

**Project Management Maturity Analysis for Construction Companies – The
Case of Ethiopian Construction Design and Supervision Works Corporation**



Girum Dessalegn

A Thesis Submitted to

**The Department of Construction Engineering and Management
School of Civil Engineering and Architecture**

**Presented in Partial Fulfillment of the Requirement for the Degree of
Master's in Civil Engineering
(Construction Engineering and Management)**

Office of Graduate Studies

Adama Science and Technology University

July, 2021

Adama, Ethiopia

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DECLARATION

I hereby declare that this Master Thesis entitled “Project Management Maturity Analysis for construction companies – The case of Ethiopian construction design and supervision works corporation” is my original work. That is, it has not been submitted for the award of any academic degree, diploma or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation

Name of the student

Signature

Date

RECOMMENDATION

I, the advisor of this thesis, hereby certify that I have read the revised version of the thesis entitled “Project Management Maturity Analysis for construction companies – The case of Ethiopian construction design and supervision works corporation” prepared under my guidance by Girum Dessalegn submitted in partial fulfillment of the requirements for the degree of Master’s of Science in Civil engineering (Construction engineering and management). Therefore, I recommend the submission of revised version of the thesis to the department following the applicable procedures.

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APPROVAL PAGE

I, the advisor of the thesis entitled “Project Management Maturity Analysis for construction companies – The Case of Ethiopian construction design and supervision works corporation” and developed by GirumDesalegn, hereby certify that therecommendation and suggestions made by the board of examiners are appropriatelyincorporated into the final version of the thesis.

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We, the undersigned, members of the Board of Examiners of the thesis by GirumDessaalegn have read and evaluated the thesis entitled “Project Management Maturity Analysis for construction companies – The Case of Ethiopian construction design and supervision works corporation” and examined the candidate during open defense.

This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement ofthe degree of Master of Science in Civil engineering (Construction engineering and management)

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ACKNOWLEDGEMENTS

First of all I would like to thank the almighty God, who has always guided me to work on the right path of the life and for His unparalleled support given for me so that I perform efficiently and effectively during carrying out this thesis work and giving me internal courage and strength to accomplish. Without God's grace, this would never come to be today's reality.

I would like to express my profound and sincere gratitude to my Advisor, Dr. Meseret Getnet for his meticulous rectification, valuable support and continuous guidance in the course of conducting my study throughout the development of this study and supported me at every step to complete the thesis. He was always available to offer me guidance through face to face and through e-mail.

I am also indebted to the management teams and all the respondents of the construction company, ECDSWCo, and its employees for their support and timely cooperation and all those who helped me throughout the duration of this thesis work and with whom I interacted during my research, for their willingness to participate in the study and for their exceptional support and coordination throughout the data collection process

Last but definitely not least, I would also like to express my heartfelt gratitude to my family and friends for their valuable support, encouragement and dedication throughout the course of the study period

Abstract

The Ethiopia government is now implementing growth and transformation plans which focus in various projects in different sectors such as construction of hydro Power plants, highways, railway projects, and many other infrastructures. Ethiopian construction design and supervision works corporation is one of the national development companies playing a key role in the construction industry. Project maturity analysis is core to capacity building, technology transfer, as well as to stay competitive in the ever growing economy. So far, the company is involved in handling many projects in country and assessing its level of maturity is vitally important for the success of the projects handled and future endeavor. The company wants give due attention to enhancement of the project management capability as a starting point for its significant improvement initiative. The objective of this research is then to assess how mature the Project Management practice using a project management maturity model and at the same time assessing the relative importance and impacts of project management knowledge areas and their correlation with maturity levels. Data have been collected from the management, experts, technical staffs and other employees of the company involved in project execution. From the results of analysis using statistical package for social sciences software, the level of organizational overall (average) project management maturity of the company has reached the third level of progressive stages of the maturity ladder according to project management maturity model. Nevertheless, there are also some project management knowledge areas lagging behind like time management, cost management and risk management. Time, cost and quality management area are found to have the highest importance levels respectively according to the employee's perception. Knowledge areas that are considered to be more important are found to be less matured as the spearman's rank correlation coefficient in this regard is found to be - 0.772.

Keywords: Project management, Maturity assessment, Project maturity models

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ACRONYMS

CMM	Capability Maturity Model
CPM3	Construction Project Management Maturity Model
IPECC	Initiating, Planning, Executing, Controlling, and Closing
ECDSW CO	Ethiopian construction design and supervision
HRM	Human resource management
PfM3	Portfolio Management Maturity Model
PgM3	Programme Management Maturity Model
PjM3	Project Management Maturity Model
PMM	Project Management Maturity
PMI	Project Management Institute
PMMM	Project management maturity Model
PM²	Project Management Process Maturity Model
PMSMM	Project Management Solutions Maturity Model,
PM3	Project Management Maturity Models
OPM3	Organizational Project Management Maturity Model
OPM3	Organizational Project Management Maturity Model
OGC	Office of Government Commerce's
SEI	Software Engineering Institute
SPSS	Statistical package for the social science
TQM	Total Quality Management

CHAPTER ONE

INTRODUCTION

1.1 Background

Project management maturity refers to the progressive development of an enterprise-wide project management approach, methodology, strategy and decision making process. Project Management Maturity Model (PMMM) is a formal tool developed by PM Solutions and used to measure an organization's project management maturity. Once the initial level of maturity and areas for improvement are identified, the PMMM provides a roadmap, outlining the necessary steps to take toward project management maturity advancement and performance improvement (Crawford, 2006).

The assessment of Project Management Maturity (PMM) is a growing practice in organizations. In general, PMM is an organizational condition that allows successful projects. Project Management Maturity (PMM) is a measure of the competence of company's project managers but company's PMM can be affected by its working environment and by the alignment between projects and company's results (Hartman and Skulmoski, 2000). According to Kerzner (2009), PMM is the implementation of a standard methodology and accompanying processes such that there is a high likelihood of repeated success.

In the last two decades, several project management initiatives have been developed to manage projects effectively. However, challenges still exist in developing capability to deliver projects successfully. Project management maturity models are among the different initiatives which assess the maturity level of the performing project organizations and create a realistic roadmap for improvement and benchmarking (Temesgen, 2013).

1.2 Statement of the problem

Ethiopian Construction Design & Supervision Works Corporation (ECDSWCo.) is a multi-disciplinary Engineering firm founded by amalgamation of three companies: Water Works Design and Supervision Enterprise (WWDSE), Construction Design Share Company (CDSCo.) and Transport Construction Design Share Company (TCDSCo.) that were engaged in Planning,

Study, Design and Supervision of Water & Hydropower, Building & Transport Sector Works since 1998, 1977 & 1987, respectively.

So far ECDSW CO is one of the main competitors in the construction design and supervision in Ethiopia as it is handling projects and still endeavoring project management processes and best practices to ensure successful delivery of projects. However, the competition is becoming tough and challenging as new and international competitor companies are emerging into the market.

Currently, ECDSW CO is implementing project management approaches and training programs for project managers and team members though limitations exists in measuring its effectiveness using scientific approaches and latest trends

Several initiatives have been implemented such as Quality Management System, Enterprise Resource Planning, Kaizen, BPR etc. But the company wants give due attention to enhancement of the project management capability as a starting point for its significant improvement initiative.

As a result, assessing the project maturity with a specific model and identification of strengths and weaknesses is considered as first step for benchmarking the organization with other local and international companies and allows the company to define systematic roadmap for improving project management processes.

1.3 General Objectives of the Study

The general objective of this research is to assess maturity of Project Management practice of ECDSW CO using PMMM (Project management maturity model).

1.4 Specific Objectives of the Study

The Specific Objectives of the Study are;

1. To assess project maturity using Project management maturity model(PMMM) with respect to project management knowledge areas in ECDSW CO.
2. To investigate comprehensively the implications of the maturity result for each PM knowledge area and identify the gaps and challenges based on the assessment
3. To determine importance ranking of each knowledge areas
4. To analyzing the relationship between maturity and relative importance of PM knowledge areas using spears man coefficient

1.5 Research Questions

This study assesses the project management capability using a project management maturity assessment using PMMM. This model assesses project maturity with respect to nine project management knowledge areas and five levels of maturity. In addition, measuring the current level of maturity, assessing PM knowledge areas importance and their correlation with maturity levels provides a road map for improvement to the highest level of maturity. Thus study is framed into four main research questions

1. What are the project maturity levels with respect to each project management knowledge areas and overall maturity level in ECDSW Co?
2. What are the implications of maturity levels of the PM knowledge areas?
3. What are the relative importance of PM knowledge areas and their correlation to maturity levels in ECDSW Co?
4. What are the major gaps, challenges in managing projects of the company and what should be done to improve the Project Management Maturity levels of ECDSW CO?

1.6 Scope and Delimitation of the Study

The study mainly focuses on assessment of project management maturity using PM3(PMMM) model. In this model five levels of maturity are used to assess the project management knowledge areas for best practices. All the gaps identified and recommendations made are based and limited only to the aforementioned model. In this thesis only the nine project management areas are considered whereas the current PMI extension has reached fourteen and our locally developed knowledge areas have reached eighteen. Due to the scope and time constraints, the study also excludes program and portfolio management maturity assessment though company projects are related with both program and portfolio management. Also appropriateness and relevancy of respondents professional profile should have more scrutinized and more time should be given for questionnaire fill up to avoid unnecessary rush.

1.7 Significance of the Project

This thesis work enhances a potential for improving the management practices of projects and implementing organizational change in ECDSW Cocompanyproject section.

As more and more organizations have embraced Project management maturity analysis as a key strategy for remaining competitive in today's highly competitive business environment, this study will help the projects in particular focus on specific actions, desired attributes and requirements necessary to improve the organizational environment that favorably impact project management outcomes to achieve higher maturity levels .

The maturity assessment result of this research can be used as initial benchmark information in prioritizing and designing improvement action. Further the same result can also be used as a baseline to compare the success of or impact of future improvement efforts.

The study would further create awareness on areas of project environment needing urgent attention and encourage further research of other project management maturity analysis with other models which are not covered in the study.

The study is expected to further provide scope for improved definition of project management best practice in systems, structures and processes in an organizational context and provide insight into organizational factors unique to constructioncompanies that are uniquely affected by successful project execution.

1.8 Organization of the study

This thesis includes five chapters. The first chapter is introduction which includes background, statement of the problem, objectives, research questions, significance, scope, limitation and organization. In the second chapter, the theoretical overview (named as the literature review), defines project management and maturity analysis briefly describes all identified project maturity models and gives detail and broad review on the past research on project maturity analysis and its application in construction industry.

In the third chapter, methodology is explained .Research design, methods of data collection and analysis, sampling technique to analyze project maturity assessments dealt.

In the fourth chapter, the results from questionnaire survey is analyzed. In this regard, tables and figures are proposed in order to summarize data. It presents the questionnaire results from each respondent's perspective along with the analysis performed on the raw collected data to find maturity levels. Implication of maturity levels on performances of project management is discussed comprehensively. Results of relative importance of PM knowledge areas and their correlation with the maturity level is discussed.

In chapter five, summary of outcomes, conclusion and recommendations is included along with some recommendations for future studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter sheds some light on theoretical and empirical backgrounds in relation to project maturity assessment in the construction industry. It deals with Theories and Practices of Project Management Maturity with specific focus on the following issues:

1. The concepts of Project Management Maturity and importance of measuring maturity of Companies.
2. The Concept of Project Oriented Organizations (POO) and its strategic importance.
3. Different Project Management Maturity Models and their purposes.
4. Justification for selection of the preferred maturity model for the study

2.2 Project Management and its application

Project Management can be described as “a general purpose management tool that can bring projects to successful completion and to the satisfaction of the project stakeholders, given the traditional constraints, of defined scope, desired quality, budgeted cost, and a schedule deadline. Hence, project management is applicable to any organization with the core objectives of scope, quality, schedule and cost” (Hutson, 1997). The need for project management and the benefits that are possible from implementing project management methodologies are well documented and in many industries project management has already become both a central activity and the third element of organizational management systems that is bringing balance, harmony, and success in global organizations (Hutson, 1997). Project management provides a special and distinct role, due to the organizational form of traditional structures, which is highly bureaucratic and cannot respond rapidly enough to a changing environment (Kerzner, 1982; Bay and Skitmore, 2006). More and more businesses are recognizing the benefits offered by project management to their organizations. By segmenting their work into defined and bounded projects, corporate management can bring a focused and dedicated effort to bear on each task. Success, however, requires that the business not only be broken into projects, but also that each project is well managed (Holmes and Walsh, 2005)

Many authors have defined a project in different ways emphasizing its different aspects. Stanleigh (2007) defines a project as: a temporary endeavor that has definite beginning and

ending time undertaken the following specific cycle of Initiation, Definition, Planning, Execution and Closing to generate a unique product, service or result through novel organization and coordination of Human, Material and Financial Resources. Schwalbe (2007) defines a project as: Project is a finite endeavor having specific start and completion dates undertaken to create a unique product or service which brings about beneficial change or added value. Project has a defined scope, it is constrained by limited resource, and it involves many people with different skill and, usually progressively elaborated throughout its life cycle (Cleland & Ireland, 2002).

According to Chartered Institute of Building (2002), Project is the application and integration of modern management and project management Knowledge, Skills, Tools and Techniques to the overall planning, directing, coordinating, monitoring and controlling of all dimensions of a project from its inception to completion. Project management includes motivation of all those involved to produce the product, service or result of the Project on time, within authorized Cost, and to the required Quality and requirement, and to the satisfaction of participants.

Project management deals mainly with coordinating resources and managing people and changes. It also includes: Identifying requirements, establishing clear and achievable objectives, balancing the challenging demands for Quality, Scope, Time and Cost; adapting specifications, plans, and approach to the different concerns and expectations of the various stakeholders (Project Management Institute, 2004).

According to PMI (2000), Project Management is: the application of knowledge, skills, tools and techniques to project activities to meet project requirements. Project management is accomplished through the use of processes such as: Initiation, Planning, Executing, Controlling, and Closing. The project team manages the work of projects, which typically involves Stakeholders with differing needs and expectations.

According to PMI (2004), there are nine core Knowledge Areas of project management. These are: Scope, Time, Cost, Risk, Quality, Human Resources, Communications, Procurement and Integration Management. In addition, there is also other industry specific Knowledge Areas that the Project Manager should consider in managing projects. For instances, PMI (2007) includes four additional important Knowledge Areas such as: Financial Management, Safety Management, and Environment Management and Claim management. Each knowledge area is composed of processes that are expected to be addressed to attain the objective of the Knowledge Areas (PMI, 2007).

Using Project Management generally helps to clarify goals and identify problem areas and risks; to isolates activities and easily monitor outcomes. Furthermore, using PM improves accountability as works can be isolated and responsibilities can be assigned; it helps to focus on few specific and important tasks (PMI, 2004).

Project management is being embraced, to some extent, by most organizations as the best way to develop and deliver new or improved products, services, and organizational process changes. It has been a continuous effort of researchers and practitioners to look for ways to develop and improve organizations' PM capability so that organizations may be able to benefit from project management. The improvement of PM capability of an organization can be realized in many different ways (training, mentoring, benchmarking, the use of new tools and techniques and use of maturity model, etc. (Cleland & Ireland, 2002))

According to Cleland & Ireland (2002), Project management can best be applied when:

1. Resources are to be shared among many units;
2. Special attention or focus is to be given to important undertakings (example to focus attention on specific customers in specific market);
3. Integration of systems and subsystems is sought within independent units;
4. Dealing with ad-hoc, complex, unfamiliar, unique, or rare; activities, problems and opportunities;
5. Dealing with tasks that require pooling of many resources and capacities from diverse sources (example to give fast responses to new or unexpected events such as emergency response during disasters);
6. When it is desired to bring a wide range of experience and viewpoints into focus (example in research and product development or solving complex problems);
7. Dealing with an undertaking that require massive input of capital, technology, skills, and resources;
8. When it is desired to have unified management of a project-based contract in order to avoid the customer work with many different functional units and;
9. When there is a need to manage change.

2.3. Project Management versus General Management

According to Carmichael (2004), the fundamental difference between Project Management and General Management stems from the difference in the type of work they manage. Project Management deals with management of projects which are temporary and unique whereas,

General Management deals with management of operations which are ongoing and repetitive. Furthermore, Project activates changes continually as the project progresses through its various phases and terminate when the mission is accomplished; whereas operation activities sustain for a long period of time and continue assuming a broader outlook (PMI, 2004).

Despite the existence of fundamental difference between Project Management and General Management, both general management and project management share many things in common. Both share the same basic philosophies, both make and implement decisions, allocate resources, manage organizational interfaces, and provide leadership for the people who are involved in performing the work (Cleland & Ireland, 2002).

2.4. Project Oriented Organizations (POO)

Project management methods have been extensively used by many public and private entities to solve their problems, manage scarce resources, and achieve important objectives (Andersen, 2008). Generally, Project Management is used extensively in some form within many organizations. There has not been identified profession or industry where project management practices will not work (Cleland & Ireland, 2002).

Anderson and Jessen (2003) argue that, today projects are seen as far more than merely solving technical problems. Projects are also avenues for mastering business and change. Graham and Englund (2004) also state, that many organizations are finding POO necessary to implement better Project Management practices. Gareis (1989) had long ago coined the concept of the Project-Oriented Organization (POO). The specific features of such an organization are identified in the way single projects are managed; as well as the manner in which management network of internal and external projects are executed and how they cultivate relationship between the Company and the implementation of Projects.

