizations' project management standards was gained through studying internal standards documents and indirect participant observance. Next questionnaire surveys were used to perform maturity assessment. The findings from survey questionnaire were analyzed to find gaps and recommendations are suggested based on best practice standard of OPM3.

4 Case study

Studied Company is a global leader in supplying processing and packaging solution across the world. This Company started its operation activities in Pakistan in 1968. The company was inaugurated in 1982 in Pakistan. Company mission is to work with its customers to provide processing and packaging solutions. Innovation, consumer needs and relationship with supplier make it possible to deliver required solution to customer. Company has different functional departments and one factory in city of Lahore Pakistan. The hierarchical structure of company is show in figure 4.1 below.

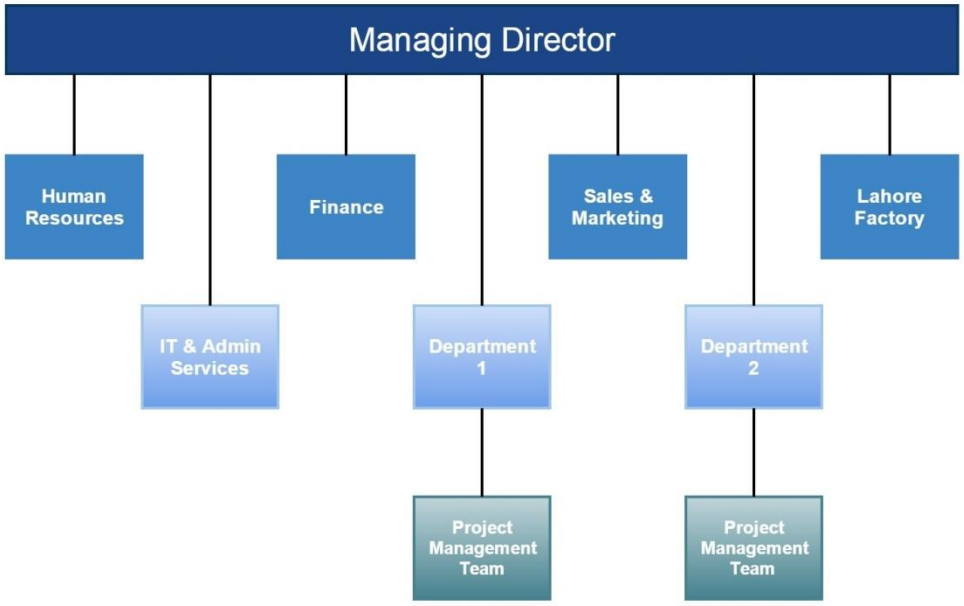

Figure 4.1: Company Organogram (adopted from company intranet, 2009)

Studied Departments of company has been names as “Department 1 (D1)” and “Department 2 (D2)” to keep the confidentiality requirements as per company policy. Both departments perform projects of installation & commissioning equipment for external customers. D1 provides processing equipment whereas D2 provides packaging equipment. The configuration of equipment supplied by both departments is as follows:

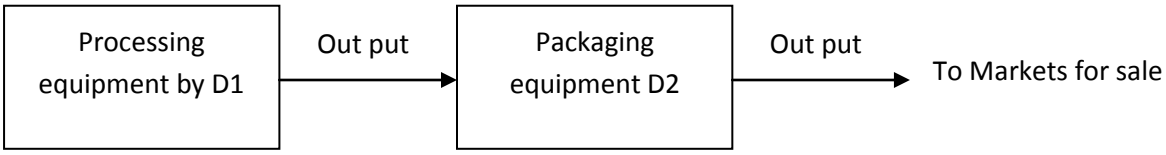

Figure 4.2: Configuration of equipment supplied by two departments

The customers of selected company have option to buy equipment by either of department as per their business needs. Depending upon customer requirements, some projects involve project management team of both departments and sometimes one of the departments deliver project independently to its customer.

D1 has its own project management team, functional manager and service engineers who provides after sales services of processing equipment to its customers. Once equipment is handed over to customer by project management team then functional manager and service engineers take care of after sales services.

D2 has similar structure like D1 where project management team, functional manager and services manager are part of D2 department. Project management team of D2 hands over equipment to customer and functional manager along with service engineers take care of after sales services.

D1 has two employees dedicated to project management team. Person1 (P1) is project engineer and person2 (P2) is project manager for D1. D1P1 will be used to mention incase if person1 of department is under discussion and D1P2 will be used to mention person2 of D1.

D2 has three employees dedicated to project management team. Person1 (P1) is PMO – area manager for Pakistan, Iran and Turkey for D2 in respective market companies. Person2 (P2) is project manager and person3 (P3) is project engineer. D2P1 will represent P1 of D2, D2P2 for P2 and D2P3 for P3 of D2.

In addition to maturity assessment of project management standards, some other factors and information about projects was captured to compare project factors of D1 & D2. These factors include:

	D1	**D2**
Organization Structure (Average)	Functional Department with dedicated Project Management Team	Functional Department with dedicated Project Management Team
Project Budget (Average)	1 to 5 Million SEK	5 to 10 Million SEK
Project Duration (Average)	Three to nine months	Three to nine months
Number of Project Members (Average)	6 to 10 persons	6 to 10 persons

Table 3.7: Additional detail about projects of two departments D1& D2

4.1 Case Study Results

The case study results are based on interviews of project management team members, participant observation and internal documents of both departments.

All the required documents were shared by respective departments. Understanding of standards and procedures was developed with help of interviewee.

4.1.1 Department 2 (D2)

The data collection about project management standards of D2 was garnered by studying two ongoing projects at two different customer sites. In order to differentiate project at one Customer site is represented as C1 and second Customer site is represented as C2.

During initial meeting at company, it was mutually decided with PMO – Area Manager that maturity assessment for all knowledge areas of project management processes will be performed. Although all the knowledge areas, inputs and outputs are related with each other but for case study discussion, analysis and recommendation for only scope, time, cost and risk management knowledge areas will be under discussion. Selected company is on the way to standardize project management procedures for both departments therefore D1 & D2 will be discussed only for above mutually agreed knowledge areas. The maturity assessment was performed using quantitative and measurable data against scale of maturity level 1 to maturity level 5. This quantitative data allowed making qualitative description of project management standards and practices in both departments.

Scope Management

Project scope management was assessed for Scope Definition, Requirement Management, Work breakdown Structure (WBS) and Scope Control as the company has adopted it from PMI – PMBOK. The responses of all three participants at D2 for Scope Management have been converted into maturity level across department “Equipment Project Control” phases. These results are:

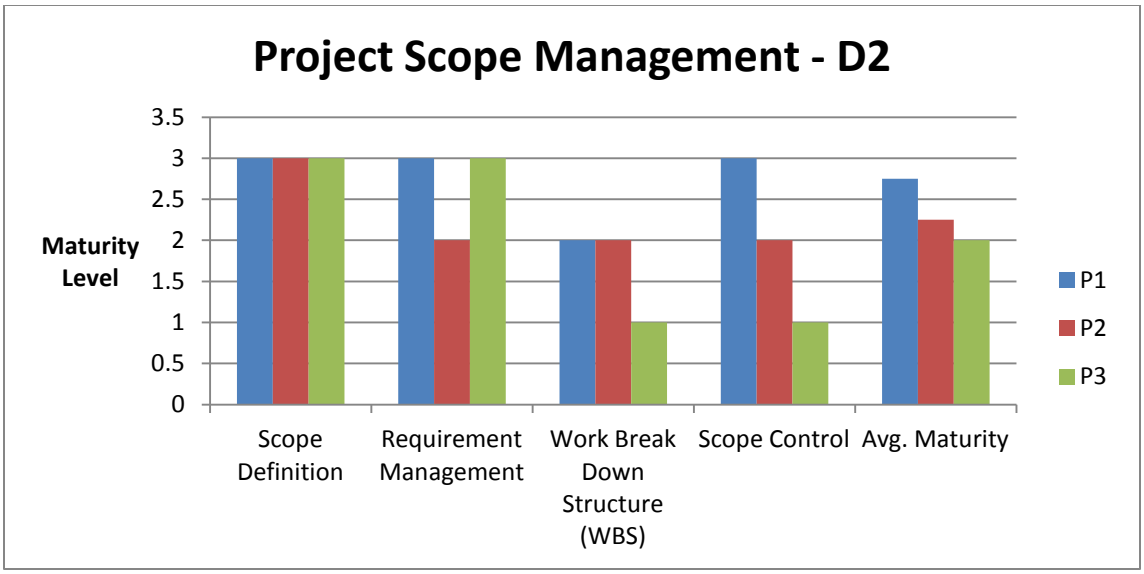

Figure 4.3: Project scope management maturity assessment of D2

Initial high level project scope definition is based on customer's technical and operational requirements. Once customer raise interest for new needs, D2 sales and project management team capture customer's needs in requirement capturing tool which has been developed for D2 business. This tool allows creating standard solution based on new project size, complexity and requirement analyses for customer. After Standard solution is finalized with customer next step is agreement signing and project manager nomination using Project Charter document. . D2 has developed standard with name of "Equipment Project Control" for all the processes after agreement is signed. The "Equipment Project Control" has standardized phases derived from PMI – PMBOK for all projects

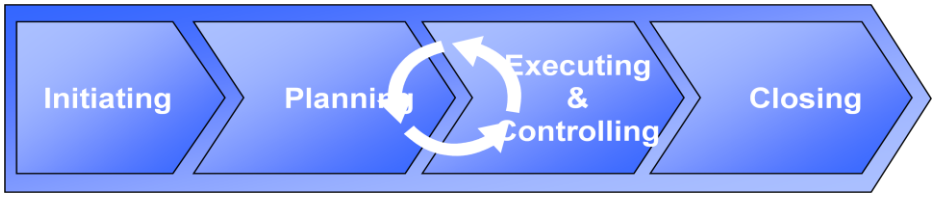

Figure 4.4: Project phases (Company intranet, 2015)

Standard solution created by requirement capturing tool provides project management team to create detailed requirements for project execution. It is a standard tool used for every project to capture customer's need and create project scope statement. Once scope is clearly decided

and agreed upon, project team start to use another tool where work break down (WBS) structure for each project is created. This tool for WBS provides only with existing activities options and project management team plans activities by selecting relevant activity. There is no flexibility to add/select any WBS activity other default activities which limits scope planning for project management team. The tool for WBS is developed by Cluster head in Dubai which is responsible for 09 market companies including Pakistan. Cluster has made this tool to standardized WBS planning across all different 09 countries due to which project management team at any market company, e.g. Pakistan, cannot add additional activities according to its customer needs. In order to cover up this limited option of WBS activity planning, project management team of D2 is using Microsoft Project to create required WBS plan according to each project.

Another limitation of need capturing and WBS planning tools is non-flexibility in case of scope and requirement change during project execution. There is no option to add change in requirement on both tools once project equipment order has been placed. Project management team have authority to implement change equivalent to of 5% budget only but in case of change greater than 5% there was no standard procedure documented. It was observed by researcher that C1 requested to D2 for change of scope during early stage of project execution. In order to evaluate scope change request there was no standard available to project management team which created chaos and ultimately project was delayed by 12 weeks in evaluating change, approvals to implement change, order placing and equipment arrival at project execution site. D2P3 responded to this scenario by claiming that procedures to handle such changes have been developed by cluster but they are not applicable to Pakistan Market Company which limits the authority of project management team also there is no procedure defined specific to Market Company in Pakistan.

Time Management

Project time management was assessed for activity sequencing, activity resource estimation, activity duration estimates and schedule control as the company has adopted it from PMI – PMBOK. The responses of all three participants at D2 for Time Management have been converted into maturity level across department “Equipment Project Control” phases. These results are:

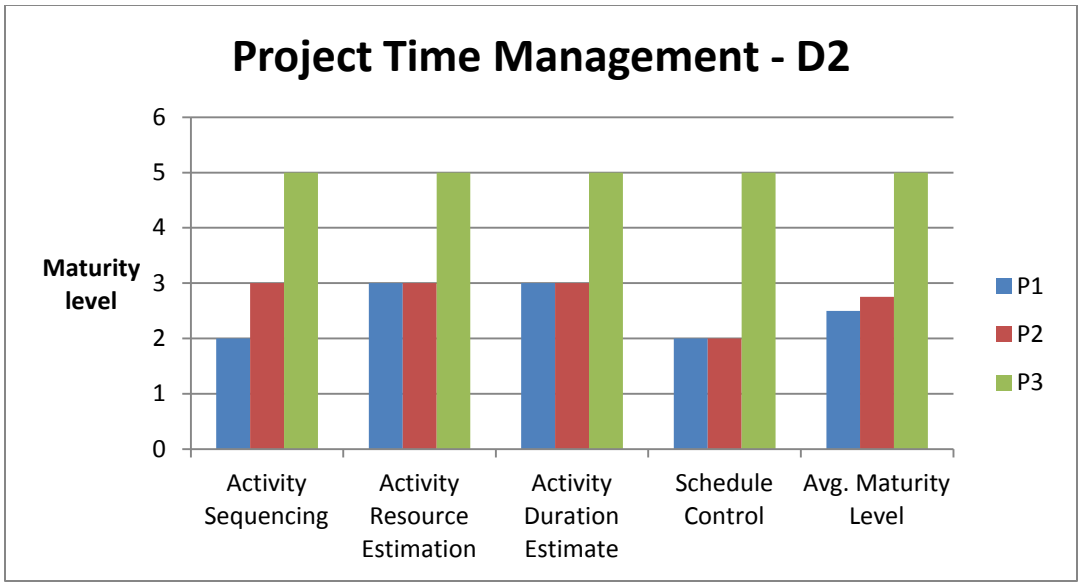

Figure 4.5: Project time management maturity assessment of D2

A tool has been recently implemented in D2 for planning and controlling of project schedule. The tool has by default activity timings for standard solution created in project scope management. Each WBS activity from standard solution is pre-calculated for resources and time required to complete it. If project management team wants to put more resources then this tool automatically calculates time based on number of resources added to completer any activity. Project management team is using past experience to calculate resources for activities and evaluate impact of adding specific resources to complete activities.

Activity duration calculation is dependent upon number and type of resources added on schedule tool while creating project schedule. Time duration on this tool does not allow for contingency duration as it calculates project schedule. Once the project schedule is created it becomes timeline for project. The need of contingency reserves for project schedule was observed at one of customers of D2. Project management team calculated schedule using this tool where only pre-defined timings to complete activities was taken as input. The actual project delivery date to customer was 15-February-2015 provided that customer prepares site as per agreement but customer was unable to prepare site which ultimately delayed overall project schedule by 14-16 weeks. There was no identified risk based on which contingency for time was calculated in advance to avoid such delays. Also, planned resources as per actual schedule were committed to other projects due to delay at C2 site which caused resources problems once C2 handed over site to D2 project management team. Delay in schedule, resources re-allocation to other projects and lack of contingencies had direct impact on project cost and

budget. The project schedule created by newly developed scheduling tool becomes realistic only if there does not occur any kind of delays in planned activity. In case of delays, project schedule is directly impacted because of lack of contingency planning. There are no standards available to project management team of D2 for resource leveling or schedule control in case of delays. Project management team is using experience of past projects in order to overcome schedule delays. . In actual, scheduling time plan is shared with customers using either on MS Project or MS Excel files.

Project Cost Management

Project cost management was assessed for Cost Estimation, Use of contingency and management reserves and cost control as the company has adopted these standards from PMI – PMBOK. The responses of all three participants at D2 for Cost Management were recorded into maturity level. These results are:

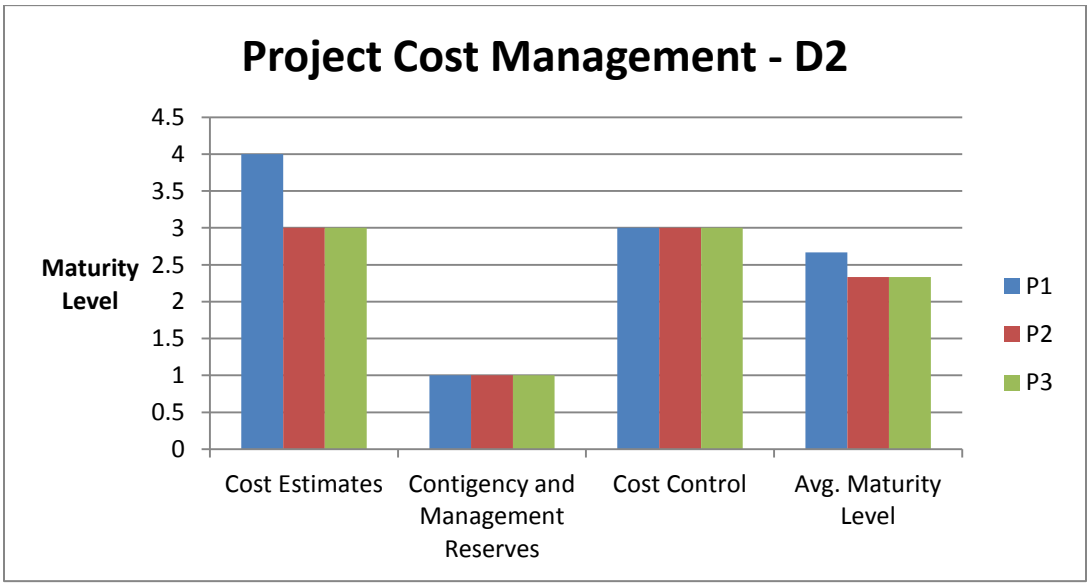

Figure 4.6: Project cost management maturity assessment of D2

Requirement capturing tool provides standard solution for customer's needs. This tool also calculates associated capital equipment cost to be sold to customer. All the equipment is insured against any risk from point of order to dispatch at customer site. Therefore, capital equipment cost does not require contingency reserves in case of any damage or risk to equipment. The project management services and execution cost is calculated in schedule development tool. This tool calculates all the associated activity cost for required resources. As explained in project time management section that schedule development tool provides standard schedule durations based on pre-defined timings for each activity. Similarly, cost is

calculated based on number of resources and time duration for each activity. This sums up to project management services cost. Project management services cost and capital equipment cost is extracted from both tools and overall project budget is calculated in Microsoft Excel in standard template called “Project Cost Calculation”. Final project cost does not include any kind of contingency reserves or management reserves to accommodate any changes during later phases of project.

D2 has not developed any standard procedure for cost monitoring and control. Cost is monitored against issues invoices and planned cost in project review meetings. When project is handed over to customer then final project cost is compared with planned cost to evaluate cost expenditures of project activities.

Project Risk Management

Project Risk Management was assessed for Identify Risks, Qualitative and Quantitative Risk analysis, Risk Responses and Risk Control as the company has adopted these standards from PMI – PMBOK. The responses of all three participants at D2 for Cost Management were recorded into maturity level. These results are:

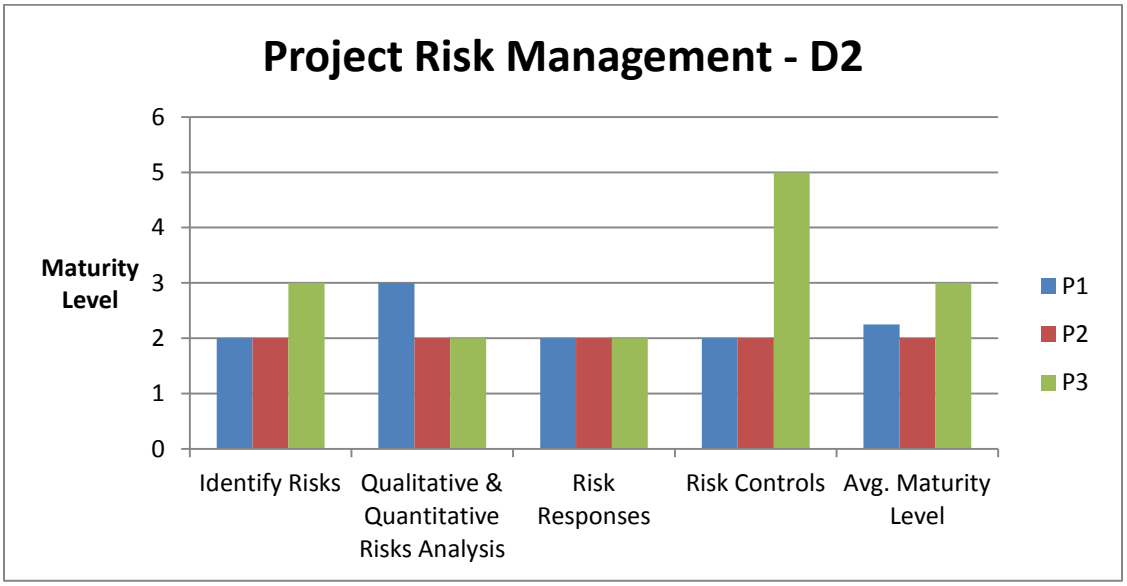

Figure 4.7: Project risk management maturity assessment of D2

Risk identification is a repetitive process which begins at early stage of project and continues throughout project execution phase as well. D2 has developed a standard template to record all identified risks. This template can be used for every project but in actual practice project management team is working on risk management when doing projects with key and big

customers only. Risks are identified on risk review meetings where project management team, functional manager and Customer provide inputs to identify potential risk. Once risk register is updated then qualitative risk analysis is performed on identified risk. Risk response is planned only on qualitatively analyzed risks. Risk owners are assigned based on risk category. Risk register template also has option to allocate additional resources if required for any specific risk. Risk review meetings are held on regular basis to evaluate risk responses and analyze new potential risks. The cluster head has developed standard to perform risk management for every project but local project management team in Pakistan Market Company has adopted risk management practices for key customers only. Standard template has defined procedure to perform quantitative risk analysis but local project management team has not performed quantitative risk analysis for any project. Project documents for projects at C1 & C2 did not have any risk management document because these customers are not defined as key customers by D2.

4.1.2 Department 1 (D1)

The survey for project management maturity assessment was sent to participants of D1 covering all knowledge areas of project management according to PMBOK. Only project scope, time, cost and risk management knowledge areas are discussed for case study analysis.

Project Scope Management

Likewise to D2, project scope management at D1 was assessed for scope definition, Requirement Management, work breakdown structure (WBS) and scope Control. The assessed areas of project scope management are based on PMI – PMBOK as company has incorporated PMI standards.