According to Gareis and Huemann (2000), in order for an organization to qualify as a Project-Oriented Organization (POO), it requires a significant maturity level in project management and Organization should have the following characteristics:

1. Defines “Management by Projects” as an organizational strategy;
2. Applies temporary organizations for the performance of complex processes;
3. Manages a project portfolio of different project types;
4. Has specific permanent organizations to provide integrative functions;

5. Applies a “New Management Paradigm” (lean management, total quality management (TQM), business process re-engineering and learning organization);
6. Has an explicit project management culture; and
7. Perceives itself as project-oriented.

Today, projects are seen as far more than solving of technical problems; they are also venues for mastering business and change (Andersen, 2003). Project-Oriented Companies consider projects not only as tools to perform business processes of medium and large scope but as a strategic option for the organizational design of the Company (Gareis&Huemann, 2000). Thus, it is important that POO must consider projects as tools to perform complex processes and as strategic options for organizational design as indicated in Figure1.



Figure 2.1: Strategy, Structure and Culture of the POO.
Source: Gareis and Huemann, (2000).

Project management is the core business process of the POO. The project management process starts with the formal project assignment and ends with the project acceptance by the project owner. The project management consists of the sub-processes such as project start, project co-ordination, project controlling, project discontinuity management and project close-down. The project management process is performed in addition to the contents related processes to achieve the project results (Gareis and Huemann, 2000).

They further argue about the aspects to consider in the project management process. These considerations are: the Project Objectives, Scope of work, Project Schedule and the Project Costs, as well as Project Organization, Project Culture, and Project Context (project environment relationships, project sustainability, correlation to company strategies and other projects, etc.). The achievable and deliverables of each project management sub-process can be compared with resource requirements for the performance of the project management sub-process.

According to Gareis and Huemann (2000), the Project-Oriented Organization is characterized by specific business processes. A process model of the POO can be visualized in a spider web as indicated below. The axes represent the specific processes of the POO

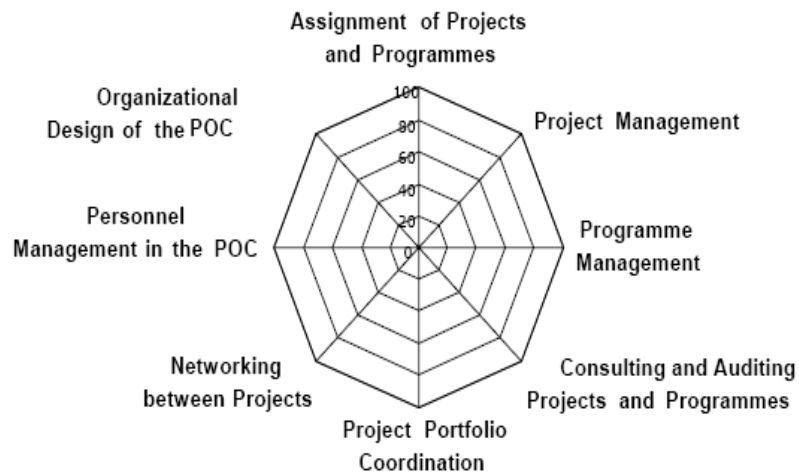


Figure 2.2: Specific Processes of the POO.

Source: Gareis and Huemann (2000).

Hillson (2003) also notes that the value of a formal and structured approach to project management is becoming increasingly recognized as the discipline develops and more organizations begin to reap the benefits of proactive project based management. According to Gareis and Huemann (2000), “Management by Projects” is the organizational strategy of companies dealing with an increasingly complex business environment. This environment is affected by a number of forces originating from the project itself, the organization sponsoring the project, and organizations involved in project implementation, the sector or industry relevant to the service or product resulting from the project, forces from the country/economy and forces coming from the world environment on economics, politics and other social pressures as indicated in Figure2.3.

By applying management by projects, Rwelamila (2007) argues that, the organization is able to sail through the forces indicated above and pursue the following objectives:

1. Organizational differentiation and decentralization of management responsibility;
2. Quality planning, control and assurance by project team work and holistic project definitions;
3. Goal orientation and personnel development; and

4. Organization of organizational learning by projects.

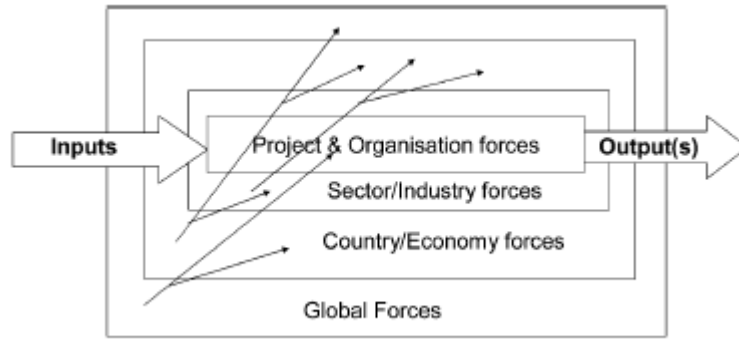


Figure 2.3: Project Management in a Complex Environment.
Source: Rwelamila (2007).

Hence, In order to embrace PM good practices, the POO is characterized by the existence of an explicit PM culture, made up of a set of PM-related values, norms and procedures (Gareis and Huemann, 2000).

2.5. Project management and construction industry

The construction industry plays significant role in the economy of developing countries. For example, in many developing countries, major construction activities account for about 80% of the total capital assets, 10 % of their GDP, and more than 50% of the wealth invested in fixed assets. In addition, the industry provides high employment opportunity, probably next after agriculture. Despite the construction industry's significant contribution to the economy of developing countries and the critical role it plays in those countries development, the project management performance of the industry still remains generally low (Lam, K. C., 2004).

As (Idoko, 2008) noted many construction projects in developing countries encounter considerable time and cost overruns, fail to realize their intended benefit or even totally terminated and abandoned before or after their completion.

Moreover, the project management practices of the construction industry in developing countries generally lag far behind from other industries in those countries and their counter parts in developed nations. (Jaroslaw Gorecki, 2014).

Similar to the case with other developing countries, the Ethiopian construction industry shares many of the problems and challenges the industry is facing in other developing countries, perhaps with greater severity. Given the critical role the construction industry plays in

Ethiopia and other developing countries, and the poor level of project performance of the industry. Improving the performance of the industry ought to be a priority action.

Previous, research works by [(Adams, 1997), (Long, et al. 2004) and others] have indicated poor managerial capability of construction companies to be one of the critical problems of project management of the construction industry in developing countries.

As contractors and consultants are one of the key players in the industry and the makers of the final product, any development and improvement initiatives in the area of project management in the industry has to consider ways of improving the capacity and capability (Hailemeskel, 2013). Thus, improving the project execution capability of the construction companies need be one of the priority considerations in developing countries.

(Dlungwana & Rwelamila, 2004), and others have also strongly emphasized the importance of improving the project management skills of construction companies which significantly contribute to the overall improvement of capability to deliver successful projects.

2.6. Project Management Maturity

Paul, Curtis, Chrissies, & Weber (1993) defined maturity as the extent to which a specific process is explicitly defined, managed, measured, controlled, and effective. Maturity implies a potential for growth in capability and indicates both the richness of an organization's (Project Management) process and the consistency with which it is applied in projects throughout the organization."

Maturity as defined by Schleicher (1999) is, "full development or a perfected condition that connotes understanding or visibility as to why success occurs and ways to prevent common problems". Furthermore, Dinsmore (1998) defines project management maturity as: "....a measure of an organization's effectiveness in the behaviors involved in delivering projects".

"Organizational Maturity is "the extent to which an organization has explicitly and consistently deployed processes that are documented, managed, measured, controlled, and continually improved." [(CMMI Product Team, 2002, p. 582). cited by (Cooke-Davies, 2005)] "Maturity is a comparative level of advancement an organization has achieved with regard to any given process or set of activities. Organizations with more fully defined and actively used policies, standards, and practices are considered more mature". (PM Solutions, 2008), "Maturity is the level of sophistication that indicates organization's current project management practices and processes".

What is common in most of the above definitions is the idea of consistent and repeated practice, measurement and improvement or advancement. According to (Paulk et-al, 1993), as an organization matures, the predictability, effectiveness, and control of an organization's processes are expected to improve. "Maturity in project management is a never-ending journey, with a never-ending cycle of bench- marking and continuous improvement (Kerzner, 2001). "As an organization gains in (project management) process maturity, it institutionalizes its project management process via policies, standards, and organizational structures. Institutionalization (demands) building infrastructure and a corporate culture that supports the methods, practices, and procedures of the organization so that they endure after those who originally defined them have gone" (Paulk etal,1993).The more mature an organization's practices are, the more likely the organization meets its project goals successfully." (PM Solutions, 2008).

According to (Chrissis, Konrad, &Shrum, 2003) , a matured process is well understood throughout a mature organization; usually through documentation and training, and the process is continually being monitored and improved by its users. The capability of a mature process is known. Process maturity implies that the productivity and quality resulting from an organization's use of the process can be improved over time through consistent gains in the discipline achieved by using its process .A mature organization has an organization-wide ability for managing initiatives based on standardized and defined management processes. In such organizations, activities are carried out according to defined processes and plans.Roles and responsibilities are well defined and understood. Such organizations have also an objective way of measuring performance and quality.

Anderson and Jessen (2003) argue that if the concept of maturity is applied to an organization it might refer to a state where the organization is in a perfect condition to achieve its objectives. Project maturity would then mean that the organization is perfectly conditioned to deal effectively with its projects. They further state that in the real world it is impossible to find a fully matured organization; no one has reached the stage of maximum development and no one apparently ever will. Therefore, it makes sense to talk about a certain degree of maturity and make an effort to measure or characterize the maturity of the organization.

According to Anderson and Jessen (2003), measuring maturity will perhaps always be more subjective than objective. Some of the most important works on project maturity seems to focus primarily on what organizations and project people are doing operationally. Kerzner (2004) also emphasizes that, all organizations go through a maturity process. The maturity in project

management is the development of systems and processes that are able to contribute to success. Kerzner (2004) however, holds the view that these systems and processes do not necessarily guarantee success, rather they just increase the probability of success.

Dinsmore (1998) further argues that, a maturity assessment is a way of determining the extent to which the organization has incorporated project management into its way of working. The better the organization or department is at delivering projects, the higher its maturity will grow. Organizational maturity implies that capabilities must be grown over time. In terms of Project management, this is related to capabilities that can produce repeatable success in project management (Schlichter, 1999).

According to Levin and Skulmoski (2002), Project management improvement does not happen overnight, and it cannot be implemented on a “fad of the week” basis. The results of a project management maturity assessment provide the opportunity to continually improve and develop an organization’s competitive position and promote its business by projects.

An assessment of project management maturity collects evidence by evaluating an organization’s performance against requirements (as set forth in the Maturity Model) and then making a judgment of whether a certain level of maturity has been achieved. By using a project management maturity model, you can “take the temperature” of your organization’s project management efforts.

Levin and Skulmoski (2000) hold the view that a project management maturity assessment provides the basis for a larger, more significant initiative. It serves as the basis for guiding a subsequent project management improvement effort. The assessment provides a useful “road map” direction or “guide book” about what improvements should be tackled first.

Levin and Skulmoski (2000) further argue that, since the improvement program is tied to the assessment itself, the assessment findings help communicate the need for the changes to the rest of the organization and help to promote commitment for the improvement initiatives. Important improvement issues will not be ignored. It enables organizations to:

1. Become project-based with predictable results;
2. Identify strengths and weaknesses in project management;
3. Establish uniform principles and processes and integrate them throughout the organization;

4. Provide the organization with the necessary know-how to improve its competitive edge by implementing effective project management processes;
5. Establish a foundation for continued improvement in project management linked to the overall contributions and objectives of the business; and
6. Target those specific initiatives that provide the next foundational level in an organization's continued project management development;

“In general, in a matured organization, a disciplined process is consistently followed because all of the participants understand the value of doing so, and the necessary infrastructure exists to support the process” (Sarshar, et al., 2000).

An immature organization on the other hand is an organization that does not have or use consistent and defined processes in management of its projects (Sarshar, et al., 2000). “An organization that is immature in project management may occasionally deliver individual (projects) that produce excellent results. However, in such cases managers are more likely to be working reactively, focusing on solving immediate issues, rather than proactively acting.

Organizations can obtain different benefits from maturity analysis (Peterson, 2000). The implication is that mature organizations are able to:

1. Manage all the projects undertaken by an organization effectively (Suares,1998);
2. Improve continually the performance of all projects undertaken by an organization (Peterson, 2000);
3. Improve dialogue between the project management community and an organization's top management (Peterson, 2000).
4. The organization is provided with project information from previous projects on which to evaluate project schedules and budgets, to ensure that these are realistic, and to review project performance (Office of Government Commerce, 2002);
5. Enables the organization to advance its strategic goals through the application of project management principles and practices. In other words, it bridges the gap between strategy and individual projects (Project Management Institute, 2003);and
6. As an organization grows in project management maturity, it obtains a better project management performance at a lower cost (Ibbs and Reginato, 2002).

According to the Office of Government Commerce (2003) the benefits that are to be expected from assessing maturities:

1. Strengthens the link between strategic planning and execution so that project outcomes are predictable, reliable and consistent, and correlate with organizational success.
2. Places Best Practices and Capabilities within the context of not only Project Management, but also Program Management and Portfolio Management processes.
3. Provides the means to assess an organization's maturity relative to a body of identified Best Practices and Capabilities.
4. Provides a basis from which organizations can make improvements in project management maturity.
5. Provides guidance and flexibility in applying the model to each organization's unique set of needs.
6. Identifies the Best Practices which support the implementation of organizational strategy throughout successful projects.
7. The creation of an organization-wide ability for managing projects based on standard and defined project management processes that can be tailored to meet the specific needs of individual projects.

The ultimate objective of reaching highest maturity level is the adoption of a project management culture which is an epitome of optimized operational efficiency and sales.

When an organization takes the steps towards advancement of maturity levels, it should consider it as an ongoing process and not a speedy transformation.

The suitable level of maturity to which an organization should endeavor varies for different organization and is based on several factors such as the organization's goals, strategies envisioned, abilities and skills of resources and the scope of the projects. Only by a detailed assessment conducted by professional qualified consulting team can the proper level of maturity be identified.

Project management maturity is attained by a progressive process during which organizations note improvements at different stages during development. The long term goal is increased profitability, sustainable growth, customer satisfaction and noteworthy performance benefits.

Furthermore the maturity goal should be set at an appropriate level in the PMMM as not every organization needs to reach Level 5 to reap considerable benefits.

Attaining maturity would not necessarily guarantee that a project would be successful. However, it could increase a project's chances of being successful. It should be noted that the processes of attaining maturity is not a one-time event that is accomplished by declaring a methodology and

structure nor it is a quick fix for immediate tactical problems rather, it is a consciously planned and properly managed continuous improvement effort.

Christopher J. Willis and Jeff H. Rankin.(2010) outlines actions taken to provide a better approach to the measurement, comparison and interpretation of the performance of a country's construction industry. The results of the maturity assessment provided by the CIM3 shows that Guyana's construction industry is least mature with respect to health and safety management and most mature with respect to cost management. The overall maturity of Guyana's construction industry was found and the overall level of realization of the combined performance goals of the construction industry is significantly low.

According to Dan Ofori., (2013) Project management maturity is the progressive development of an enterprise-wide project management approach, methodology, strategy, and decision-making process. The study was exploratory in nature and utilized a questionnaire survey method to collect data on project management Maturity in Ghanaian organizations. The findings showed that differences exist in the current project management maturity levels across each phase of the project life cycle for all organizations

JaroslavGorecki.,(2014), describes the problem of project maturity for construction companies when analyzed by their ability to execute construction investment projects. On the basis of survey results it was revealed that the success of a company is connected with the increasing level of project maturity as a condition for a successful project management.Eliminating uncertainties and reducing risks coming from economic activity is an attempt to improve project management capabilities. For this reason construction companies need to pay more attention to the phenomenon known as project maturity

Francis Hartman.(2008) that the Maturity of project management helps us understand several things like the competence of the organization with current trends and in the self-assessment of the key factors in the organization. It suggests that construction contractors are the key persons for the success and development of the industry. He also suggests that the project management will continue to evolve and varies from institution to institution

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level of project maturity as a condition for a successful project management. Eliminating uncertainties and reducing risks coming from economic activity is an attempt to improve project management capabilities. For this reason construction companies need to pay more attention to the phenomenon known as project maturity.

Mullaly, M.E.M. & Thomas J.(2010) made a study to assess project management maturity level in Indonesian businesses may bring insight about current business practices, which is important to speed up country development and business sustainability. Pointed out that there seems to be a relationship between maturity and performance, but that no statistically significant correlations exist to prove it. The research indicated that project failures are often the result of organizational aspects beyond the influence of the project manager; and they claim that a higher level of organizational maturity enhances project performance and Adapting the Project Management Maturity Model (ProMMM), a survey instrument has been developed and applied to professionals from Jakarta and surrounding area. The result of analysis shows that construction and primary industry have a higher maturity level compare to manufacturing and services.

Naomi Brookes and Robin Clark, (2009) presents the findings of an investigation to evaluate the role of Project Management Maturity Models (PMMM) in improving practice. The paper critically evaluates existing PMMMs and delineates a number of differences between them and performed a benchmarking study that explored variations in project management practice in 21 organizations across six industries, identified their results to be statistically reliable indicators of project management maturity rather than a qualitative factor. From their study they found that the construction industry has an overall maturity level or rank of 3.56.

SewerynSpalek,(2014), presents the assessment done using the PMM model, which measured maturity in four areas: methods and tools, human resources, project environment and knowledge management. The major research effort was focused on the machinery industry as this sector of the economy is not well recognized in empirical research related to project management. Moreover, the main aim of the study was to compare Polish and foreign companies via an examination of diverse industries. The results from this article show that, irrespective of the country of origin of the company, the lowest maturity levels in the knowledge management area were noticed in the machinery industry (1.59). Then, the maturity level increases slightly in construction (2.35) firms. Effectively managing knowledge in projects is the key factor in the company gaining a decisive advantage. This is of special importance in those organizations running a significant number of projects on a yearly basis. Nearly 99% of construction

companies reported the initial (1st) or standardized (2nd) level of maturity, while all foreign ones were at the standardized (2nd) or appliance (3rd) level.

Young Hoon Kwak, and C. William Ibbs, (2011) summarize the results of research conducted by investigators in assessment of project management maturity. The principal goal of this study was to determine the financial and organizational impacts of Project Management (PM). The PM Maturity assessment for all companies averaged 3.26 on a relative scale of 1 (lowest) to 5 (highest). Overall the Engineering-Construction (EC) industry had the highest score, and the Information Systems (IS) application area had the lowest. PM Maturity assessment methodology provides solid and comparative studies on PM practices across industries and companies within an industry. This study is one of the few, if not the first attempt to truly integrate PM Knowledge Areas and PM Phases against actual project performance data. The result is that this study methodology provides a set of tools for organizations to use in identifying key areas of opportunity for improvement in project management.

2.7. Project Management Maturity Models

Project Management Maturity models are just one such means that organizations can use in their pursuit of improving their Project Management capability.

Maturity models have their origin in the field of total quality management (TQM). They drive strategically linked continuous improvement and so require a thorough understanding of an organization's current position and where it aims to be in the future (Brookes and Clark, 2009). A maturity model provides a systematic framework for carrying out benchmarking and performance improvement beginning as early as the Software Engineering Institute (SEI), which is affiliated with Carnegie Mellon University, began developing a process maturity framework for software development and it resulted in the publication of the Capability Maturity Model (CMM) with five levels, in 1991. It turns out that the CMM is quite robust and has application beyond software engineering, for which it was originally developed. There are two areas of application that it has spawned. They are the People Capability Maturity Model (P-CMM), which is a five-level model patterned after the five levels of the CMM, and the Project Management Maturity Model (Wysocki, 2004).

Project Management Maturity Models provide a systematic means to perform benchmarking and hence are adding considerable value to contemporary organizations. According to (Cooke-Davies, 2005), against the practice of its peers in the industry in general or best practice in the

the use of maturity models provides a frame work for purposeful and progressive development of project management capability of repeatedly delivering successful projects. Generally maturity models help an organization know how mature its project management practice is; that is, it helps the organization measure the degree to which it is executing Project management industry (Man, 2007).In addition, maturity models help frame improvement efforts by identifying priority area and suggesting improvement subjects.

According to Levin and Skulmoski (2000), the Maturity Models provide a framework to help enable organizations to increase their capability to deliver projects on schedule, within budget and according to the desired technical performance. Maturity Models provide a progressive standard to help organizations continue to improve their project management processes.

There are numerous maturity models in use today. These models will illustrate that there are differences among companies in terms of their actual utilization of projects as a means to achieve objectives. However, many of these models are rather limited in scope (PMI, 2002).

Different maturity models embody both different concepts and different suggestions as to the route to achieve maturity (Cooke-Davies, 2001). Jugdev and Thomas (2002) argue that, there is no one particular model which is universally accepted. Moreover, according to Ibbs and Kwak (2000), there are no universally accepted methodologies for impartially measuring project management practices.

This chapter of the dissertation covers ten different maturity models which are widely used in modern project management practices. Some of these models are organizationally focused Maturity Models and the others are project based. The mainstream project management maturity models include:

1. Capability Maturity Model (CMM),
2. Organizational Project Management Maturity Model (OPM3),
3. Portfolio, Program and Project Management Maturity Model (P3M3),
4. Project Management Maturity Model (PM3),
5. Kerzner's PM Maturity Model,
6. PM Solutions Project Management Maturity Model

2.7.1 Capability Maturity Model (CMM)

Capability maturity model is the first maturity model to be developed. The model was developed by the Software Engineering Institute (SEI) at Carnegie Mellon University. The model was

primarily developed to evaluate software contractor's capability for contract award and administration purpose. Later the model has been used by software developers as a guide for the improvement of their processes (Sarshar, *et al.*, 1999).

The Software Engineering Institute (SEI) developed a framework of five stages of evolution in levels of capability called a Capability Maturity Model (SEI, 1993). SEI describes a model as a simplified representation of the world; its Capability Maturity Models (CMMs) contains the essential elements of effective processes for one or more bodies of knowledge (SEI, 2002).

Paulk, *et al.* (1993) structured the internal architecture of the model along the lines illustrated in Figure 4 below. In this structure, each maturity level is composed of Key Process Areas. Each Process Area consists of a cluster of activities; when these activities are collectively executed they achieve the goals necessary for enhancing process capability. The Key Process Areas are the essential actions.

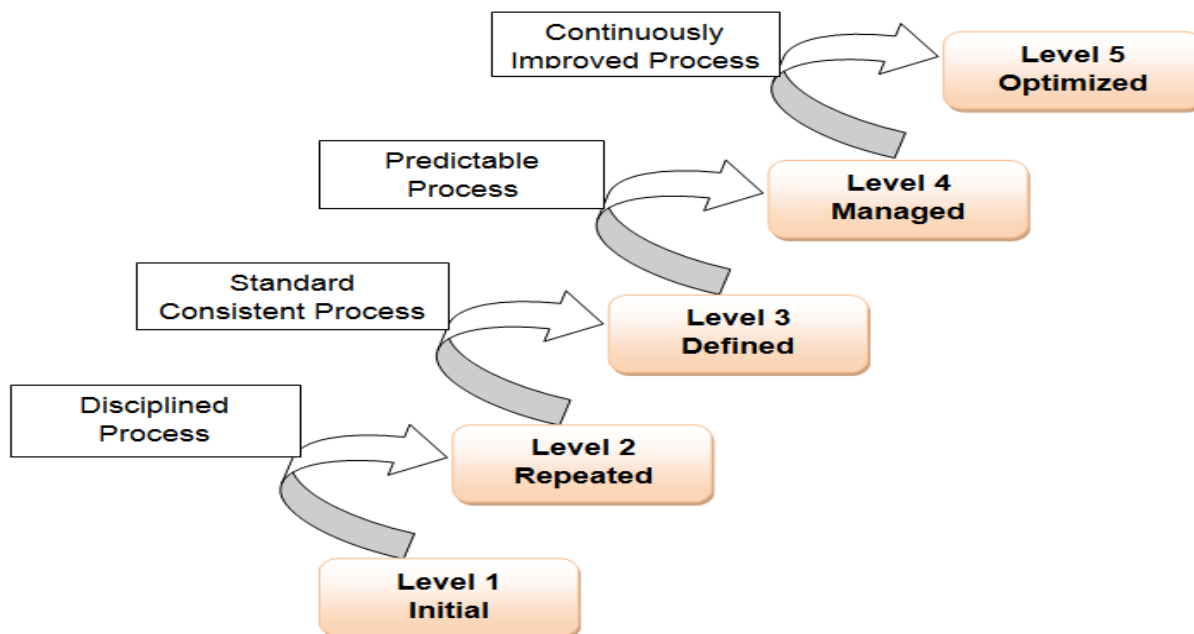


Figure 2.4: CMM for Software Development.
Source: Paulk, *et al.* (1993).

2.7.2 Organizational Project Management Maturity Model (OPM3)

The Project Management Institute (2003) defines the Organizational Project Management Maturity as “The extent to which an organization practices organizational project management”. For an organization wishes to initiate improvements, OPM3 is intended to help them determine what specific Capabilities they need to acquire to achieve the desired Best Practices, and in which order. So they can advance their agenda while conserving limited organizational resources (Fahrenkrog, *et al.*, 2003).

As with other PMI Standards, OPM3’s intent is not to be prescriptive by telling the user what improvements to make or how to make them, rather the intent is simply to offer the standard as a basis for study and self-examination, and to enable an organization to make its own informed decisions regarding potential initiatives for change (PMI, 2003).

According to Project Management Institute (2003), the progression of increasing maturity designed into OPM3 consists of several dimensions, or different ways of looking at an organization’s maturity. One dimension involves viewing best practices in terms of their association with the progressive stages of process improvement--from Standardized to Measure to Control and to Continuously Improve. Another dimension involves the progression of best practices associated with each of the domains; first addressing Project Management, then Program Management, and finally, Portfolio Management. Each of these progressions is a continuum along which most organizations aspire to advance. Also, within these two dimensions are the progressions of incremental Capabilities leading to each best practice. This can be graphically described as shown in Figure 5 below:

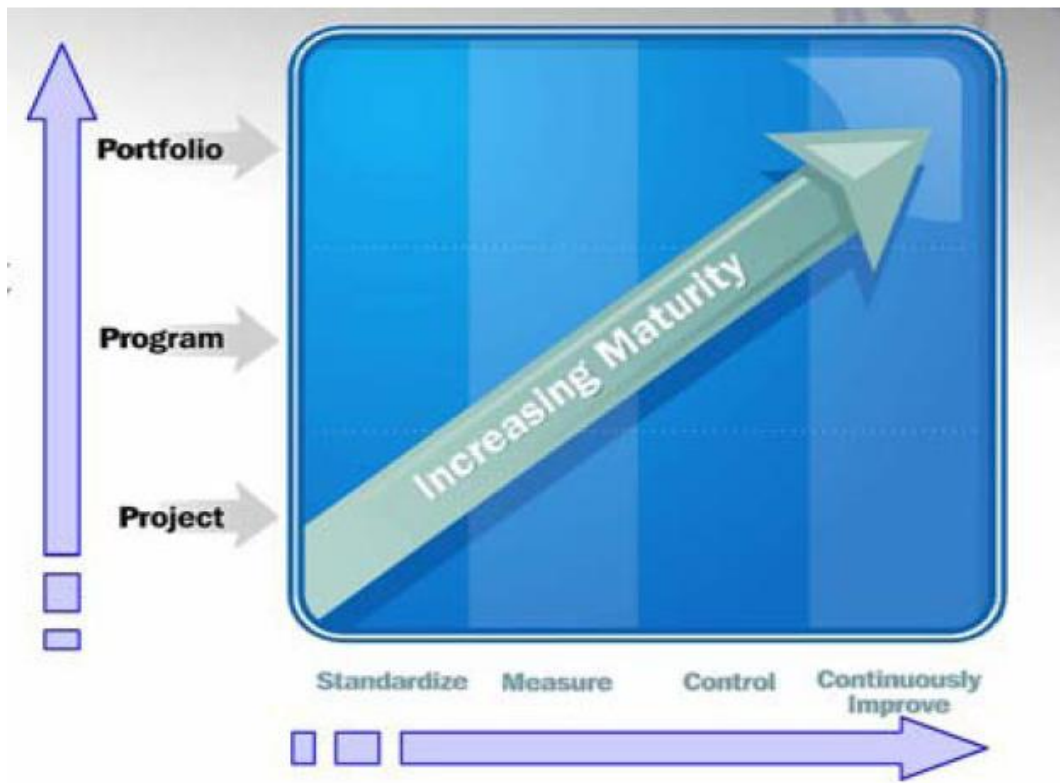


Figure 2.5: The Organizational Project Management Maturity Model (OPM3).
Source: PMI (2003).

Moreover, OPM3 seeks to create a framework within which organizations can re-examine their pursuit of strategic objectives via Best Practices in organizational project management. This Standard is an initial statement on this Model, identifying and organizing a substantial number of generally accepted and proven project management practices, and providing a means to assess an organization's maturity against the Best Practices identified in this standard (PMI, 2003). Finally, with the result of such an assessment, an organization can decide whether to plan for improvements and how to approach these improvements to increase its maturity by developing more of the capabilities identified by the Standard.

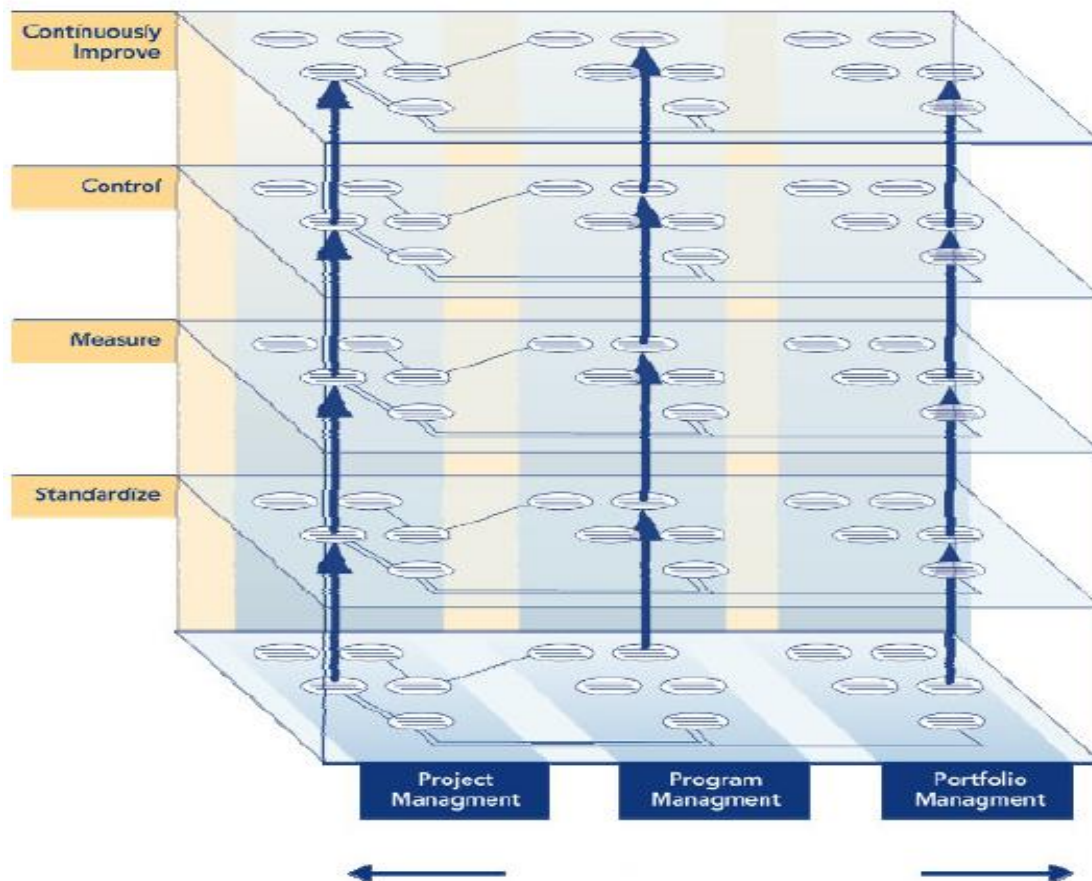


Figure: 2.6: OPM3's Multi-Dimension Level of Maturity.
Source: PMI (2003)

2.7.3 Portfolio, Program and Project Management Maturity Model

P3M3 originated as an enhancement to the Office of Government Commerce's (OGC's) Project Management Maturity Model, which in turn was based on the process maturity framework that evolved into the Capability Maturity Model (CMM). This was a descriptive reference model to provide organizations with more effective guidance in establishing process improvement programmes. It could also be used as the foundation for systematically building a set of tools, including maturity questionnaires. P3M3 therefore followed the CMM structure, using a five-level maturity framework (Introduction and Guide to P3M3, 2010).

P3M3 is an overarching model containing three individual models:

1. Portfolio Management Maturity Model (PfM3)
2. Program Management Maturity Model (PgM3)
3. Project Management Maturity Model (PjM3)

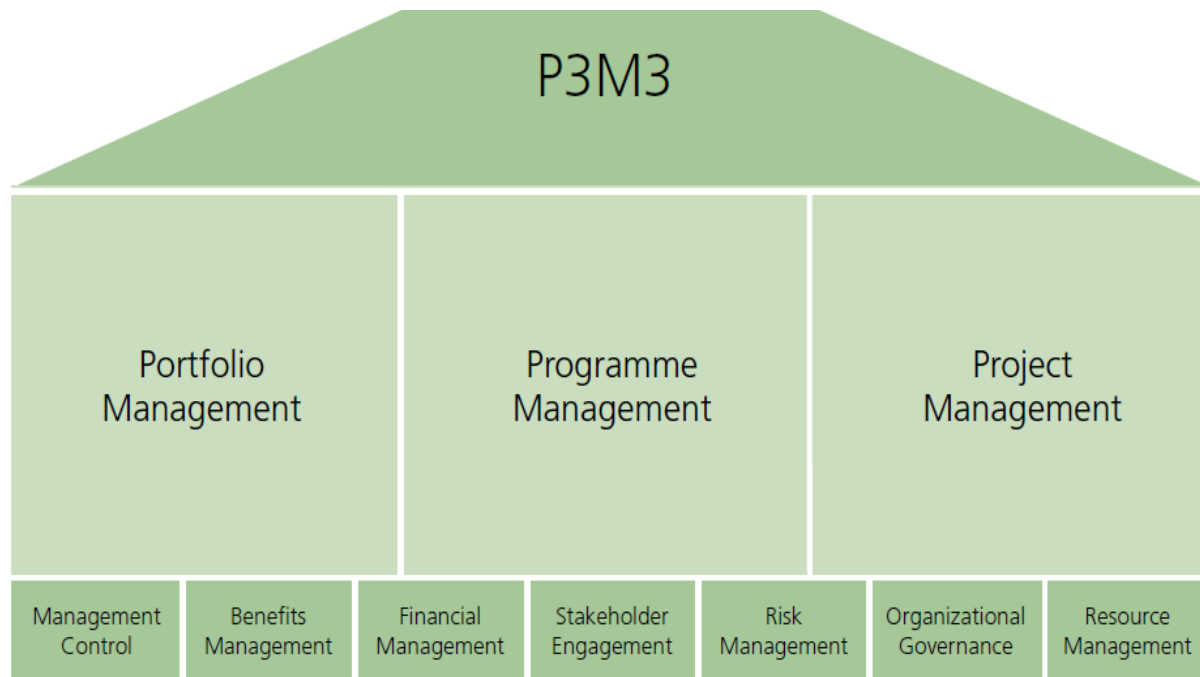


Figure: 2.7. The three independent Models of P3M3.
Source: Introduction and Guide to P3M3, (2010).