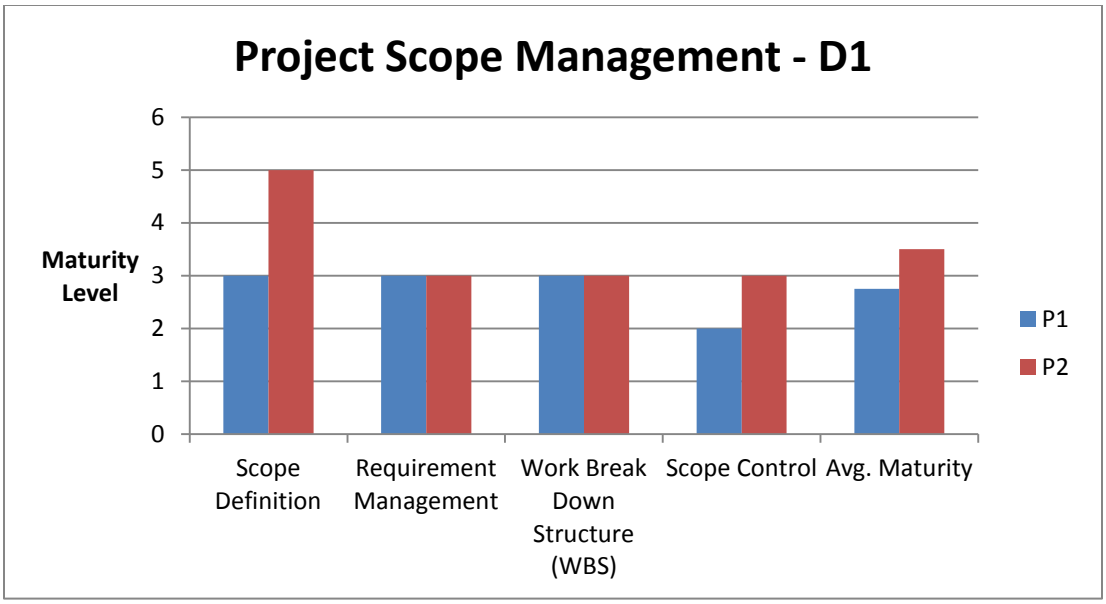

Figure 4.8: Project scope management maturity assessment of D1

The tool used for requirement capturing and customer's need by D1 is the same as used by D2 project management team. Customer's needs are captured with collaboration of sales and project management team. Requirement tool helps to create standard solution for customer based on customer's needs. This standard solution is used as input for sales agreement between customer and D1. Once project scope is defined next step is creation of WBS using another tool that has been recently implemented. This tool has pre-defined set of activities. Pre-defined activities limits the flexibility of the WBS creation for company working in Pakistan Market where sometimes customer needs vary compared to existing standard solutions. D1 has developed standard procedure for scope control. Project management and project engineering team has been authorized to change technical requirements, whenever necessary and inevitable, by incorporating locally available solutions. These scope change control procedures are adopted for all projects of D1.

Project Time Management

Project time management at D1 was assessed for activity sequencing, activity resource estimation, activity duration estimates and schedule control as the company has adopted it from PMI – PMBOK. These results are:

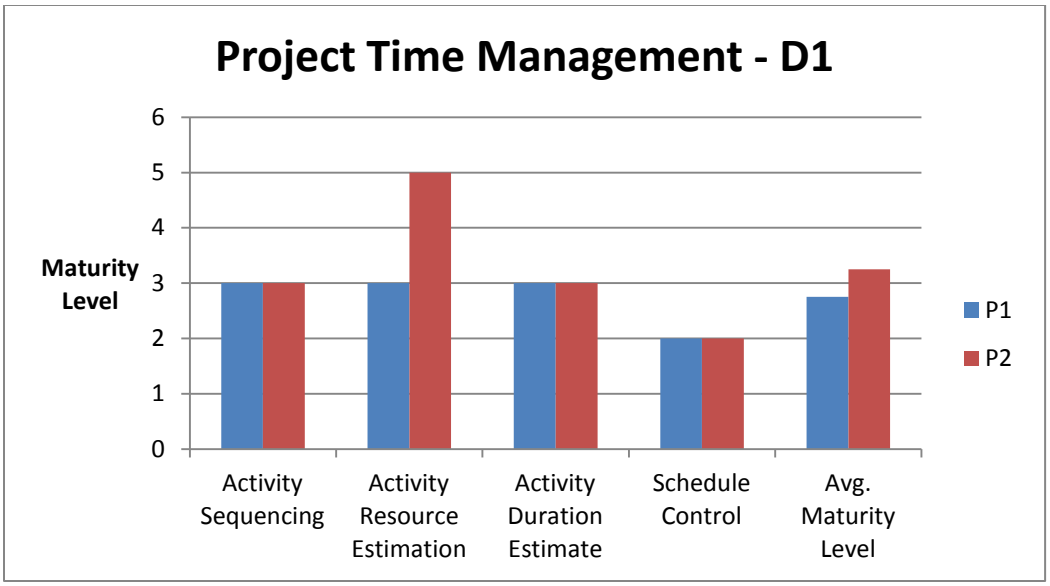

Figure 4.9: Project time management maturity assessment of D1

D1 has also implemented tool for project schedule and control. Scheduling tool has pre-calculated timings for project activities. These activities have been imported from the scope capturing tool. Standard time for each activity has been defined by cluster head. Cluster head is responsible for control of project management team across all 09 countries. In addition to standard timings, scheduling tool has also a pre-defined number of resources required to complete each activity of standard solution. It helps in calculating number of resources required and associated time to complete each activity of WBS. Although this scheduling tool provides standard calculated time and resources still this tools fails to accommodate delays in project activities. In case if delays are forecasted by project during schedule planning, there is no flexibility to incorporate contingency time reserves in project schedule. Similarly when it comes to schedule control during project execution phase, this tool provides only with limited and pre-defined decision options. There is no standard defined in this tool to handle situations where project activities face delays or project is expected to be completed earlier than planned. Project management team at D1 is using its experience and reacting according to situations for handling such issues. D1 project management team was also involved in delivering project to C2 with timeline of 15-February-2105. Initially project was delayed due to delay in site preparation but it had direct impact on project schedule plan by D2 project management team. There was no time management standard available that could incorporate delays in project scheduling tool. Also, there were no time contingency reserves in project schedule. The only remedy was a rescheduled time plan but having same durations as those of original plan. It is important to mention here that project schedule is not shared with customers using scheduling

tool interface. In actual practice, scheduling time plan is shared with customers using either on MS Project or MS Excel files.

Project Cost Management

Project cost management was assessed for cost Estimation, use of contingency and management reserves and cost control as the company has adopted these standards from PMI – PMBOK. The responses of both participants at D1 for Cost Management are shown below:

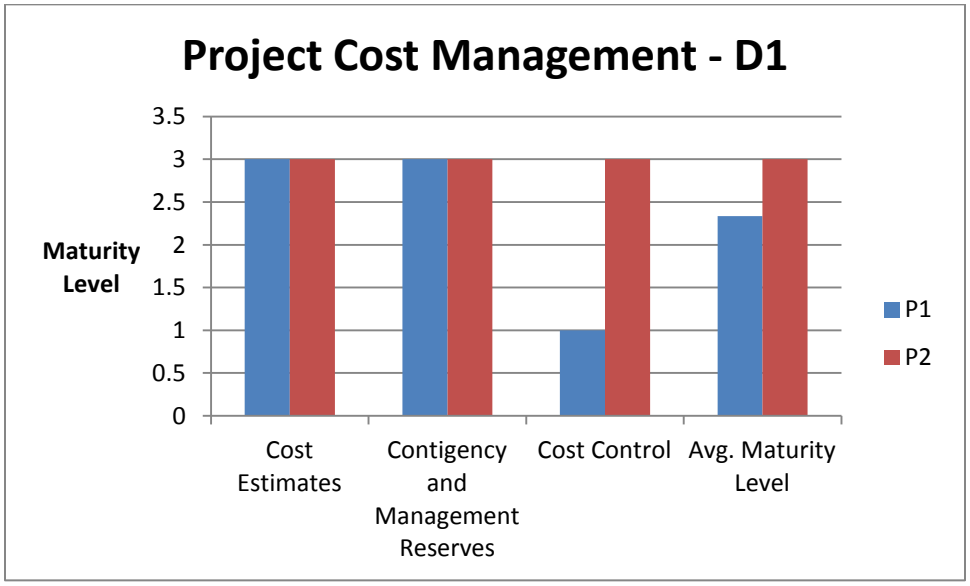

Figure 4.10: Project cost management maturity assessment of D1

D1 has developed standardized procedures for estimating project cost. Equipment cost is calculated for standard solution in requirement capturing tool. This equipment cost becomes part of sales agreement along with project management services cost and sales margin. Equipment cost and project management services cost sums to project budget. Equipment cost, project management services cost and other costs, if any, are written down on Microsoft Excel sheet in standard format and are shared with customer. D1 has defined standards for calculating and incorporating contingency reserves into final project budget. The standard practices for contingency reserves are used by all projects. Project Cost control is monitored and controlled by project board during status review meetings. The frequency of status review meetings is determined by the project board and the project management team. Actual and planned project costs are discussed, monitored and forecasted to evaluate cost control

decisions. Although cost control is practiced by D1 but still there is no use of earned value tools for cost monitoring and controlling throughout project.

Project Risk Management

Project Risk Management was assessed for identify risks, qualitative and quantitative risk analysis, risk responses and risk control as the company has adopted these standards from PMI – PMBOK. The responses of all two participants at D1 for Cost Management were recorded into maturity level. These results are:

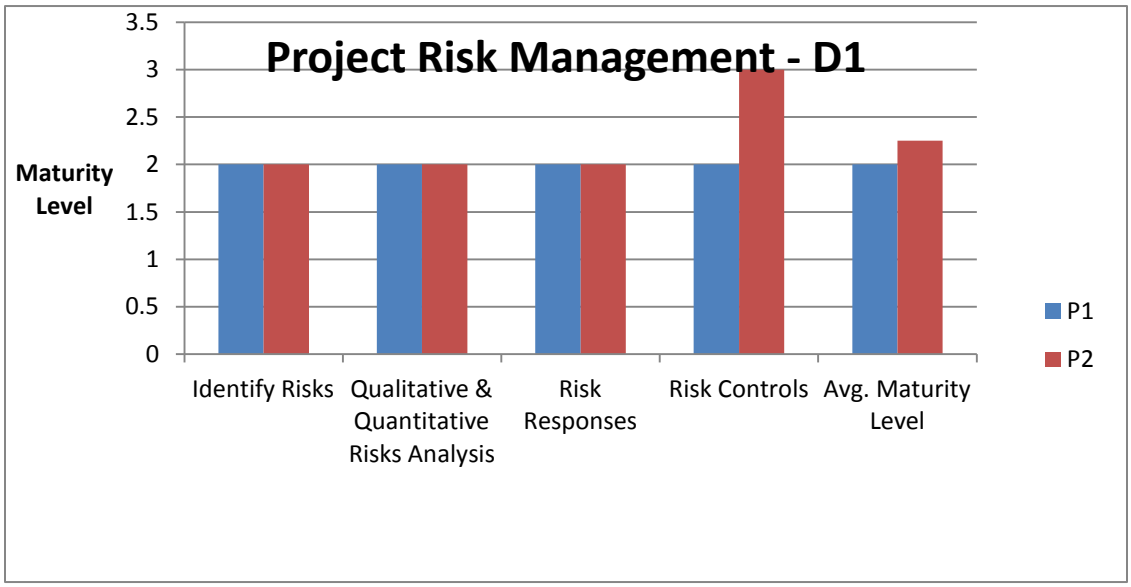

Figure 4.11: Project risk management maturity assessment of D1

Project risk management planning by D1 project management team begins once a project kick-off meeting takes place during early stage of project. Although, D1 has developed project risk management standards but responses of participants show that risk management practice is not used for all project. Risk management planning is done only for projects with key customers or very large scaled projects. D1 project management team starts to identify risks and at very early stage of project. Identified risks are recorded on standard risk register template. The standard for project risk management also involves analyzing risks both quantitatively and qualitatively. Risks responses are decided based on risks category. Risks responses include either minimizing or avoiding risk. Risk owners ensure implementation of risk responses. Risks are reviewed by the project management team during status review meetings and in case new risk are identified for project then they are recorded in risk register and risk responses are planned accordingly. D1 had defined project sizes as L1, L2 & L3 where L1 is used for small size project, L2 for medium size and L3 for large size projects. During time of research at company, D1 was

nearing completion of L3 size project at one of its customer. Project documents for L3 sized projects included project risk management plan where all above identified areas of risk management were part of plan. Whereas for project with C2, where both D1&D2 project management teams were involved, only risk identification and risk response section were part of the project plan.

4.1.3 Summary of Research Findings

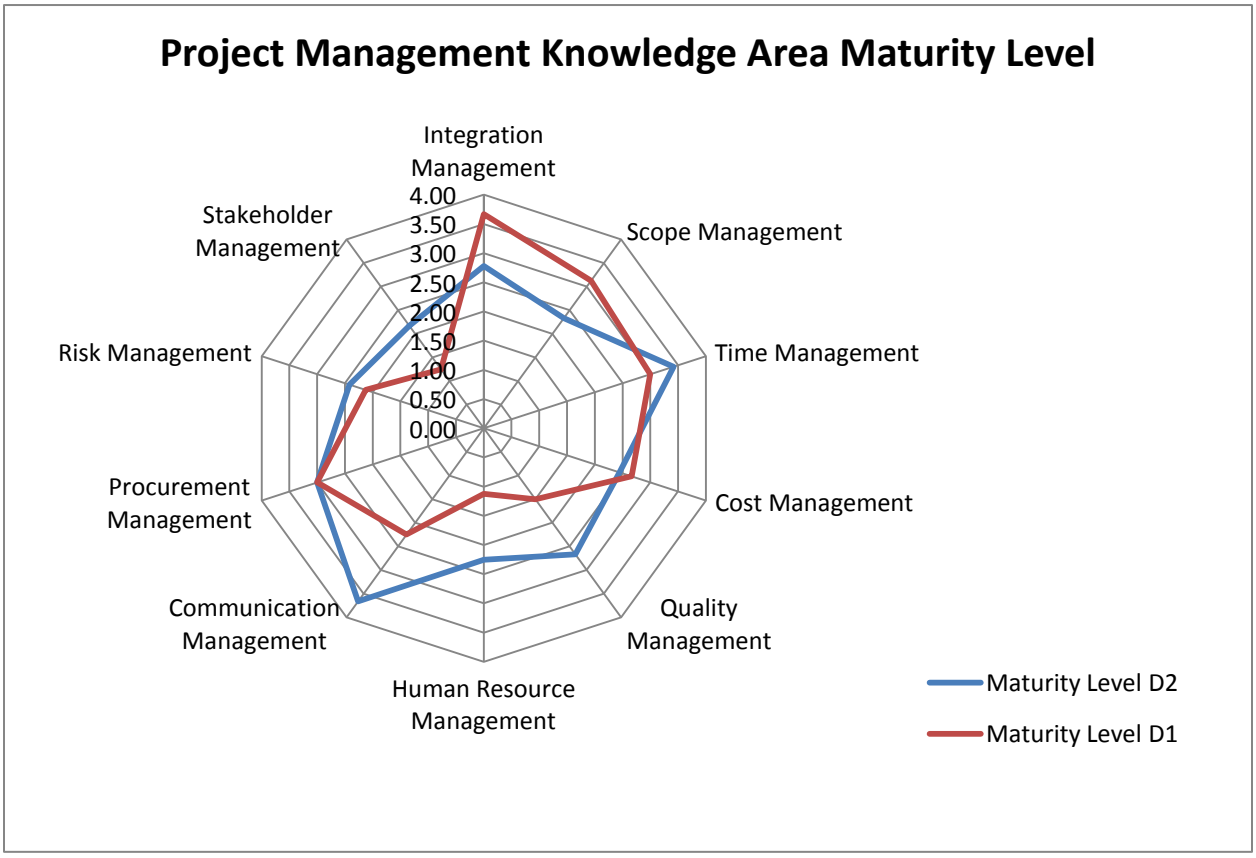

Figure 4.11: Summary of Project Management maturity assessment for D1&D2

5 Discussion

The focus of this section is to discuss and analyze the findings of case study in light of theoretical framework.