Table 2.1: Structural Components of P3M3.

Maturity Level	Portfolio Management	Programme Management	Project Management
Level- 1 awareness of process	Does the organization's Executive Board recognize programmes and projects, and maintain an informal list of its investments in programmes and projects?	Does the organization recognize programmes and run them differently from projects?	Does the organization recognize projects and run them differently from its ongoing business?
Level-2 repeatable process	Does the organization ensure that each programme and or project in its portfolio is run with its own processes and procedures to a minimum specified standard?	Does the organization ensure that each programme is run with its own processes and procedures to a minimum specified standard?	Does the organization ensure that each project is run with its own processes and procedures to a minimum specified standard?
Level-3 defined Process	Does the organization have its own centrally controlled program and project processes and can individual programmes and projects flex within these processes to suit particular programmes and / or projects. Does the organization have its own portfolio management process?	Does the organization have its own centrally controlled program processes and can individual programmes flex within these processes to suit the particular programme?	Does the organization have its own centrally controlled project processes and can individual project flex within these processes to suit the particular project?

Level-4 Managed process	Does the organization obtains and retain specific management metrics on its whole portfolio of programmes and projects a means of predicting future performance? Does the organization assess its capacity to manage programmes and prioritize them accordingly?	Does the organization obtain and retain specific measurement on its programme management performance and run a quality management organization to better predict future performance?	Does the organization obtain and retain specific measurements on its project management performance and run a quality management organization to better predict future performance?
Level-5 Optimized process	Does the organization undertake continuous process improvement with proactive problem and technology management for the portfolio in order to improve its ability to depict performance over time and optimize processes?	Does the organization undertake continuous process improvement with proactive problem and technology management for programmes in order to improve its ability to depict performance over time and optimize processes?	Does the organization undertake continuous process improvement with proactive problem and technology management for projects in order to improve its ability to depict performance over time and optimize processes?

Source: Introduction and Guide to P3M (2010).

According to Introduction and Guide to P3M3 (2010), P3M3 focuses on the following seven Process Perspectives, which exist in all three models and can be assessed at all five Maturity Levels.

1. Management Control ;
2. Benefits Management ;
3. Financial Management ;
4. Stakeholder Engagement ;
5. Risk Management ;
6. Organizational Governance; and
7. Resource Management.

The flexibility of P3M3 allows organizations to review all seven Process Perspectives across all three Models – Portfolio, Program and Project management – but they can also review just one (or several) of the Process Perspectives, whether across all three models or across only one or two of them. This can be useful to gain a better understanding of an organization’s overall effectiveness.

Most organizations have strengths in some areas but not in others. P3M3 is designed to acknowledge these strengths as well as highlighting weaknesses. The Figure below illustrates how an organization might be viewed from the Process Perspectives (Introduction and Guide to P3M3, 2010).



Figure 2.8: Process Perspectives of P3M3.
Source: Introduction and Guide to P3M3 (2010).

2.7.4 Project Management Maturity Model (PMMM)

The Project Management Maturity Model denoted as PMMM is a recognized tool developed by PM Solutions, a project management firm that assists organizations to implement, administer and assess their portfolios towards improvement of business performance. This firm was established in 1996 by J. Kent Crawford, PMP, who was earlier the past president and chair of Project Management Institute (PMI).

According to Project Management Institute (2000), all the nine Project Management Knowledge Areas are included at each level in this model. It is a fairly close adaptation of the CMM. So it also has five levels and their definitions reflect the same types of goals as the CMM.

The Five Levels of PMMM

- Level 1: The Initial Process.
- Level 2: Structured Process and Standards.
- Level 3: Organizational Standards and Institutionalized Process.
- Level 4: Managed Process.
- Level 5: Optimizing Process.

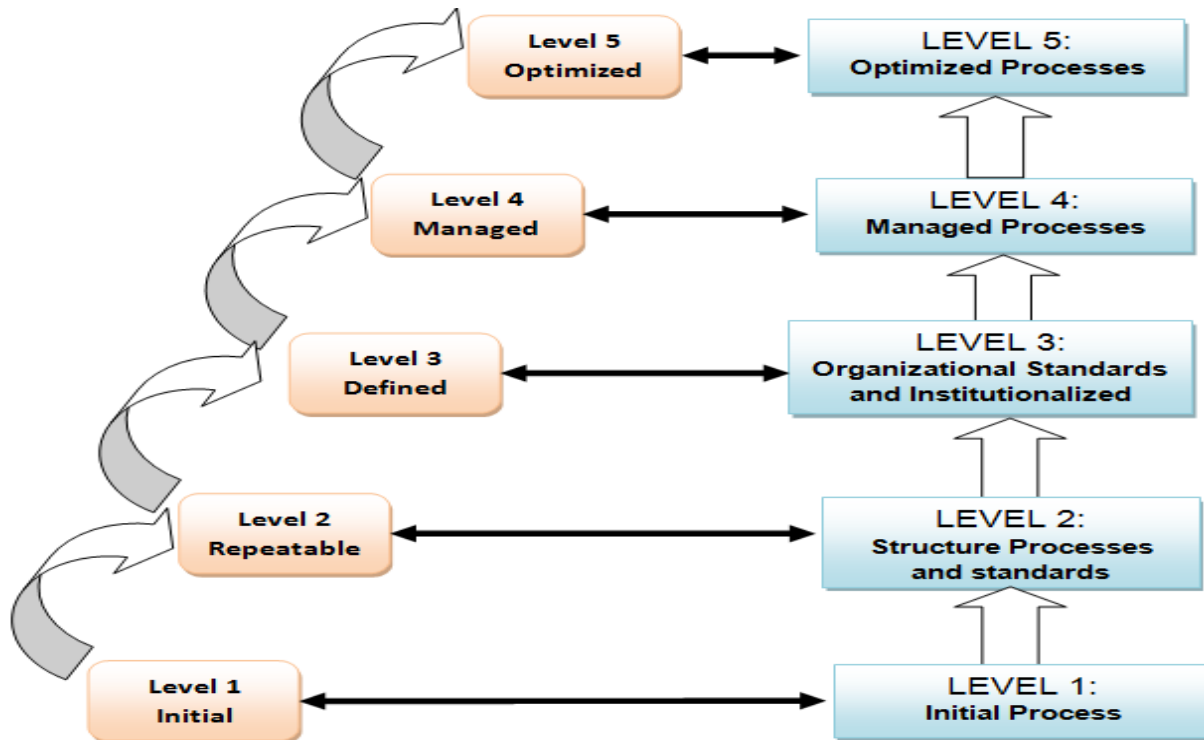


Figure 2.9: Mapping of CMM to PMMM. Source: Crawford (2002).

Table 2.2: Definition of the Levels of PMMM.

LEVEL	NAME	CHARACTERISTICS
Level 1	Initial process	There are no established practices or standards and individual project managers are not held accountable by any specific standards. Documentation is loose and Ad Hoc.
Level 2	Structured process and Standards	Many project management processes exist in the organization but they are not considered an organizational standard. Documentation exists on these basic processes.
Level 3	Organizational Standards and institutionalized process	All project management standards are in place and are organizational standards. Almost all projects use these standards with few exceptions. Management is regularly involved in the input and approval of key decisions and issues.
Level 4	Managed process	Metric becomes the norm for managerial decision making. These help to make decisions based on past performance efficiency and prediction of future performance.
Level 5	Optimizing process	All processes are in place and are actively used to improve project management processes.

Source: Crawford (2002).

2.7.5 Kerzner's Project Management Maturity Model

The model bears a number of similarities to CMM. It is a five level model with continuous improvement at the upper most level. However, this model allows for some degree of overlapping of the maturity levels. Even though overlapping does and can occur, the order in which maturity levels occurs dose not is change (Kerzner, 2004).

Like (PM)2 and CMM, Kerzner's Maturity Model defines five levels by which an organization is ranked from Insufficient project management processes to adequate project management processes leading to Continuous Improvement (Kerzner, 2004).

Kerzner has also described the characteristics of each level of maturity in detail and the roadblocks, `risks', and actions required completing at each level. In addition, an assessment instrument included for each maturity level Kerzner (2004). The five levels of this model are graphically displayed as shown in Figure 13 and described as shown in Table 4.

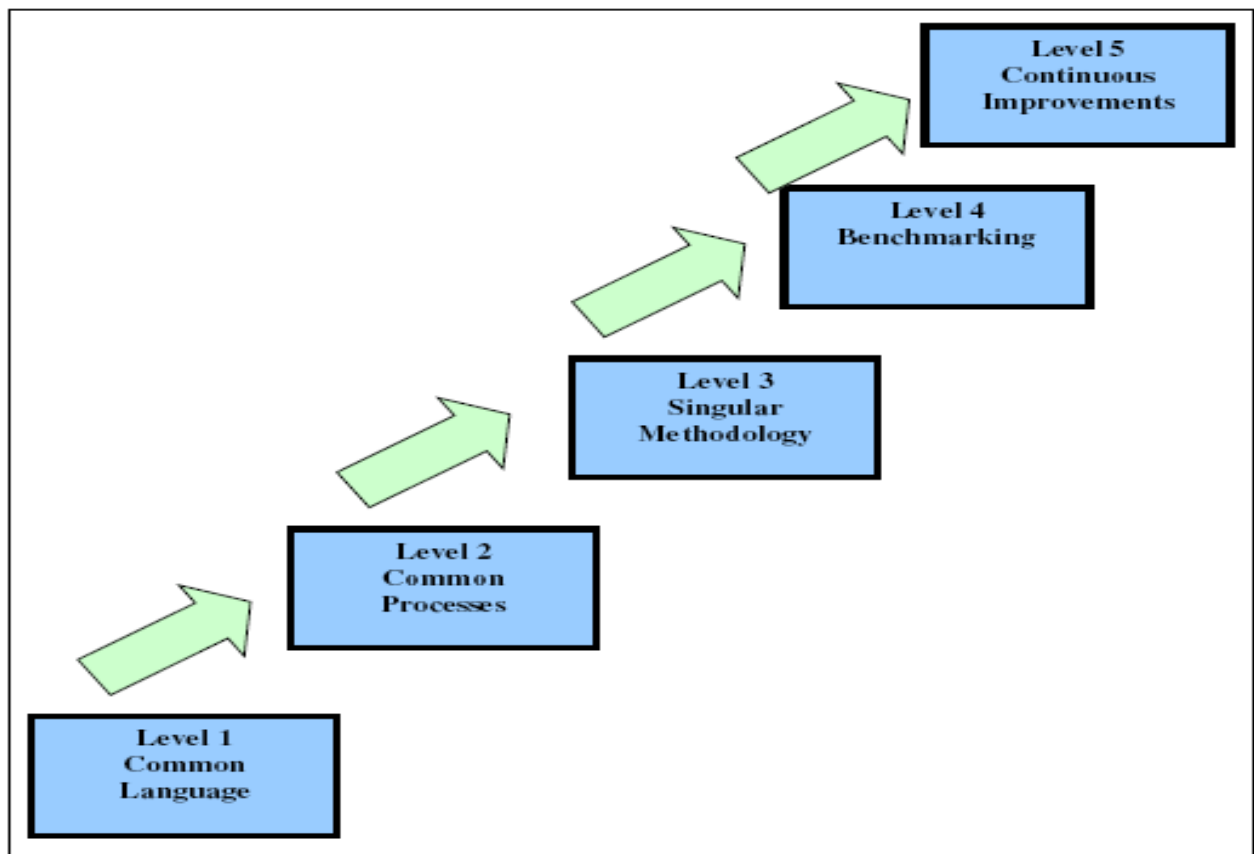


Figure 2.10: Kerzner Maturity Model.
Source: Kerzner, (2005).

According to Kerzner (2005), when an organization reaches Continuous Improvement level of maturity, it means it has institutionalized project management to the extent that its continuous process improvement cycle is self- sustaining. Table 2.3 below provides summary of general description and main characteristics of the Model.

Table 2.3: Kerzner’s Maturity levels.

Levels	General descriptions	Main characteristics
Level1 Common Language	Organization recognizes the importance of project management and the need for a good understanding of the basic knowledge of PM and its language terminology.	• None or sporadic use of project management. • No Executive level support. • No investment or support for project management training.
Level 2 Common Processes	Organization recognize the need for common processes and they make a concerted effort to use project management and develop Processes and Methodologies to support its effective use.	• Recognition of benefit of PM. • Organizational support at all levels. • Recognition of need for processes/methodologies. • Recognition of the need for cost control • Development of a project management Training curriculum.
Level -3 Singular Methodology	Organizations develop singular methodologies (rather than using multiple methodologies) to best achieve synergy and process control	• Total communication to the concept of PM. • Integrated Process: Example integrated PM and TQM. • Cooperative culture visible management support at all level. • Visible management support at all level. • Informal project management based upon guidelines and checklist with little paper work rather than rigid policies and procedures. • Training and education.
Level 4 Benchmarking	Organizations perform benchmarking on continuous bases against those practiced in similar and non –similar industries. Few selected critical success factors are benchmarked.	• Establishment of project Office (PO) or center of Excellency (COE) that is dedicated to the project management improvement process • Performance of both qualitative and quantitative benchmarking.
Level 5 Continuous Improvements	Organizations evaluate the information learned during benchmarking and implement the changes necessary to improve the PM processes. Especially on existing Process Improvements, Integrated Process Improvements and Behavioral Benchmarking and Managerial issues.	• Creation of lessons learned files and transfer of knowledge to other projects and teams. • Recognition of the need for and implementation of a program for future project managers • A corporate-wide understanding that strategic planning for project management is a continuous, ongoing process.

Source: Kerzner, (2005).

2.7.6 PM Solutions Project Management Maturity Model

Similar to the (PM) 2 model, this model is developed by mirroring PMI's knowledge areas with that of CMM's five level maturity stage. The model examines an organization's PM implementation across the nine PM knowledge areas, which are in turn broken down in to components (Crawford, 2002).

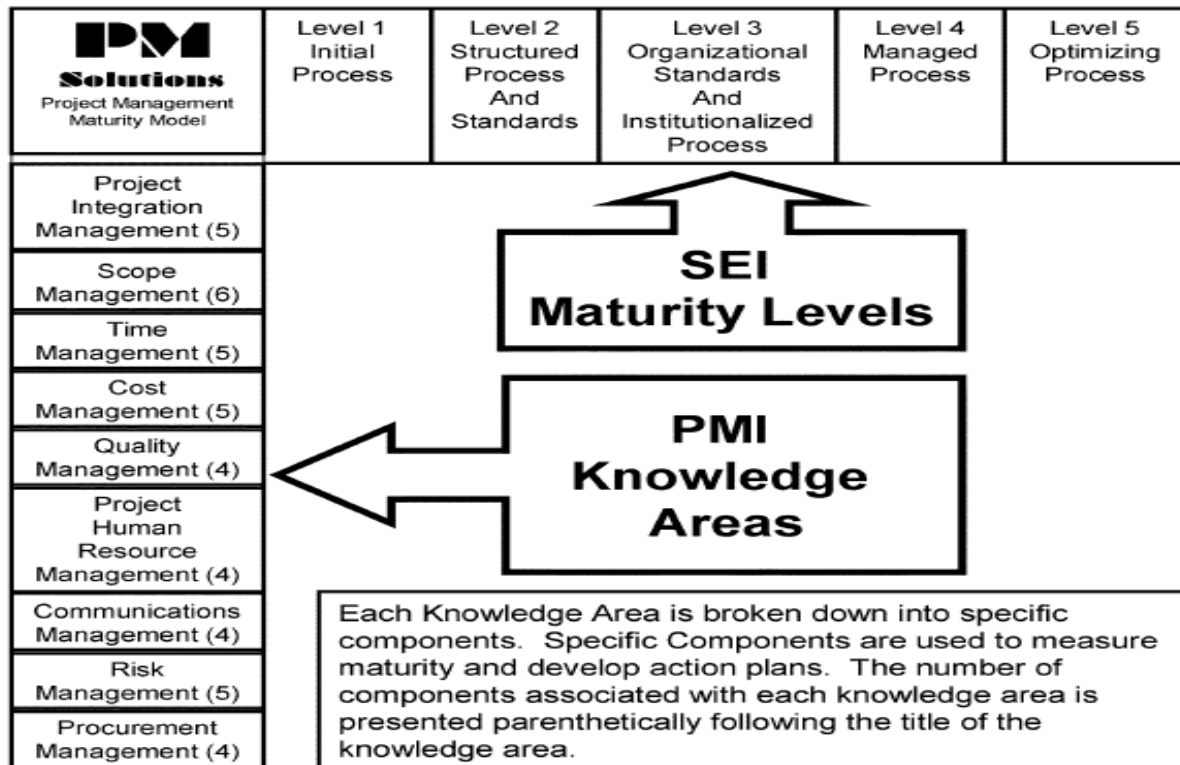


Figure: 2.11. PM Solutions Project management Maturity Model.

Source: (Grant and Pennypacker, 2006).

According to Grant and Pennypacker (2006), the PM Solutions Project Management Maturity Model adopts two- dimensional (2-D) frame work. Both of the dimensions are based on accepted industry standards. The first dimension reflects the level of maturity. The second dimension depicts the key Knowledge Areas of project management addressed. This dimension adopts the structure of PMI's nine Knowledge Areas. Each of the nine Knowledge Areas was further decomposed in to key components that provide for a more rigorous and specific capabilities. The Model has received widespread acceptance as a standard for process modeling and assessment of organizational maturity in several areas. The table below presents a summary description of the five maturity level.

Table 2.4: PM Solutions five Maturity Levels and their Key Attributes.

Maturity Level	Key Attributes
Level 1 Initial Process	• Ad hoc process. • Management awareness.
Level 2 Structured Process and Standards	• Basic process; not all standard on all projects; used on large and highly visible projects. • Management supports and encourages use of processes. • Mix of intermediate and summary –level information. • Estimate and schedules are based on expert knowledge and generic tools. • Mostly project –centric focus.
Level 3 Organizational Standards and Institutionalized Process	• All process are standard for all projects and are repeatable • Institutionalized process. • Summary and detail information. • Informal collection of actual data. • Estimate and schedule based on industry standards. • More of organizational focuses. • Informal analysis of project performance.
Level 4 Managed process	• Processes are integrated with corporate process. • Management mandates compliance. • Management takes an organizational entity view. • Solid analysis of project performance. • Estimate and schedule are normally based on organization. • Management uses data to make decisions.
Level 5 Optimizing Process	• Use of Processes to measure project effectiveness and efficiency. • Processes in place to improve project performances. • Management focus on continues improvements.

Source: (Grant and Pennypacker, 2006).

2.8 Relevance of PMMM model

Based on the literature review discussed before, in this study, PMMM model is selected for analysis because of the following reasons:

1. Project Management Maturity Model (PMMM) is getting popular because of its versatility and its ability to control time and cost most efficiently.
2. The PMMM allows the organization to identify what steps must be taken, what deeds must be accomplished and in what sequence to realize meaningful and measurable results
3. Project management maturity model is regarded as a useful tool to evaluate organizations' current project management capability.
4. The project management maturity model, as the framework and tool to evaluate the level of organizational project management capability has aroused widespread concern of experts in recent years
5. This model has set up a quantitative evaluation index system to present the final result.
6. The PMMM offers a logical path for progressive development and a tactical plan to proceed with project management improvement within the organization. Once the preliminary level of maturity and shortcoming areas are identified, the PMMM makes available a roadmap for performance recovery and progress.
7. PMMM provides a systematic approach to perform benchmarking and gives an assessment framework that enables contemporary organizations to improve project management maturity and experience improved return on investments.
8. The PMMM makes use of the five maturity levels outlined in the Software Engineering Institute (SEI) Capability Maturity Model and scrutinizes maturity development across nine knowledge areas outlined in the Project Management Institute's (PMI) A Guide to the Project Management Body of Knowledge. Thus it is an integration of industry proven standard (Introduction and guide to PMMM,2010).

The five maturity levels are Initial Process, Structured Process and Standards, Organizational Standards and Institutionalized Process, Managed Process and Optimizing Process. The nine knowledge areas are Project Integration Management, Project Scope Management, Project Time Management, Project Cost Management, Project Quality Management, Project Human Resource

Management, Project Communications Management, Project Risk Management and Project Procurement Management.

If an organization meets the requirements and standards pertaining to Project Management as defined by the PMMM it is said to have achieved complete project management maturity. It should also additionally exhibit improvement in project delivery times, cost reductions, profitability etc.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1. Research Design

A research process consists of a number of sequential steps. It begins with finding the research area and formulating research questions. Further, the investigation method should be chosen along with research design and data collection techniques. Finally, the collected data is analyzed and interpreted what leads to drawing conclusions.

A case was chosen for study as a research design. The case study in this thesis focuses on ECDSW CO. Selection of the company was done based on the presumption that the company will have a formal project management culture and get sufficiently experienced personnel on the area.

Given that the Project Management Body of Knowledge (PMBOK) has already identified key knowledge areas in project management (PMBOK, 2013), this paper intends to build upon this widely adopted guideline for project maturity level usage. A list of criteria included in the questionnaire to assess project maturity levels via a proposed PMMM model is found in Appendix A, and it spans across the project management knowledge areas of PMBOK. The nine knowledge areas covered under PMBOK (2013) are: integration; scope; time; cost; quality; human resources; communication; risk; and procurement to measure in levels of maturity.

The research design that is used for the study is descriptive research type. A structured questionnaire is used to collect data from ECDSW CO project execution management as well as employees of ECDSW CO related to the project execution.

Then, assessment of Maturity level of the knowledge areas, the overall the maturity level of ECDSW CO and rating of the relative Importance levels of knowledge areas. Prioritizing improvement initiatives along their correlation with the maturity levels is conducted using Spearman correlation formula.

■ Rank Spearman correlation formula

$$r_R = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

Where n = number of data points of the two variables

d_i = difference in ranks of the “ i th” element

Implications of the maturity levels is discussed comprehensively based on the finding and literature bases.

3.2. Population and Sample of the Study

The population of this study includes the top management, senior engineers (department heads), supervisors, other junior technical staffs and employees of ECDSWCo who are involved in project management practices.

Sampling is related with the selection of a subset of individuals from within a population to estimate the characteristics of whole population. Each observation measures one or more properties observable subjects distinguished as independent individuals. In business research, medical research, agriculture research, sampling is widely used for gathering information about a population (Zikmund and Babin, 2010). The sample is calculated separately by the approach used to be determining the number of respondent samples in this study is a simplified formula provided by (Kothari, 2004)

For the research purpose confidence of successfully collect or return rate should be expected to more than 70% and sample size to be determined at 95% confidence level.

3.3. Data sources and methods of data collection

The source of information is generally classified as both primary and secondary sources. The primary data is to be collected through questionnaire from employees and management of ECDSW CO projects. To accomplish the data collections, questionnaire was adopted from similar research paper after critically commented and reviewed in consultation with advisor, containing items measured on the 5-point Likert type.

A five Likert scale: 1 (Never), 2 (Sometimes), 3 (Usually), 4 (Frequently), and 5 (Always) are provided to each factor to draw the perception of respondent of criticality to project success for further statistical analysis and classification. The questionnaire was developed based on reviewed literature and customized to the case under investigation. The questionnaire is divided into three parts. The first part is designed to capture general data about the respondents. The second part has questions developed from literature about the maturity of the PMO. The questions are grouped into nine knowledge areas set by PMI in PMBOK.

Under these knowledge areas various questions are devised to measure the degree of maturity of the project management practice. The collected data is evaluated with criteria used to evaluate the maturity of project execution based on the project management maturity model. The third part of the question focuses on importance of project maturity knowledge areas. Any other relevant secondary data is to be collected from the books, records, reports, minutes and documents related to the execution of the projects. For the theoretical background, a literature study has been conducted, using both scientific articles written by professionals in the field as well as books in the area of project maturity assessment.

3.4. Data collection and Sampling Technique

To determine the size of the sample size for the number of respondents; Kothari's (2004) sampling formula is used (Appendix D) in this paper the number of population is 280. Using the Kothari's formula the sample size is determined to be 30 taking a 95% level of confidence.

3.5. Methods of Data Analysis

According to Kombo and Tromp, (2011), data analysis procedure includes the process of packaging the collected information putting in order and structuring its main

components in a way that the findings can be communicated easily and effectively. After the fieldwork done before analysis, all the questionnaires adequately checked for reliability and verification, editing, cleaning, coding and tabulation were carried out. The results obtained were analyzed and interpreted by using descriptive statistics included use of frequencies, means and percentile. The data presented in the form of tables, frequency, mean and percentages with description. The collected data is analyzed& interpreted in relation to the theoretical propositions.

The analysis of the data followed in this paper is the descriptive methods of data analysis. All collected data is entered into and analyzed with the statistical package for the social science (SPSS). This software is a widely utilized program for statistical analysis in social sciences. SPSS is basically designed for analyzing statistical data, and as a result, it offers a great range of charts, methods and graphs. SPSS also provides more techniques of cleaning or screening the data in planning for further assessment.

Frequency distributions of all variables are checked for outliers, missing data, and entry errors. Summary statistics, including the computation of means, ranges, standard deviations, frequency counts, and percentages of all demographic and project maturity level data evaluation is performed. And the discussions is done using tables, charts, and graphs to analyze the actual practice observed from the responded collected using questionnaires and secondary sources. The results of the survey are compared with the criteria of project maturity model and recommendations are forwarded for the identified gaps.

The questionnaire designed to get the level of project management maturity helps to find the project management maturity levels discussed in literature review sections incorporating the following: Level 1(0-1), Level-2(1-2), Level-3(2-3), Level-4(3-4), and Level-5(4-5) according to the PMMM model based on the average values of the results found from the responses of second part of the questionnaire with likert scale(Appendix B).

To determine project management maturity level of company, a judgment-based scoring system is used to determine the organization's present maturity level using the following rating scale(PMMM model):

Table 3.1 Project management maturity level (PMMM model)

Level 1	Initial process
Level 2	Structured process and Standards
Level 3	Organizational Standards and institutionalized process
Level 4	Managed process
Level 5	Optimizing process

The numeric values assigned to each response to the questionnaires were 1 to 5. These values were added per knowledge area and average values are used to determine the maturity levels of Knowledge areas. The averaged total scores of all the nine key knowledge areas are outlined. It also gives result for ranking values for the relative importance of the PM by using the average values of the response scores of the third part of the questionnaire (Appendix C). Importance levels and maturity levels correlation assessment was done using spearman's rank correlation coefficient (Appendix D). Spearman correlation formula that best describes the correlation between two variables he correlation between two variables, to show how the strength and weaknesses of one affects the other. The Spearman Coefficient, ρ , can take a value between +1 to -1 where,

A ρ value of +1 means a perfect association of rank

A ρ value of 0 means no association of ranks

A ρ value of -1 means a perfect negative association between ranks.

Closer the ρ value to 0, weaker is the association between the two ranks (MM Mukaka, 2012)

3.6. Reliability and validity

3.6.1. Reliability

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. Reliability refers to the extent to which your data collection techniques or analysis procedures will yield consistent findings (Saunders et al., 2007). Chronbach's alpha is used to assess the internal consistency of variables in the research instrument. Chronbach's alpha is a coefficient of reliability used to measure the internal consistency of the scale. Cronbac's Alpha (α); it is the most common measure of scale reliability (Field, 2006). According to Zikmund (2010), scale with coefficient alpha between 0.6 and 0.7 indicate fair reliability so for this study a Chronbach's alpha score of 0.70 or higher is consider adequate to determine reliability.

The Alpha value ranges from a minimum of zero to a maximum of 1.0 for a perfect score, a good measure of the alpha should be 0.70 or higher (Neuman, 2007). According to (George & Mallery, 2003) scales exhibiting a coefficient of alpha greater than 0.90 is considered to have excellent reliability, between 0.80 and 0.90 are considered to have good reliability, between 0.70 and 0.80 are considered to have acceptable reliability, alpha value between 0.60 and 0.70 indicates the reliability is questionable, when the coefficient alpha is between 0.50 and 0.60, the scale has poor reliability and the coefficient alpha is less than 0.50 it is unacceptable.

To ensure reliability of the instrument, a pilot study is carried out. The importance of pre-testing a questionnaire according to (Creswel, 1999) is to help the researcher understand the meaning of the questions to be responded and how they arrive at their response.

The researcher measured the reliability of the data using Cronbach's Alpha and that the Cronbach's Alpha value for final survey and was found to be between 0.8 and 0.9 according to (George & Mallery, 2003), which is good reliability. Therefore, all variables and questionnaire were acceptable for further analysis.

3.6.2. Validity

Validity is the extent to which difference found with measuring instrument reflecting true differences among those being tested. In order to ensure the quality of the research design content and construct validity of the research is checked (John, 2007).

According to (Adams et al., 2007) internal validity used to assure the research validity. To treat the internal validity of this research, a questionnaire was distributed within the same period and collected within two weeks and reasonable sample was taken from the population and questionnaire randomly and distributed to participants. The major objective of the pilot test was to get feedback on the questionnaire way of preparation, wording, coherence and any other valuable comment and to incorporate any important comments and finalize the questionnaire.

3.7. Ethical consideration

As Saunders et.al (2007) mentioned, research ethics deals with how the researcher treat those who participate in the study and how to handle the data after collection.

Efforts were made to make the research process professional and ethical. To this end, the

researcher clearly informed to the respondents about the purpose of the study i.e., purely for academic. As I introduced its purpose in the introduction part of the questionnaire to the respondents, confirmed that subject's confidentiality was protected. In addition, the study was based on their consents. The researcher was also not personalizing any of the response of the respondents during data presentations, analysis and interpretation. Furthermore, all the materials used for this research were duly acknowledged.

Thus the researcher has tried to keep the privacy of the respondents by avoiding personal questions to protect the identity of individuals from being known by readers. The research will respect the following ethical principles: Sufficient informed consent is provided; Privacy is respected; Integrity is fundamental. Records is kept confidential and anonymity is guaranteed during and after this paper is compiled.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1. Introduction

This chapter presents the results of the data obtained from respondents regarding the Project Management Maturity of the Project Execution – The Case of ECDSWCO. In the first part, the demographic profile of the respondents is explained. In the second part, the Project Management Maturity level of Project Execution is evaluated by analyzing the detail responses of the respondents in PMMM. Then, Average Project Management Maturity level of each knowledge area is presented to represent the overall maturity value for the company. Then the relative importance of each knowledge area is analyzed. Finally, relationship between perceived importance and maturity level of project management knowledge areas are analyzed using spearman coefficient. For this research PMMM model is the selected model for analysis as its features and levels best fit project works found in construction companies.

4.2. Demographic characteristics of the sample

4.2.1. Responserate

Out of 30 questionnaires distributed only 23 of them are returned back from the respondents. Actually, not all responses analyzed, one response were found incomplete and rejected from analysis.. The returned questionnaire was believed to be sufficient to draw analysis.

Table 4.1: Detail of research survey

Number of Questionnaires Distributed	30
Number of Questionnaires Used in Thesis	22
Percentage of Survey Response rate	73.3%
Average Respondent's Experience	5-12yrs
Average Number of Workforce and Employee	280

Total responses analyzed was 23 (73.3%) from distributed (30) to respondents. If a response rate is found 60%, it is going to be good for analysis whereas if a response rate found to be 70%, it is very good for analysis.

4.2.2. Educational background of the respondents

Those respondents participated in the study have different educational background (see Table below). Most of them (>85%) were a graduate of first, second degree and third degree. Those who had first degree were accounts 45.46 % out of the whole population.

Table 4.2. Respondents Educational Level

Academic level	Frequency	Percent
Diploma	3	13.6
Bsc	10	45.46
Msc	8	36.4
Phd	1	4.54

Source: own survey result, 2021

On the other hand, those who had a third degree account about 4.54 % out of the total population. Diploma holders who participated in the study covered 13.6 % (see above Table 4.2).

4.2.3 Respondents position

The respondent's position is also summarized in the table below as follows.

Table 4.3. Respondents Position in the company

S/No	Positionstaff	Number of staff
1	General manager	1
2	Project manager	2
3	Logistic manager	1
4	Civil engineer	10
5	Architect(Architectural designs)	3
6	Electrical engineer (Electrical installations)	1
7	Mechanical Engineer	1
8	Technician	2
9	Finance head	1

4.3. Results and Implications of the maturity levels of PM knowledge areas and the overall maturity level of the company

Maturity is a comparative level of advancement an organization has achieved with regard to any given processes or set of activities. Organizations with more fully defined and actively used policies, standards, and practices are considered more mature (PM Solutions, 2008). To evaluate the project management maturity level of company, judgment-based scoring system was used using the rating scale. In this part, the maturity level of each knowledge area is evaluated by analyzing the detail responses of the respondents in comparison with the Maturity Model PMMM. Then, the overall Average Project Management Maturity level of the company is evaluated.

Detail investigation has been made for each knowledge area to determine the implications of the achieved maturity level. Furthermore, correlation between the maturity levels found and relative importance levels of knowledge areas are also analyzed. The results found for the maturity levels for each knowledge areas and their implications are discussed below.

4.3.1. Integration Management

Integration Management describes the processes required to ensure that various elements of the project are properly coordinated. It consists of plan development, plan execution, and integrated change control (PMI, 2004).

According to PMI (2004), integrated project management system facilitates the work for the management team and also establishes a certain level of professionalism in the organization

According to Antvik&Sjöholm (2007), lack of integration management often causes delays, high costs and general execution problems in projects. The reasons for this poor performance in this sub-component are:

1. The overall project management plans (project roadmaps) are not consistently developed or used,
2. The planning processes are separately conducted by each project,
3. Projects usually enter in to execution phase without proper understanding and development of a project plan, and
4. There is no formal way to integrate various project activities and requirements.