The research method used in this research work involved sending out survey to selected participants in organization. The researcher was present with respondents when they were

responding to survey questionnaire. This helped in performing project management maturity assessment. Also, researcher made participants observation to better understand project management standards and practices used by participants while dealing project activities. Participant observation proved to be of great help for understanding and interpreting the use of project management standards in selected company. Participant observation was made by attending project status meetings and customer site visits.

5.1 Project Scope Management

Effective scope management throughout the project is part of project success factors (PMBOK, 2013). Project scope management maturity assessment results from case study show that D1 & D2 project management team has realized significance of effective scope management. The implementation of value capturing tool and scope management tools in D1 & D2 depicts the commitment of project management team at both D1 & D2 for achieving excellence in project scope management knowledge area. Although these tools have limitations, which require improvement for better and efficient usage, still a lot has already been standardized in project scope management.

Collins and Baccarini (2004) concluded from their research that well defined scope provides a path to meet customer expectations. D1 & D2 both have implemented value capturing tool. The purpose of this tool is to capture customer's needs and requirements. Mirza, Pourzolfaghar and Shahnazari (2013) stated that project scope definition sets path for execution of project activities. Once customer's requirements are captured in value capturing tool, next step involves defining the project scope. It is a standard practice in both D1 & D2 that scope is defined on the basis of customer's requirements. Scope definition includes standard solution that is already available on value capturing tool. All the three participants of D2 project management team have similar response to project scope management maturity assessment. According to their responses, scope definition process for new projects has a standardized practice. Use of value capturing tool has made it possible to define project scope in standard way regardless of project size.

Participants of D1 project management team have two different responses for scope definition. According to D1P1 response, scope definition follows standard procedure for all projects whereas D1P2 believed that scope definition procedure is continuously improved for every project. This continuous improvement for scope definition process is reflection of personal

practices of P2. PMO of D2 has defined standard procedure for scope definition and it is in practice for all projects. Requirement management at D1 also follows standard practice that allows standard way for capturing customer's requirements. Requirement capturing tool has a limitation for handling change request. In case of a requirement change request during project execution, there was no standard practice defined to handle change requests. It was a finding that project at C1 was delayed due to change request during project execution. On other hands, D1 has defined standards for requirement changes.

Work breakdown structure (WBS) is one of the important components of project scope management. WBS tool is used to translate project scope into activities for project execution (Maylor, 2010 and PMBOK, 2013). Although both D1 & D2 have standardized tools and practices for creating WBS once scope is defined, but this tool has limited application for project within Pakistan. WBS tool was created by cluster head for 09 Market Companies and it has only pre-calculated activities for standardized solutions. These standardized solutions cover most of project activities for Pakistani Market but sometimes it fails to provide activity which might be a requirement to deliver the project. Pre-defined activities provide benefit of reduced efforts for WBS creation but it also limits flexibility options at both D1 & D2.

It can also be seen from case study results that D1 & D2 has not defined standardized approaches for scope change control. The project management team of D1 & D2 is not following any guidelines which could be used to control and reduce the factors for scope change control requests.

5.2 Project Time Management

Project time management ensures necessary processes and procedures required for completion of project on time. These procedures include an activity list from scope management, activity resources and time estimates, developing schedule and control procedures (PMBOK, 2013; Maylor, 2013).

It was observed that the scheduling tool at D1 & D2 provides only pre-defined timings and resources required to complete standard solution. If a project management team at D1 & D2 wants to increase or decrease resources (both types and volumes) then associated time changes accordingly. Each standard solution has pre-defined timings to complete project and defined timing becomes KPI for project management team. There is no flexibility to handle changes in project schedule. D1 & D2 has defined standards for activity sequencing, activity resource estimation and activity duration estimates but these standards and project time

management tool limits the options for Company in Pakistan. Because of pre-defined resources and time durations, scheduling tools does not provide with any option for contingency reserves for time duration. Project management teams of both D1 & D2 have ongoing discussion to improve scheduling tool. Another weak point observed about scheduling tools was unavailability of any kind of techniques for schedule control. Tool only provides monitoring of schedule but in case of delays or earlier completion of project activities there are no techniques or standard procedures to follow. Only past experience of project management team is being used to handle such situations. It is not possible to share final project schedule using scheduling tool interface with customers do not have access to this tool. In actual practice, D1 & D2 project management team convert schedule in to Gantt chart using Microsoft Project/Excel and share it with relevant customer. Tonchia and Cozzi (2008) identified various drawbacks of using Gantt chart for scheduling. One of most important drawbacks of using Gantt chart is that it does not prioritize among activities.

One of interesting observation from the case study can be seen in terms of uniformity for responses. P1 & P2 from D2 responses related to all four measured areas of project time management are similar. P1 & P2 responded that activity sequencing, activity resources and duration estimation follows a standard approach for all projects where as existing procedures for schedule controls are not adopted for all projects. Compared to P1 & P2, P3 response shows that improvement is continuously practiced for every new project. At time of filling survey, P3 explained that although these improvement steps does not become part of standard procedures but still they are using experience and lessons learnt from previous projects and are implementing and trying to improve decision making for new projects. The difference in opinion among these respondents can be a reason of lack of knowledge transfer among project management team members. Knowledge transfer and discussions sessions would create harmony for mutual understanding of standardized procedures. Respondents at D1 seem to have same level of understanding about standardized procedure as

5.3 Project Cost Management

According to Maylor (2010), the costing process has resemblance with project time planning process. Project Cost Management ensures procedures for planning, estimating, budgeting and expending cost to carry out project activities. Project Cost Management involves Estimate cost, budget determination (also includes contingency and management reserves) and cost control processes (PMBOK, 2013). Maturity assessment for D2 shows overall average 2.44 maturity

level results and for D1 maturity level is 2.67. According to Tonchia and Cozzi (2008), project costing follows three stages as:

i) Detailed classification and analysis of cost elements.
ii) Allocation of costs and estimation of budget.
iii) Summarizing all the cost to calculate selling price of products and services.

Both D1 & D2 have developed asimilar approach as explained by Tonchia and Cozzi (2008). Requirement capturing tool used by D1 & D2 provides standard cost for capital equipment to be sold. D1 & D2 also calculates project management services cost for new projects and both capital equipment cost and project management services cost become final project budget. Final project budget is shared with customers in Microsoft Excel template named as “Project Cost Calculation”. PMBOK (2013) has recommended three techniques for cost estimates. These techniques include analogous estimate, parametric estimates and bottom-Up estimates. Both D1 & D2 are using bottom-up estimate technique for equipment cost calculation. Bottom-Up estimates involve calculating cost for each component to lowest level and then summarizing all the costs. Whereas for project management services cost, D1 & D2 are following analogous estimate technique. Analogous estimates technique involves calculating costs based on previous projects which had similar scope. The pre-defined resources and time estimates have costs which costing tool calculates based on previously defined standard costs. PMBOK (2013) identifies drawback of using analogous estimate techniques as less accurate. The same drawback was observed for D1 & D2 project management services cost that incase of delayed on earlier completion of project activities no standard was define to tackle with cost overrun or under spend.