Inappropriate integrated management system mostly affects coordination between different areas of the management team since all managers use different methods based on their own experience. It also affects the ability for the project manager to control and monitor different areas of the project since there is no consistency in the management methods (Karlsson, 2011).

The respondents were requested to share their understanding about Integration management practice of company using eight variables. These variables measure the extent of the ECDSWCo's Integration management practice. The Project maturity level on Integration Management is shown in the following Table.

Table 4-4: Project maturity level on Integration Management

Source: Field survey (own), 2021

No	Variables	Mean	Std. Deviation
1.1	Project constraints are clearly defined for each project.	3.17	1.11
1.2	Formal Organizational policies exist that include quality management, personnel and financial controls.	3.45	1.08
1.3	A project planning methodology is documented and strictly adhered to.	2.82	1.02
1.4	A project Management Information System (PMIS) is in place, consisting of the tools and techniques used to gather, integrate, and disseminate the output of the Project management Processes.	2.82	0.98
1.5	There is an overall change control processes to manage scope change, maintain performance measurement integrity and implement approved changes that affect cost, risk, and staffing.	2.90	1.05
1.6	A documented configuration management procedure is in place to apply technical and administrative project management methodology.	3.07	0.95
1.7	A performance measurement criterion has been developed to establish how project progress is determined and reported.	3.13	0.91
1.8	Project Progress Process is following as part of the project management continuous improvement process.	3.47	0.98
	Average maturity Level	3.10	1.01

N.B. The maturity level result found is high when compared the existing PM scenarios observed in the country and similar previous researches done.

From the above table, the mean of the integration management area of knowledge is 3.1. This means, all project management standards are in place and are organizational standards. Almost all projects use these standards with few exceptions. Management is regularly involved in the input and approval of key decisions and issues.

However, project planning methodology documentation and strict adherence to it, using project Management Information System consisting of the tools and techniques that can be used to gather, integrate, and disseminate the output of the Project management Processes, as well as the overall change control processes to manage scope change, maintain performance measurement integrity and implement approved changes that affect cost, risk, and staffing are at lower level from the other integration management maturity criterion. Employees depend on informal practices to manage activities. Furthermore, within the Company there are limitations in project management plans that should be consistently developed, published and used. Project Management Information System (PMIS) that is used to gather, integrate, and disseminate the outputs of the project management processes is not yet established.

4.3.2. Scope Management

Scope Management is set of processes required to ensure that the project includes all the work required, and only the work required to complete the project successfully. The project scope management process involves the processes: Identify Requirement, Define Scope, Create WBS (Work Breakdown Structure), Verify Scope, and Control Scope (PMI, 2004).

Different opinions of respondents about Scope management practice of company are collected using seven variables. These variables reveal the extent of Scope management practice of the ECDSWCo. Some of the variables are creating Scope statements for each project, establishing change control processes and communicating approved changes to all stockholders.

Table 4-5: Maturity level of Scope Management practices of company

Source: Field survey (own), 2021

No	Variables	Mean	Std. Deviation
2.1	A Project scope statement is created for every project.	3.72	1.15
2.2	Project Scope Statement are prepared with customer input throughout the development process	3.03	1.06
2.3	A Documented change Control Process in place for managing Change to the project Scope	2.75	0.91
2.4	All Project participants indorse the Scope Statement.	2.87	1.14
2.5	Approved changes to the scope statement are communicated to the project team and the client	3.37	1.01
2.6	The Management, the project team, and the client review all project progression on a regular basis.	3.23	0.91
2.7	A work Breakdown document (WBD) containing detailed description of the project's work is created for each project.	3.00	1.04
	Average maturity Level	3.14	1.03

N.B. The maturity level result found is high when compared the existing PM scenarios observed in the country and similar previous researches done.

As presented in table above, the mean values of all variables are between 2.75 (Level-2) and 3.72 (Level-3). With plus or minus 1 as a standard deviation, more than half of the respondents (60%) believed that Customers input are not always considered during scope statements preparation and change control processes are not documented. As per the understanding of 23% of respondents, even approved changes are not well communicated to project team and customers; however, 42% said that the management, the project team and the customer review projects development on a regular basis, but 23.4% have disagreed with this.

Scope management from company's perspective is mainly about ensuring that all works the ECDSWCo doing is what originally agreed on and covered by the contract documents. However, Scope Management maturity of the Company, 3.14 (62.8%), indicates that the maturity in this

sub component could be considered at level - 3 (Organizational Standards and institutionalized process). Some Scope management practices are rarely or never applied. Approved changes to the scope statement are not on time communicated to the project team and the customer as well, and documented change control process is not consistently implemented.

4.3.3. Time Management

Project time management includes the processes required to ensure timely completion of a project. Project time management involves the processes: Define Activity, Sequence activities, Identify relationship among project activities, Estimate activity resource, Estimate activity Duration, Develop schedule and Control schedule (PMI, 2004). The respondents gave their opinion about Time management practice of company using eight variables which measure the extent of the firms' time management practice. Project maturity level of time management practices of company is shown in Table below.

Table 4-6: Project maturity level of time management practices of company

Source: Field survey (own), 2021

No	Variables	Mean	Std. Deviation
3.1	The project requirements (deliverables) are reflected in the project's work Breakdown Structure (WBS).	3.03	1.24
3.2	The project WBS and resource estimate are used to develop the project's baseline schedule.	3.00	1.14
3.3	All project assumptions are documented when developing the project schedule.	2.93	1.09
3.4	The project schedule identifies schedule constraints driven by the consumer, technology, suppliers, or management.	2.87	1.08
3.5	A critical path analysis is performed on the project schedule during each progress update cycle.	2.93	1.10
3.6	Project schedule are update on a regular basis against the baseline plan.	3.17	0.99
3.7	Resource –constrained and resource – leveled schedule is created and maintained	2.62	0.94
3.8	Schedules are optimized to conform to contract requirements.	2.98	0.97
	Average maturity Level	2.94	1.07

Mean values of all variables is 2.94, which means all activities related to time management are still at Level -2 which means Many project time management processes exist in the organization but they are not considered an organizational standard. Documentation exists on these basic processes. From the component of the time management, the lowest ratings are given to component stating “The majority Resource –constrained and resource – leveled schedule are created and maintained” followed by “The project schedule identifies schedule constraints driven by the consumer, technology, suppliers, or management.”

In addition the data collected confirmed that project schedules do not identify all constraints driven by the Customer, Technology, Suppliers, or Management. Moreover, resource-constrained and resource-leveled schedules are not regularly maintained. Only 5% of the respondents said that schedules are updated always on a regular basis.

Consequently, average Time Management maturity of the Company is 2.94. This score is equivalent to 59% of the overall total score of 5 points assigned as the maximum point achievable. This shows that Time Management maturity of company could be considered level - 2. At this level, many project time management processes exist in the organization but they are not considered an organizational standard. Documentation exists on these basic processes. The construction process capability of level-2 organization is not fully predictable because the processes are not fully planned and are not constantly changed or modified as the work progresses. Performance depends on the capabilities of individuals since the time management practices are not considered an organizational standard.

4.3.4. Cost Management

Cost management includes the processes involved in estimating, budgeting and controlling costs so that the project can be completed within the approved budget. It consists of resource planning, cost estimating, cost budgeting, and cost control (PMI, 2004).As shown in Table below, Cost management practice of the ECDSWCo is evaluated using nine variables. The respondents have different opinion about each question. The mean values are 2.68. This shows that Cost management maturity of the Company is at Level 2. About half of the respondents confirmed that all Cost management variables such as Cost center establishment, utilization of consistent financial standards and procedures and proper gathering of financial data for periodic reports are not practiced in the Company. On average, less than 5% of respondents replied that these variables are always practices. Moreover, 50% replied that actual costs of projects are not

tracked and reconciled with the original estimated costs. 80% replied that employees never received or rarely received training in financial standards and procedures. This area is also the lowest rated area of this group which is only 2.68 and 46.7% confirmed that Cost centers don't properly track actual expenditures against budget for specific line items.

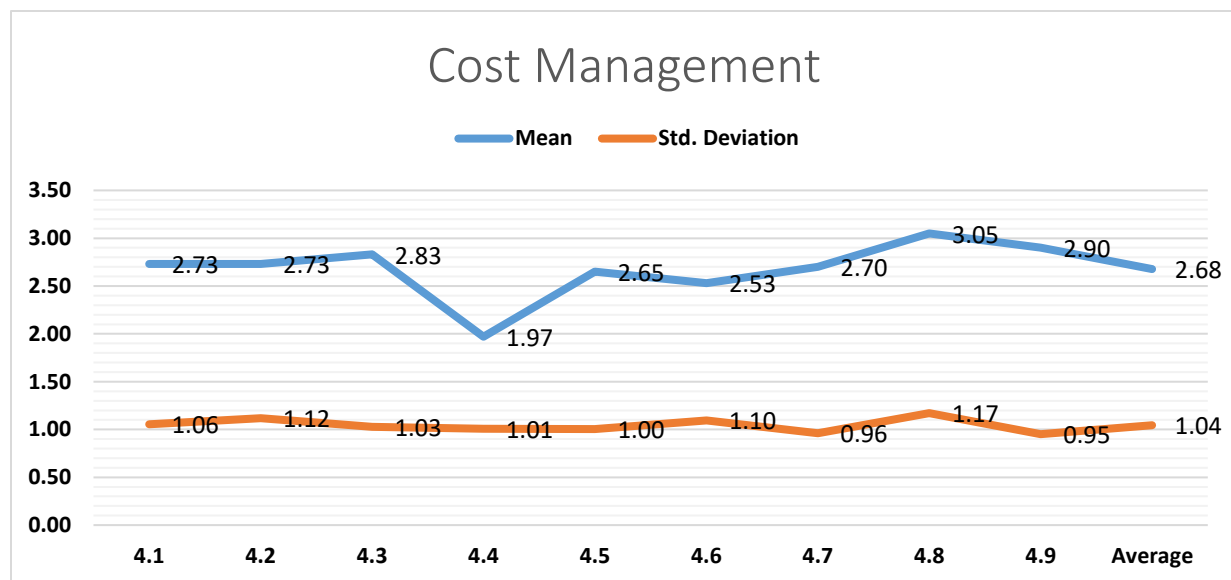


Figure 4-1: Maturity level of cost management practices of company.
Source: Field survey (own), 2021

Consequently, average Cost Management maturity of the Company is 2.68. This score is equivalent to 54% of the overall total score of 5 points assigned as the maximum point achievable. This shows that Cost Management maturity of company could be considered level-2. Thus, many of project Cost Management processes exist in the ECDSWCo but they are not considered an organizational standard. Documentation exists on these basic processes. The project management environments do not have standardized processes that support gathering of financial data for periodic reports. In addition, cost centers are not fully efficient to track actual project expenditures against budget for specific line items of the project. Some project and department Managers generally have little or no knowledge to control costs. Project team members do not receive training in financial standards and procedures.

4.3.5. Quality Management

Quality Management includes the processes and activities of the organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. Project quality management includes the processes such as Plan Quality, Perform Quality Assurance and Perform Quality control (PMI, 2004).

Table 4-7: Quality Management Maturity Levels

Source: Field survey (own), 2021

No	Variables	Mean	Std. Deviation
5.1	A document procedure exists for creating and maintaining a project workbook.	3.03	1.10
5.2	Every project has Quality Assurance plan.	3.57	1.13
5.3	The project team reviews all of the processes and procedures that apply prior to the start of every project.	3.05	0.95
5.4	Common documented processes and procedure for technical performance, business performance, and quality, performance are applied to every project.	3.03	0.96
5.5	An initial review of the project plan, involving all participants, is conducted prior to creating a baseline project plan to ensure completeness and consistency.	2.98	0.89
5.6	On a regular basis, Variances are reviewed between the current progress status and project Quality against the baseline plan.	2.85	0.84
5.7	On a regular basis, project trend data are analyzed, based on metrics data	2.72	1.08
5.8	Quality Issues Resolution process for the project is established and followed.	3.18	0.95
5.9	Quality change control process for the project is established and followed.	3.25	0.95
	Average maturity Level	3.07	0.98

N.B. Thematurity level result found is high when compared the existing PM scenarios observed in the country and similar previous researches done

Mean values of quality management practice is 3.07. This means the organization is at level 3 in general, but, out of the nine variables 3 activities are still at level-2. On a regular basis, variances are reviewed between the current progress status and project Quality against the baseline plan(2.85), and on a regular basis, project trend data are analyzed, based on metrics data (2.72), An initial review of the project plan, involving all participants, is conducted prior to creating a baseline project plan to ensure completeness and consistency (2.98).

Average Quality Management Maturity of the company is 3.07 (Organizational Standards and institutionalized process). At this level, the ECDSWCo begins using standard quality management processes. But the management is still localized to particular teams or areas.

Quality variances between the current progresses against the quality baseline plan are regularly reviewed.

4.3.6. Human Resource Management

Human Resource Management includes the processes that organize, manage, and lead the project team. Project human resource management involves the processes: Develop Human Resource Plan, Acquire Project Team, Develop Project Team and Manage Project Team. Project Human Resource Management includes the processes of organizational planning, staff acquisition, and team development (PMI, 2004).

As indicated in the following tables and Figures, the respondents believed that Human resource Management maturity is Level-2 in aspects like; All project resource needs (such as hardware, software, and space) are clearly document (2.82), The training and developmental needs of all team members are documented (2.62), and A documented process is in place for recognizing outstanding commitments or performance on a project (2.97).

But the mean of Human resource management practices is 3.10 means the organization is in level 3 in this area.

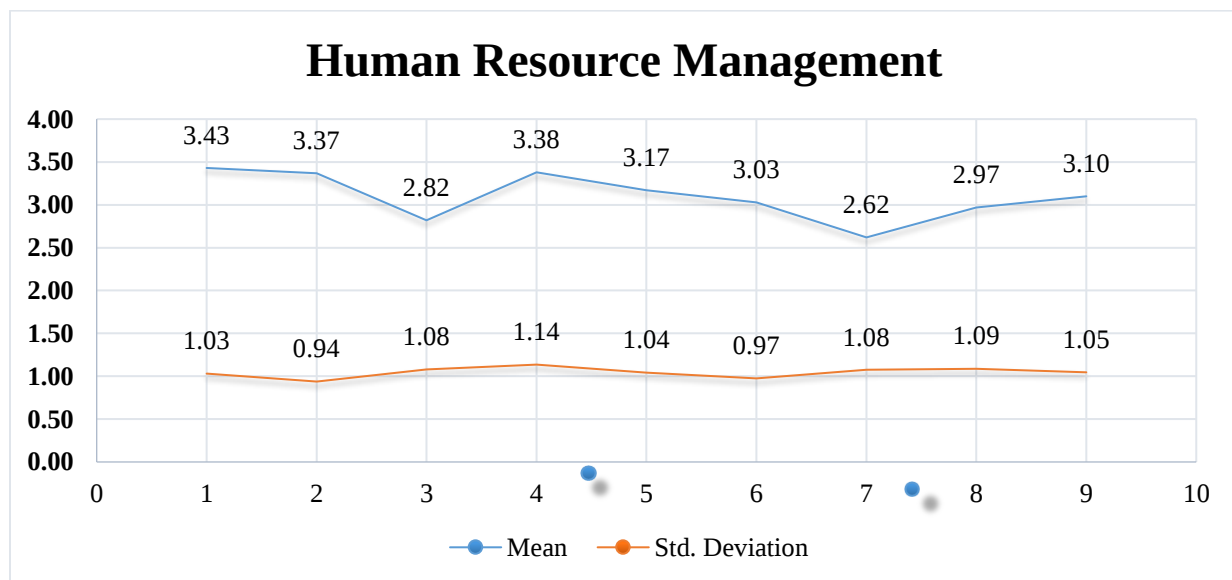


Figure 4 2: Human Resource Management Maturity.

Source: Field survey (own), 2021

N.B The maturity level result found is exaggeratedly high when compared the existing PM scenarios observed in the country and similar previous researches done

However, the overall maturity Level, 3.10 with standard deviation of 1 shows that Human Resource Management Maturity of company could be considered to be Level - 3 (Organizational Standards and institutionalized process). The result shows human Resource management standards are in place and are organizational standards.. The responses of the participants in this sub component confirmed this fact.

1. The Company lacks qualified project management professionals to carry out management responsibilities according to best practices.
2. The project team is not consistently involved in project planning development process.
3. Staffing plan is not consistently created and followed for each project. Some people are “accidentally” assigned to project manager position.

4.3.7. Communication Management

Project Communication Management includes the processes required to ensure timely and appropriate generation, collection, distribution, storage, retrieval, and ultimate disposition of project information. Project communication management includes the processes: Identify Stakeholders, Plan communication, Distribute Information, Manage Stakeholder Expectations, and Report Performance (PMI, 2004).

Table 4-8: Maturity level of Communication Management of company.

Source: Field survey (own), 2021

No	Variables	Mean	Std. Deviation
7.1	A Communication plan, documenting the required project communications, is created for each project and is followed by the project team.	3.30	0.94
7.2	A project Announcement is made to both the customer's organization and yours to increase project awareness.	3.37	1.03
7.3	After each formal meeting, minutes are prepared and distributed to all affected parties.	3.13	1.02
7.4	Project status reporting procedures are established and followed.	3.37	1.01
7.5	Project information is update and readily accessible to the organization at all times.	3.35	1.04
7.6	Variance analysis for schedule, budget, and effort is communicated on a regular basis.	2.85	0.97
7.7	Project status review meetings are held regularly with company leadership, the customer, and suppliers.	3.37	0.96
7.8	Project successes are documented for including into a close- Down Announcement and success story.	3.12	1.11
Average maturity Level		3.23	1.01

N.B. The maturity level result found is high when compared the existing PM scenarios observed in the country and similar previous researches done

The overall Communication Management maturity is found to be 3.23 (65%). This indicates that Communication Management Maturity of company could be considered to be level - 3 (Organizational Standards and institutionalized process). Common Communication weaknesses that are identified are:

1. Internal cross team communication occurs through the top management Committee meetings, but People who are not part of these meetings do not get the required information.
2. Project status reporting procedures are not consistently followed; Project information is not regularly updated and not readily accessible to the organization at any times
3. Project information is not regularly updated and not readily accessible to the organization at any times.

The above table Communication Management Maturity assessment result of company. Therefore, on average 17% of the respondents said project information is not usually updated and readily accessible to the organization. In view of the fact that variance analysis for schedule and budget are not always communicated, and 79% of them believed project status review meetings are usually held with company Leadership and the Customer. Moreover, 100% of the respondents confirmed that after each formal meeting, minutes are not always prepared and distributed to all affected parties.

4.3.8. Risk Management

Project risk management includes the processes of conducting risk management planning, identification, analysis, response planning, and monitoring and control of project risk. The objectives of risk management are to increase the probability and impact of positive events, and decrease the probability and impact of negative events in the project. Risk management processes are: Plan Risk Management, Identify Risks, Perform Qualitative and Quantitative risk analysis, Plan risk Responses, Monitor and Control risks (PMI, 2004).

Average Risk management maturity value, 2.81 (56%), which is similar to Time and Cost managements. Risk Management Maturity could be considered to be level - 2 (Structured process and Standards).

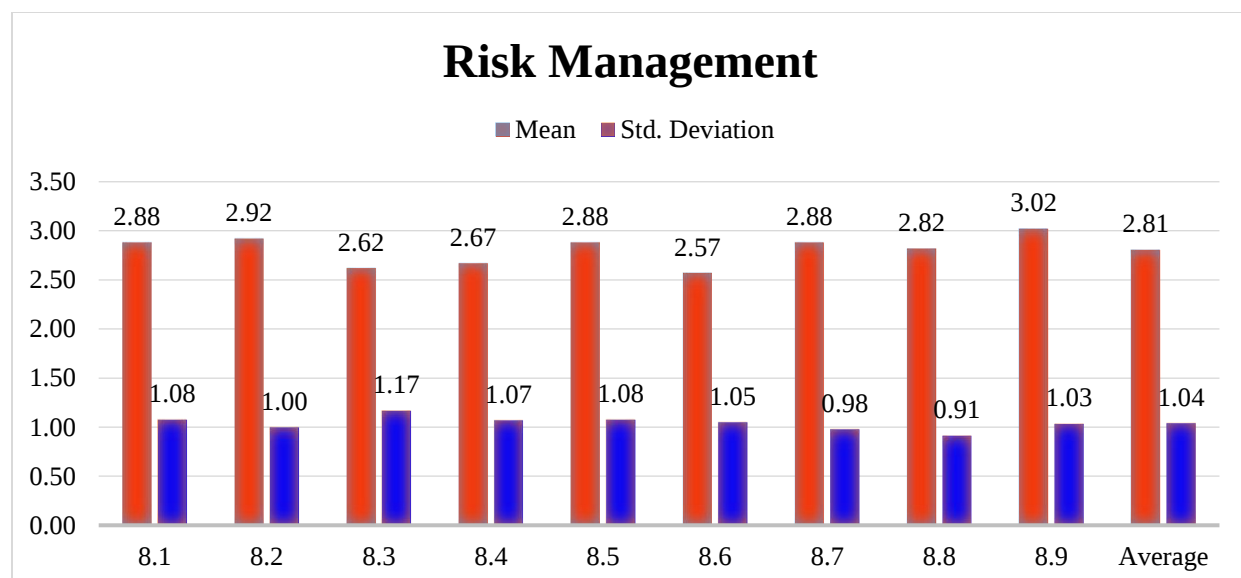


Figure 4-3: Risk Management Maturity Levels.

Source: Field survey (own), 2021

N.B. Though it is in level 2 ,the maturity level result found is still very high when compared the existing PM scenarios observed in the country and similar previous researches done

Therefore, within the Company risk management strategy is not well established. Risks are not consistently identified, documented or tracked. Project risks are not always evaluated for priority and probability.

4.3.9. Procurement Management

Procurement management includes the contract management issued by an outside organization (Buyer) or issued by the performing organization to an outside organization (sub contract management) and change control processes required to develop and administer contracts or purchase orders. Procurement management the processes: Plan Procurements, Conduct Procurement, contract administration, and contract closeout.

Table 4-9: Maturity level of Procurement Management of company.

Source: Field survey (own), 2021

No	Variables	Mean	Std. Deviation
9.1	A standard (agreement) that includes project management requirements is issued for project goods and services.	3.20	1.04
9.2	A procurement plan is in place that identifies what to procure and when is developed at the start of each project.	3.10	1.07
9.3	Project timing and requirements are clearly defined in a formal contract or agreement.	3.22	0.92
9.4	Contract Administration is an integral part of the project management.	3.33	1.02
9.5	A “make-buy” analysis performed prior to the start of every project.	2.87	0.97
9.6	Procurements Management processes have been documented	3.23	1.06
9.7	All Procurements are identified with the specific plan	3.05	1.02
9.8	An evaluation process that meets specific criteria has been formalized to provide a consistent method for procurement proposal review and acceptance,	2.98	0.93
9.9	A contract change control process is in place.	2.93	0.99
9.10	A Contract close out process that records the evaluation of supplier performance in meeting their contact requirements is documented.	3.18	1.05
Average maturity Level		3.11	1.01

N.B. The maturity level result found is still very high when compared the existing PM scenarios observed in the country and similar previous researches done

The overall Procurement Management maturity of company is 3.11 (62%). This shows that the Maturity could be considered to be Level - 3 (Organizational Standards and institutionalized process). For this reason, Procurement Management practices are in place and are organizational standards. Almost all projects use these standards with few exceptions. Management is regularly involved in the input and approval of key decisions and issues. The respondents were requested to share their opinion about Procurement management practice of company using ten variables. These variables evaluate the extent of the Company's Procurement management practice in terms of Procurement plan preparation, Contract Administration practice, "make-buy" decision analysis, Procurement Management processes, Formal and consistent evaluation criteria development and utilization, and Contract change control process. The perception of respondents is shown in table below

The problems identified in this area are;

1. A "make-buy" analysis is not performed prior to the start of every project.
2. An evaluation process that meets specific criteria has not been formalized to provide a consistent method for procurement proposal review and acceptance,
3. A contract change control process is not in place.

4.3.10. Overall management maturity level of company

Numeric values assigned to each response to the questions were 1 to 5. The response values are added per knowledge area and average values are used to determine maturity level of each knowledge area. Maturity levels of the nine project management knowledge areas are evaluated using the following levels :(Using PMMM maturity model)

Table 4.10: Maturity levels (Using PMMM maturity model)

Score	Maturity levels	Value
Level 1	Initial process	1.0 – 1.99
Level 2	Structured process and Standards	2.0 – 2.99
Level 3	Organizational Standards and institutionalized process	3.0 – 3.99
Level 4	Managed process	4.0 – 4.99
Level 5	Optimizing process	5.0

As indicated in the following table, project management maturity levels of the nine knowledge areas are between 2.68 and 3.23. Time Management, Cost Management and Risk Management maturities are Level-2 (Structured process and Standards). Integration Management, Scope Management, Quality Management, Human Resource Management, Communication Management, and Procurement Management maturities reached the next maturity ladder, which is Level-3.

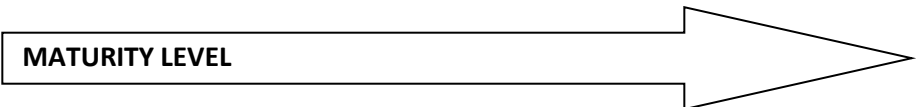
Table 4-11: Overall Project Management Maturities of Knowledge Areas of the company.

Source: Field survey (own), 2021

No	Knowledge Areas	Average maturity Level	Std. Deviation
1	Integration Management	3.10	1.01
2	Scope Management	3.14	1.03
3	Time Management	2.94	1.07
4	Cost Management	2.68	1.04
5	Quality Management	3.07	0.98
6	Human Resource Management	3.10	1.05
7	Communication Management	3.23	1.01
8	Risk Management	2.81	1.04
9	Procurement Management	3.11	1.01
10	Overall Average Maturity Level	3.02	1.03

By mapping the maturity values of each knowledge areas along the two- dimensional (2-D) frame work of the selected Model, it is possible to link knowledge areas to the five quadrants where each quadrant represent specific maturity levels as shown in Figure below.

Table 4-12: Mapping of Project Management Maturities of Knowledge Areas of the company.

						
No	Knowledge Areas	Level 1 Initial process	Level 2 Structured process and Standards	Level 3 Organizational Standards and institutionalized process	Level 4 Managed process	Level 5 Optimizing process
1	Integration Management			3.1		
2	Scope Management			3.14		
3	Time Management		2.94			
4	Cost Management		2.68			
5	Quality Management			3.07		
6	Human Resource Management			3.1		
7	Communication Management			3.23		
8	Risk Management		2.81			
9	Procurement Management			3.11		
10	Average			3.02		

N.B Though the overall project management maturity of the company is found to be level -3(i.e all organizational Standards and institutionalized process are put in place), the result need to be further investigated for comfomity with the existing realistic scenarios.

According to the results,average maturity value of the nine project management knowledge areas is found to be 3.02 which means all project management standards are in place.Maturity level of each knowledge area is found to be between the range of 2.68 and 3.23. Time Management, Cost Management and Risk Management maturities are Level-2 (Structured process and Standards).

Where as the other knowledge areas reached the next maturity ladder. Despite the result, based on the reality of the country's project management practices and assessments done previously, the results do not seem to have conformity with the existing condition which indicates further case study ,action research,interviews and focus group discussions are necessary.

Also according to the result found perceptions of the respondents reflected that the current organizational project management maturity of the company is level three (Organizational Standards and institutionalized process).

According to the findings of Yimam (2010) which states that most government's company are at level two of project management maturity. The project management maturity of company should not make the management very satisfied with what they have achieved rather they have to strive to reach the higher level of maturity Level 3 and 4 by continually improving the project management process of the company.

Based on the outcome of the assessment results, it is clear that there is a necessity for company to develop project management improvement plan that will assist to improve project management competences of the organization in accomplishing its objectives and to improve its involvement in projects in the country useful for the ECDSWCo.

4.4 Relative importance rankings of PM Knowledge Areas

As shown in the following Figure below, Quality management practice of company is relatively more matured (3.07) than that of Time management (2.94), but its` Importance level (4.2) is less than that of Time management (4.5) .Similarly Cost management is less matured (2.68) than time management practices(2.94) and less important (4.32) than that of time management(4.5). The lower importance level of Quality management ranked by the respondents might be due to facts that, in the construction quality controlling and managing responsibilities are up on the Consulting firm.

Similarly, time management practice is considered by respondents the most important variable (4.5), nevertheless the maturity level is among the lowest rank (2.94). Furthermore, Cost management is also considered as important variable (4.32) next to time management but its` maturity level is again lowest (2.68).

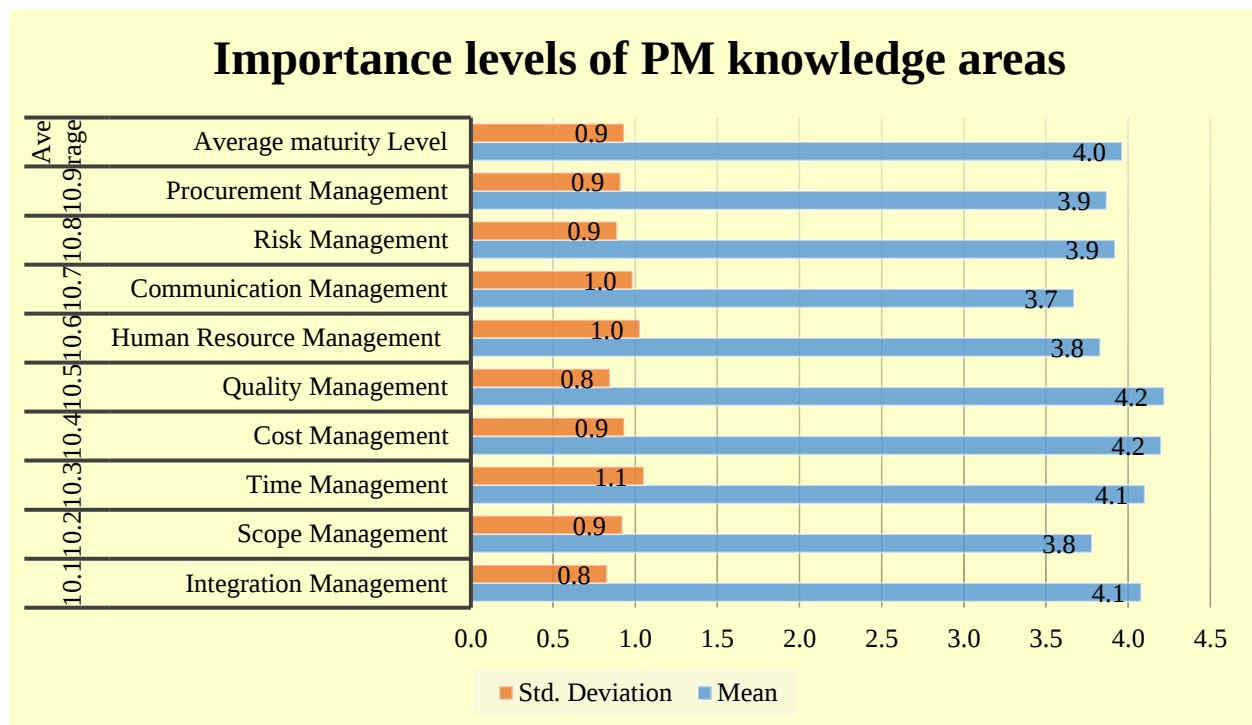


Figure 4-4: Importance levels of PM knowledge areas Source: Field survey (own), 2021

4.5 Correlation of importance ranking with the maturity levels

Table 4-13: Importance versus maturity levels of PM knowledge areas
Source: Field survey (own), 2021

No	Variables	Importance	Maturity
10.1	Integration Management	4.1	3.10
10.2	Scope Management	3.8	3.14
10.3	Time Management	4.5	2.94
10.4	Cost Management	4.3	2.68
10.5	Quality Management	4.2	3.07
10.6	Human Resource Management	3.8	3.10
10.7	Communication Management	3.7	3.23
10.8	Risk Management	3.9	2.81
10.9	Procurement Management	3.9	3.11
Average Importance Level		4.0	3.02

And the result from spearman coefficients showed that knowledge areas that are considered to be more important are found to be less matured. Spearman's rank correlation coefficient in this regard is found to be -0.772. This rank correlation coefficient between Importance level of knowledge areas and maturity level showed weak correlation between them.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary and conclusion

The main objective of this research was to assess the project management maturity level of company in Execution of ECDSWCo projects. Chapter four has presented the results and the detail findings of the survey. In this Chapter, Bearing this in mind the project maturity level criteria in the literatures, summary, conclusion and recommendation is forwarded.

The results showed that the level of organizational project management maturity of company has reached the third level of progressive stages of the maturity ladder. i.e project management maturity of company is found level -3 (Organizational Standards and institutionalized process) stage of Maturity ladder.

The results do not show the reality of the project management practices existing in the country which may be due the fact that the researcher used only questionnaire as an instrument and it is suggested that further future study is crucial with action research as the respondents may feel favoring their company when they give higher value for questionnaire parameters. Also case study, focus group discussion and interviews to get a result which best describe the real current practices in the country is necessary.

The result also confirmed that not all knowledge areas fulfilled the requirements of level three and is thus still at level two. According to the findings of the study, the major causes of the lower maturity levels are due to the low maturity levels of time, cost and risk management.

To conclude, the probable reasons for all the above lower maturity situation is the misunderstanding of the nature of project-oriented approach, government institutions tend to manage projects on the basis of managing operations, which arises a great number of problems and the rupture with the approach. The Company has to fill the identified gaps that still exist at level two and thereafter it may strive to the next level.

This strongly indicates that company does have formal project management Policies and Procedures but such processes are however inconsistently implemented. Project Management

Process Standards are not sufficiently established and practiced. The result confirmed that the ECDSWCo has not fulfilled the requirements of Level Four and is thus still at level Three. The Company has to fill the identified gaps that still exist at level three and thereafter it may strive to reach level four. The Company as a whole does possess some project management capabilities required for effective application of all the nine Project Management knowledge Areas in. but, the management should not be satisfied with what they have achieved rather they have to strive to reach the next level of maturity level by continually improving the project management process of the company.

The degree or level of the Company's Organizational project management maturity cannot be separated from that of its projects and therefore by implication the projects handled by company are also at Level three of project management maturity.

Although the overall average maturity value showed Level three, the Company still lacks in some Knowledge Areas didn't fulfill the requirements of Level three.

5.2. Recommendations

Based on the identified gaps on the knowledge areas, the following major recommendations are made for company has to fill the identified gaps thereafter strive to reach the next maturity level.