D2 has defined standardized procedure for cost estimation. The standardized procedure is followed for all new projects. However P1 response show that cost estimation process follows a maturity level of 4. P1 views about this process show that resources cost for project management services is controlled by measuring resources efficiency from previous projects. It only reflects personal views of P1 about cost estimation process. The other two respondents P2 & P3 are following standardized approach for estimating project costs. D2 has not defined any procedures to include contingency reserves or management reserves for estimating final budget. PMBOK (2013) recommends adding contingency reserves while estimating project budget because it would help to accommodate any kind of risk to cost overrun. The three respondents at D2 have same understanding about project cost control. There are no defined standards to use earned value management for project cost control. The only procedure in

practice at D1 is reviewing costs against issued invoices during status review sessions for each project.

Respondents at D1has the same understanding for cost estimates and use of contingency reserve procedures. Standardized procedures have been defined and used for all project. The only difference in understanding of procedures among D1 participants is observed for cost control procedures. P1 answered that they have not defined any standard procedures about cost control whereas P2, who is project manager, answer shows that standard procedure has been defined and in practice for all project. Standard procedure is available in D1 internal documents for project management standards. The difference in answers by two respondents shows lack of knowledge transfer, mutual understanding and communication of information among two participants i.e. Project Engineer and Project manager.

5.4 Project Risk Management

Project Risk Management involves procedures for risk identification, risk analysis, planning responses for identified risks and risk control (PMBOK, 2013; Maylor, 2010). Maturity assessment results show average level of 2.67 for D1 and average level of 2.44. Project management maturity assessment results and company internal documents show that both D1 & D2 have standardized procedures for project risk management. In actual practice, risk management processes are not used for every project done at D1 & D2. Project management teams of both D1 & D2 found to be resistant for using risk management processes in all projects. It is mutual understanding among project team members that they will be able to handle all the risks for projects without implementing risk management plan. It was also observed that only L3 sized projects have project risk management planning where as smaller projects with category of L2 and L1 do not have risk planning. PMBOK (2013) has recommended to perform first qualitative risk analysis and then quantitative risks analysis to determine risk contingency and prioritize risks. Risk template used by D1 & D2 have qualitative risk analysis and contingency budget option but only D1 is using contingency budget option for its L3 project whereas D2 project management team does not put any efforts to determine contingency budgets based on risk analysis.

6 Conclusion

The aim of research was to perform project management maturity assessment of two departments in selected organization. It would provide the basis to determine how project

management process can be improved by utilizing project management maturity model. The research questions were formulated as following: “How projects are performed and what is current level of maturity for projects in organization? Which maturity model is best for measuring maturity of selected organization based on what criteria? What are the gaps in project management practices based on project management maturity assessment? What are recommendations to improve desired knowledge area of project management practices?”

The studied literature about project management maturity models stated that higher level of project management maturity ensures efficient projects delivery. Different research studies were discussed in support of argument that project management maturity has direct impact on project efficiency (Grant and Pennypacker, 2006; PWC, 2004; PWC, 2007; PWC, 2012). A wide range of project management maturity models are available but only five maturity models have been discussed for this thesis work. Man (2007) described three selections criteria as a). Structure b). Applicability and c). Usage of maturity model for project management maturity assessment. Nenni et al. (2014) extended Man (2007) selection criteria and shortlisted five project management maturity model. The five maturity models include following list:

1. Organizational Project Management Maturity Model (OPM3)
2. Capability Maturity Model Integration (CMMI)
3. Kerzner Project Management Maturity Model (K-PMMM)
4. Project, Program, Portfolio Management Maturity Model (P3M3)
5. Maturity Increments IN Controlled Environments (MINCE)

The comparison of these five maturity models reveals that OPM3 is best among all of them. A three point criteria was also developed to select project management maturity model for this thesis work. OPM3 was selected as result of shortlisted criteria.

The case study approach was adopted for this thesis work. It involved project management maturity assessment for D1 & D2. The assessment was performed by selecting project management and engineering participants from D1 & D2 who responded to survey questionnaire as per their understanding of standardized processes in practice. Data collection was also done by studying and reviewing internal company documents and participatory observance. The role of researcher during participatory observance was to participate in internal planning and discussion meetings, visit customer site for project status review meetings and general talk with project management team in case if any clarity is required about any specific topic. In total five persons from both departments participated for filling out survey

questionnaire. The results of case study research were explained and discussed based on related literature. It provided the basis to determine and understand gaps for improvements

Reflecting upon literature review for case study results and analysis, it was found that company has strong realization for standardized project management processes. It was found from responses that one of the assessed department i.e. D2 has already undergone project management maturity assessment in 2014. A clear understanding of project management processes and desire to improve processes was found among participants of this department. During general discussion with participants of both departments it was found that project management team of both D1 & D2 believed that D1 is more mature for project management than D1. Although actual results of project management maturity assessment do not vary a lot between two departments i.e. (D2 – D1 = 2.71 – 2.37 = 0.34), but the impact of higher project management maturity was clearly observed for delivering projects to customer. It was found out that C1 & C2 customers, where both D1 & D2 were delivering projects during research work, were more satisfied with project management efficiency of D2 compared to that of D1. This finding was observed by participating in project review meetings held at both customers. The feedback of customers during meetings proved that D2 project management team delivered projects with better efficiency and customer satisfaction. The feedback of customers also supported that higher project management maturity enables to deliver project with increased efficiency.

In addition to impact of project management maturity on efficient project delivery, it was also observed that although standardization of project management procedures provide direction on how to deliver projects but it is not sufficient alone. There were many other factors observed in D2 project management team which were not present in D1 project management team. These factors included vast experience; good customer relations and customer approach, certified project management team and project management team structure. For example P1 at D1 has around 30 years of working experience with selected organization. Compared to D2, project management team at D1 has less experience and also not even a single member has professional project management certification. The researcher did not evaluate the impact of such factors on delivering projects with more efficiency. Only it was realized that two departments does not have same factors for delivering projects. A further study would be needed to conclude the impact of these factors on efficient projects delivery.

7 Recommendations

In order to implement improvements in existing project management standards, it is recommended to the company that it should apply these recommendations as a pilot project for delivering project to one of its customer. The results of improvements should be recorded for analyzing the impact and then based on results these improvements can be standardized for all projects of company. The recommendations are based on best practice list of OPM3 model and are recommended as general to both studied departments of selected company. The recommendations are:

- Clearly defined procedures to handle scope change during project execution. These procedures would also include roles and responsibilities to incorporate required changes into project scope.
- Modification of WBS tool for company's market in Pakistan. This would include more flexibility to add/remove activities related to each project rather than having pre-defined activities that limits options for project team. Project Management team should be able to add activities according to needs and requirement of each project
- Project time durations for each activity should be determined by project management team based on resources availability. It will eliminate the problem of time duration calculation based on pre-defined durations in scheduling tool. Also, project management standards should be defined for taking contingency reserves while calculating project durations. Furthermore, project management standards should also provide project management team with schedule control tools like Crashing and Fast-Tracking.
- Standards should be defined for project cost contingency reserves. These standards should be monitored continuously to evaluate trend of contingency budget as project continues to execution phase. The analysis of trend can be used to re-define standards for introducing contingency reserves in overall project budgets.
- Risk management standards are not used consistently for all projects. These existing risk management standards should be evaluated by taking Pakistan Market Company into consideration and re-define to use consistently across all projects.

8 Future Research

Project management Maturity has evolved in last decade or so as more and more maturity model has been introduced in recent years. Based on the findings and research work of this thesis work two related areas would be recommended as future research in the field of project management maturity.

Firstly, it is recommended to extend the concept that higher project management maturity ensures project delivery with more efficiency beyond one organization. It would be really interesting to involve more than two organizations and study the impact of higher project management maturity level on efficiency of project delivery. This would provide broader view on role of project management maturity for delivering projects.

Secondly, it would also be interesting to extend the research for evaluating factors like project management team competency, organizational structure, culture and organization support to project management. These factors would be evaluated to determine if only higher level of project management maturity would be enough to deliver project with high efficiency or there are other supporting factors that would contribute as whole for delivering projects with high efficiency.

9 Reference

Albrecht, J. C. and Spang, K. (2014) 'Linking the benefits of project management maturity to project complexity', *International Journal of Managing Projects in Business*, 7(2), pp. 285–301.

Association for Project Management (2012) *APM Body of Knowledge. (*6th ed.), Buckinghamshire: APM Publishing.

Andersen, E. and Jessen, S. A. (2003) 'Project maturity in organisations',*International Journal of Project Management*, 21(6), pp. 457–461

Backlund, F., Chronéer, D. and Sundqvist, E. (2015) 'Maturity assessment: towards continuous improvements for project-based organisations?',*International Journal of Managing Projects in Business*, 8(2), pp. 256–278.

Brookes, N., Butler, M., Dey, P. and Clark, R. (2014) 'The use of maturity models in improving project management performance', *International Journal of Managing Projects in Business*, 7(2), pp. 231–246

Bryman, A. (2012) Social Research Methods. (4th Ed). New York: Oxford University Press.

Bushuyev, S. D. and Wagner, R. F. (2014) 'IPMA Delta and IPMA Organisational Competence Baseline (OCB)', *International Journal of Managing Projects in Business*, 7(2), pp. 302–310.

Collins, A. and Baccarini, D. (2004) 'Project Success – A Survey', *Journal of Construction Research*, 5 (2), pp. 211-231

Constantinescu, R., and Iacob, I. M. (2007) 'Capability maturity model integration'. *Journal of Applied Quantitative Methods*, *2*(1), pp. 187.

Crawford, J. (2006) 'The Project Management Maturity Model', *Information Systems Management*, 23(4), pp. 50-58.

Farrokh, J., and Mansur, A. K. (2013) 'Project Management Maturity Models and Organizational Project Management Maturity Model (OPM3®): A Critical Morphological Evaluation', *Project Management*, *2*(7), pp. 23-33.

Grant, K. P. and Pennypacker, J. S. (2006) 'Project management maturity: an assessment of project management capabilities among and between selected industries', *IEEE Transactions on Engineering Management*, 53(1), pp. 59–68

Hillson, D. (2003) 'Assessing organisational project management capability', *Journal of Facilities Management*, 2(3), pp. 298–311.

Ibbs, C.W. & Kwak, Y.H. (2000) 'Assessing project management maturity', *Project Management Journal*, 31(1), pp. 32.

Jamaluddin, Chin, C. M. M. and Lee, C. W. (2010) 'Understanding the requirements for project management maturity models: Awareness of the ICT industry in Malaysia', *2010 IEEE International Conference on Industrial Engineering and Engineering Management*.

Kerzner, H. (2002) Strategic Planning for Project Management Using a Project Management Maturity Model. United States: New York : John Wiley,

Kaur, J. (2014) 'Comparative Study of Capability Maturity Model', International Journal of Advanced Research in Computer Science & Technology, 2(1),

Khoshgoftar, M. and Osman, O. (2009) 'Comparison of maturity models',2009 2nd IEEE International Conference on Computer Science and Information Technology.

Man, T. J. (2007). A framework for the comparison of Maturity Models for Project-based Management.

Available at: http://www.ipma.nl/wiki/sites/pmwiki.nl/files/Thesis_Tjman_2007.pdf (Accessed: 24 March 2015).

Maylor, H. (2010) *Project Management*. 4th edn. Harlow: Pearson Education.

Meisner, R. (2007) MINCE®-A Framework for Organizational Maturity. 1st edn. Van Haren.

Mirza, M. N., Pourzolfaghar, Z. and Shahnazari, M. (2013) 'Significance of Scope in Project Success', *Procedia Technology*, 9, pp. 722–729

Mullaly, M. (2014) 'If maturity is the answer, then exactly what was the question?', *International Journal of Managing Projects in Business*, 7(2), pp. 169–185

Nenni, M.E., Arnone, V., Boccardelli, P. and Napolitano, I. (2014) 'How to Increase the Value of the Project Management Maturity Model as a Business-oriented Framework', *International Journal of Engineering Business Management*

Noor, K. B. (2008). Case study: A strategic research methodology. *American journal of applied sciences*, *5*(11), 1602-1604.

Paulk, M. C., Curtis, Chrissis, M. B. and Weber, C. V. (1993) 'Capability maturity model, version 1.1', *IEEE Software*, 10(4), pp. 18–27.

Project Management Institute (2013). *A Guide to the Project Management Body of Knowledge (PMBOK)*. (5th ed.), Project Management Institute (PMI), Inc, Newtown Square, Pennsylvania.

Pretorius, S, Steyn, H and Jordaan, J. (2012) 'PROJECT MANAGEMENT MATURITY AND PROJECT MANAGEMENT SUCCESS IN THE ENGINEERING AND CONSTRUCTION INDUSTRIES IN SOUTHERN AFRICA', *The South African Journal of Industrial Engineering*, 23(3),

Project Management Institute (2013) *Organizational project management maturity model: OPM3 knowledge foundation*, 3rd Ed., Project Management Institute (PMI), Inc, Newtown Square, Pennsylvania.

Rad, P. F., and Levin, G. (2006). Project management maturity assessment. *AACE International Transactions*, , PM61

Tonchia, S. and Cozzi, F. (2008) *Industrial Project Management: Planning, Design, and Construction*. Berlin: Springer-Verlag Berlin and Heidelberg GmbH & Co. K

Yazici, H. J. (2009) 'The role of project management maturity and organizational culture in perceived performance', *Project Management Journal*, 40(3), pp. 14–33

Website

(OGC) Office of Government Commerce (2011) *Best Management Practice Portfolio*. GOV.UK. Available at: https://www.gov.uk/government/publications/best-management-practice-portfolio (Accessed: 5 March 2015).

MINCE2 Foundation (2007). *Maturity INcrements IN Controlled Environments (MINCE2).* Available at: http://www.mince2.org/ (Accessed: 10 March 2015).

(PWC) Pricewaterhouse Cooperrs (2004) *Boosting Business Performance through Programme and Project Management.* Available at: http://www.pwc.com/us/en/operations-management/assets/pwc-global-project-management-survey-first-survey-2004.pdf (Accessed: 18 March 2015)

(PWC) Pricewaterhouse Cooperrs (2007) Insights and Trends: Current Programme and Project Management Practices. Available at: http://www.pwc.com/us/en/operations-management/assets/pwc-global-project-management-survey-second-survey-2007.pdf (Accessed: 18 March 2015)

(PWC) Pricewaterhouse Cooperrs (2012) Insights and Trends: Current Portfolio, Programme and Project Management Practices. Available at: http://www.pmi.org/~/media/PDF/RCP/PwC_PPPM_Trends_2012.ashx (Accessed: 18 March 2015)