1. Project Management Information System (PMIS) should be used to gather, integrate, and disseminate the outputs of the project management processes is not yet established. Lack of integration management often causes delays, high costs and general execution problems in projects. The project management environments should have standardized processes for data, human resource, finance, schedule, procurement, quality management. Project team members should receive training in these standards and procedures.
2. Cost management variables such as cost center establishment, utilization of consistent financial standards and procedures and proper gathering of financial data for periodic reports should be practiced in the Company. Actual costs of projects should be tracked and reconciled with the original estimated costs. And cost centers should properly track actual expenditures against budget for specific line items. Also cost centers should be fully efficient to track actual project expenditures against budget for specific line items of the project. Some project and department Managers should have knowledge to control costs.

The project management environments should have standardized processes that support gathering of financial data for periodic reports

3. Internal cross team communication should occur through the top management committee meetings, but People who are not part of these meetings should also get the required information. And after each formal meeting, minutes should always be prepared and distributed to all affected parties. Also project status reporting procedures should be consistently followed; Project information should be regularly updated and be readily accessible to the organization at any times.. All project resource needs (such as hardware, software, and space), training and developmental needs of all team members should be clearly documented and should be in place for recognizing outstanding commitments or performance on a project.
4. Some Scope management practices should be frequently applied. Approved changes to the Scope statement should be on time communicated to the project team and the customer as well, and documented change control process should be consistently implemented. A review of the project plan, involving all participants, be better be conducted prior to creating a baseline project plan to ensure completeness and consistency.
5. As action plans are not always produced for risks to be mitigated or transferred. Risks should be consistently identified, documented or tracked by establishing by risk management strategy. Project risks should always be evaluated for priority and probability. Quality variances should be regularly reviewed by the quality baseline plan.
6. An evaluation process that meets specific criteria should be formalized to provide a consistent method for procurement proposal review and acceptance.
7. Most importantly ,as the results do not fully depict the reality existing in the country which compromises the validity of the results, the research has to be supplemented using action research, other case study, focus group discussion and interview. The mere dependence on questionnaires may be one of the reasons which resulted in some exaggerated results especially with respect to the existing risk management practices in our country as the respondents may show biased evaluation with intention of favouring their company..
8. Nevertheless, this research is meant only a starting work towards a long journey to the development of project management practices in the country as a whole and the company

in particular. More recent project maturity models and methods of analysis have to be tested. Future research should be done including more recent with respect to PMI extension or locally developed knowledge areas and using recent documents and researches done in the country in the area. Therefore, the study proposes further works that will address the more recent approaches.

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APPENDICES

Appendix A (Questionnaire)

Profiles of Respondents

Dear respondents, thank you for taking your time to answer these questions carefully. This will help me understand and improve current practices for managing projects. Please provide the requested information on the space provided.

General Information Questions:

1. Name of the person filling the questionnaire (optional)_____
2. Name of the project / Department / you are working in_____
3. Specify your gender.
 - a) Male
 - b) Female
4. What is your position in the Organization?
 - a) Department manager
 - b) Division & Section Head(Team leader)
 - c) Project Manager/Senior engineer
 - d) Supervisor/Forman/ Other staff member
5. Number of years you worked in the company
 - a) 0-3 years.
 - b) 4-6 years.
 - c) 7-9 years.
 - d) >9 years.
6. Have you received any project Management related training?
 - a) Yes.
 - b) No.
7. What is your Educational level?
 - a) Diploma
 - b) First Degree / Bachelor
 - c) Second Degree / Masters level
 - d) If other specify_____
8. Have you participated in project Related works.

- a) Yes
b) No
9. Do you believe that applying project management Knowledge for sugar factory is necessary to ensure continued process improvement projects in Sugar factory? a) Yes b)No

Project Management Maturity Survey Questionnaires

These questionnaires are intended to facilitate the researcher in assessing the Project Management Maturity Level of Project Execution in ECDSWC. It also encourages discussion of existing practices and processes within the company. Please Rate each of the following project management practice and mark (✓) on the space provided as per the following definition:-

1. =Never

3. =Usually

5. =Always

2. =Sometimes

4. =Frequently

1. Integration Management

It describes the Processes required to ensure that the various element of the project are properly coordinated. It consists of project plan development, plan execution, and integrated change control.

ITEM	STATEMENT	1	2	3	4	5
1.1	Integration Management					
1.2	Formal Organizational policies exist that include quality management, personnel and financial controls.					
1.3	A project planning methodology is documented and strictly adhered to.					
1.4	A project Management Information System (PMIS) is in place, consisting of the tools and techniques used to gather, integrate, and disseminate the output of the Project management Processes.					
1.5	There is an overall change control processes, to manage scope change, maintain performance measurement integrity and implement approved changes that affect cost, risk, and staffing.					
1.6	A documented configuration management procedure is in place to apply technical and administrative project management methodology.					
1.7	A Performance measurement criterion has been developed to establish how project progress is determined and reported.					
1.8	Project Progress Process is following as part of the project management with continuous improvement process.					

2. Scope Management

Describes the process required to ensure that the project includes all the work required and complete the project successfully. It consists of initiation, scope planning, scope definition, scope verification, and scope change control.

ITEM	STATEMENT	1	2	3	4	5
2.1	A Project scope statement is created for every project.					
2.2	Project Scope Statements are prepared with customer input throughout the development process					
2.3	A Documented change Control Process in place for managing change to the project Scope					
2.4	All Project participants indorse the Scope Statement.					
2.5	Approved changes to the scope statement are communicated to the project team and the client					
2.6	The Management, the project team, and the client review all project progression on a regular basis.					
2.7	A work Breakdown document (WBD) containing detailed description of the project's work is created for each project.					

3. Time Management

Describes the process required to ensure timely completion of the project. It consists of activity definition, activity sequencing, duration estimation, schedule development, and schedule control

ITEM	STATEMENT	1	2	3	4	5
3.1	The project requirements (deliverables) are reflected in the project's work Breakdown Structure (WBS).					
3.2	The project WBS and resource estimate are used to develop the project's baseline schedule.					
3.3	All project assumptions are documented when developing the project schedule.					
3.4	The project schedule identifies schedule constraints driven by the consumer, technology, suppliers, or management.					
3.5	A critical path analysis is performed on the project schedule during each progress update cycle.					
3.6	Project schedule are update on a regular basis against the baseline plan.					
3.7	Resource –constrained and resource – leveled schedule are created and maintained					
3.8	Schedules are optimized to conform to contract requirements.					

4. Cost Management

Describes the processes required to ensure that the project is completed within the approved budget. It consists of resource planning, cost estimating, cost budgeting, and cost control.

ITEM	STATEMENT	1	2	3	4	5
4.1	Cost centers are set-up to track actual project expenditures against budget for specific line items of the project schedule.					
4.2	The project management environment has processes that support gathering of financial data for Periodic reports.					
4.3	Project Financial Standards, processes and procedures are documented and consistently followed.					
4.4	Project team members receive training in financial standards and procedures.					
4.5	Project budgets are based on resource estimates and the resource plan.					
4.6	Actual cost are tracked and reconciled with the original estimated plan.					
4.7	There is a consistent process documenting all estimates and cost assumptions.					
4.8	A common list of cost categories exists for all project budgets					
4.9	A common documented process is in place for completing all financial procedures required to close a project.					

5. Quality Management

Describes the processes required to ensure that the project will satisfy the needs for which it was undertaken. It consists of quality planning, quality assurance, and quality control.

ITEM	STATEMENT	1	2	3	4	5
5.1	A document procedure exists for creating and maintaining a project workbook.					
5.2	Every project has Quality Assurance plan.					
5.3	The project team reviews all of the processes and procedures that apply prior to the start of every project.					
5.4	Common documented processes and procedures for technical performance, business performance, and quality performance are applied to every project.					
5.5	An initial review of the project plan, involving all participants, is conducted prior to creating a baseline project plan to ensure completeness and consistency.					
5.6	On a regular basis, variances are reviewed between the current progress status and project quality against the baseline plan.					
5.7	On a regular basis, project trend data are analyzed, based on metrics data					
5.8	Quality change control process for the project is established and followed.					

6. Human Resource Management

It describes the processes required to make the most effective use of the people involved with the project. It consists of organizational planning, staff acquisition, and team development.

ITEM	STATEMENT	1	2	3	4	5
6.1	A Staffing plan is created and followed for every project.					
6.2	Team members are selected to match roles and responsibilities which are defined and documented.					
6.3	All project resource needs (such as hardware, software, and space) are clearly documented.					
6.4	An organization structure is created each project.					
6.5	Customer human Resource requirements for the project are planned and documented.					
6.6	Project skills and developmental needs of all team members are documented.					
6.7	The training and developmental needs of all team members are documented.					
6.8	A documented process is in place for recognizing outstanding commitments or performance on a project.					

7. Communication Management

It describes the processes required to ensure timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project information. It consists of communications planning, information distribution, performance reporting, and administrative closure.

ITEM	STATEMENT	1	2	3	4	5
7.1	A Communication plan, documenting the required project communications, is created for each project and is followed by the project team.					
7.2	A project Announcement is made to both the customer's organization and yours to increase project awareness.					
7.3	After each formal meeting, minutes are prepared and distributed to all affected parties.					
7.4	Project status reporting procedures are established and followed.					
7.5	Project information is update and readily accessible to the organization at all times.					
7.6	Variance analysis for schedule, budget, and effort is communicated on a regular basis.					
7.7	Project status review meetings are held regularly with company leadership, customers, and suppliers.					
7.8	Project successes are documented for including into a close-Down Announcement and success story.					

8. Risk Management

It describes the processes concerned with identifying, analyzing, and responding to project risk. It consists of risk management planning, risk identification, risk analysis, risk response planning and risk monitoring and control.

ITEM	STATEMENT	1	2	3	4	5
8.1	A high-level risk assessment is completed at the start of each project.					
8.2	The high-level risks are rated as low, medium, and high probabilities.					
8.3	Project risks are documented using a common format.					
8.4	A risk assessment/ handling plan is created for projects.					
8.5	Project risks are evaluated for priority, probability, and impact.					
8.6	The method for managing each accepted risk is documented.					
8.7	Action plans are created for risks to be mitigated or transferred.					
8.8	Contingency schedule project status meetings include a review of a project's risks.					
8.9	Regularly scheduled project status meetings including a review of a project's risks.					

9. Procurement Management

It describes the processes required to acquire goods and services from outside the performing organization. It consists of procurement planning, request planning, solicitation, source selection, contract administration, and contract close out.

ITEM	STATEMENT	1	2	3	4	5
9.1	A standard (agreement) that includes project management requirements is issued for project goods and services.					
9.2	A procurement plan is in place that identifies what to procure and when is developed at the start of each project.					
9.3	Project timing and requirements are clearly defined in a formal contract or agreement.					
9.4	Contract Administration is an integral part of the project management.					
9.5	A "make-buy" analysis performed prior to the start of every project.					
9.6	Procurements Management processes have been documented					
9.7	All Procurements are identified with the specific plan					
9.8	An evaluation process that meets specific criteria has been formalized to provide a consistent method for procurement proposal review and acceptance,					
9.9	A contract change control process is in place.					
9.10	A contract close out process that records the evaluation of supplier performance in meeting their contract requirements is documented.					

Project management Knowledge areas comparison questions

General Direction

Please compare the relative importance of each of the knowledge area considering their relative contribution for success of project Management practice in the factory project Execution in MSF. Please mark (✓) using the following scale to give your option.

1 = Much less important 2 = Less important 3 = Equally important

4 = More important 5 = Much more important

Project management knowledge areas level of importance comparison

ITEM	Maturity Level knowledge Areas	Level of Importance				
		1	2	3	4	5
1	Integration Management					
2	Scope Management					
3	Time Management					
4	Cost Management					
5	Quality Management					
6	Human Resource Management					
7	Communication Management					
8	Risk Management					
9	Procurement Management					

Appendix B

1. Respondents response on Integration Management

No	Variables	Never	So met ime s	Usual ly	Freq uentl y	Always	Total
1	Project constraints are clearly defined for each project.	6.7	21.7	31.7	28.3	11.7	100
2	Formal Organizational policies exist that include quality management, personnel and financial controls.	3.3	15	35	26.7	20	100
3	A project planning methodology is documented and strictly adhered to.	10	25	45	13.3	6.7	100
4	A project Management Information System (PMIS) is in place, consisting of the tools and techniques used to gather, integrate, and disseminate the output of the Project management Processes.	10	26.7	36.7	25	1.7	100
5	There is an overall change control processes. To manage scope change, maintain performance measurement integrity. And implement approved changes that affect cost, risk, and staffing.	10	26.7	30	30	3.3	100
6	A documented configuration management procedure is in place to apply technical and administrative project management methodology.	3.3	25	40	25	6.7	100
7	A Performance measurement criterion has been developed to establish how project progress is determined and reported.	3.3	20	41.7	30	5	100
8	Project Progress Process is following as part of the project management continuous improvement process.	1.7	16.7	28.3	40	13.3	100

2. Respondent Responses on quality Management

No	Variables	Never	Sometimes	Usually	Frequently	Always	Total
1	A document procedure exists for creating and maintaining a project workbook.	12	18	30	35	5	100
2	Every project has Quality Assurance plan.	5	15	18	42	20	100
3	The project team reviews all of the processes and procedures that apply prior to the start of every project.	3	28	32	33	3	100
4	Common documented processes and procedure for technical performance, business performance, and quality, performance are applied to every project.	5	25	35	32	3	100
5	An initial review of the project plan, involving all participants, is conducted prior to creating a baseline project plan to ensure completeness and consistency.	5	22	47	23	3	100
6	On a regular basis, Variances are reviewed between the current progress status and project Quality against the baseline plan.	7	23	48	22	0	100
7	On a regular basis, project trend data are analyzed, based on metrics data	18	20	33	28	0	100
8	Quality Issues Resolution process for the project is established and followed.	2	27	28	38	5	100
9	Quality change control process for the project is established and followed.	2	22	35	33	8	100

3. Responses on Human resource Management

No	Variables	Never	Sometimes	Usually	Frequently	Always	Total
1	A Staffing plan is created and followed for every project.	3	17	27	40	13	100
2	Team members are selected to match roles and responsibilities, which are defined and documented.	2	18	30	42	8	100
3	All project resource needs (such as hardware, software, and space) are clearly document.	12	27	37	18	7	100
4	An organization structure is created each project.	7	15	28	33	17	100
5	Customer human Resource requirements for the project are planned and document.	7	18	35	32	8	100
6	Project skills and developmental needs of all team members are documented.	7	22	37	32	3	100
7	The training and developmental needs of all team members are documented.	18	27	32	22	2	100
8	A documented process is in place for recognizing outstanding commitments or performance on a project.	13	17	33	33	3	100

4. Respondent Responses on Communication Management of company.

No	Variables	Never	Sometimes	Usually	Frequently	Always	Total
1	A Communication plan, documenting the required project communications, is created for each project and is followed by the project team.	2	17	43	27	12	100
2	A project Announcement is made to both the customer's organization and yours to increase project awareness.	3	20	23	43	10	100
3	After each formal meeting, minutes are prepared and distributed to all affected parties.	5	22	37	28	8	100
4	Project status reporting procedures are established and followed.	3	17	32	37	12	100
5	Project information is update and readily accessible to the organization at all times.	5	17	27	42	10	100
6	Variance analysis for schedule, budget, and effort is communicated on a regular basis.	10	25	35	30	0	100
7	Project status review meetings are held regularly with company leadership, the customer, and suppliers.	0	22	32	35	12	100
8	Project successes are documented for including into a close- Down Announcement and success story.	12	13	33	35	7	100

5. Respondent Responses on Risk Management of company.

No	Variables	Never	Sometimes	Usually	Frequently	Always	Total
1	A high-level risk assessment is completed at the start of each project.	8	30	35	18	8	100
2	The high-level risks are rated as low, medium, and high probabilities.	8	23	42	22	5	100
3	Project risks are documented using a common format.	23	20	32	22	3	100
4	A risk assessment/ handling plan is created for projects.	15	30	32	20	3	100
5	Project risks are evaluated for priority, probability, and impact.	13	18	40	23	5	100
6	The method for managing each accepted risk is documented.	20	23	38	17	2	100

7	Action plans are created for risks to be mitigated or transferred.	10	18	50	17	5	100
8	Contingency schedule project status meetings include a review of a project's risks.	8	25	45	20	2	100
9	Regularly scheduled project status meetings including a review of a project's risks.	7	27	30	32	5	100

6. Response for procurement management of company.

No	Variables	Never	Some times	Usually	Frequently	Always	Total
1	A standard (agreement) that includes project management requirements is issued for project goods and services.	5	22	30	35	8	100
2	A procurement plan is in place that identifies what to procure and when is developed at the start of each project.	10	15	37	32	7	100
3	Project timing and requirements are clearly defined in a formal contract or agreement.	3	18	37	37	5	100
4	Contract Administration is an integral part of the project management.	5	17	27	43	8	100
5	A "make-buy" analysis performed prior to the start of every project.	10	22	42	25	2	100
6	Procurements Management processes have been documented	8	15	28	42	7	100
7	All Procurements are identified with the specific plan	7	22	38	27	7	100
8	An evaluation process that meets specific criteria has been formalized to provide a consistent method for procurement proposal review and acceptance,	3	30	35	28	3	100
9	A contract change control process is in place.	7	28	33	28	3	100
10	A Contract close out process that records the evaluation of supplier performance in meeting their contract requirements is documented.	7	18	33	33	8	100

7. Respondents response on Scope Management

No	Variables	Never	Sometimes	Usually	Frequently	Always	Total
1	A Project scope statement is created for every project.	5	11.7	18.3	36.7	28.3	100
2	Project Scope Statement are prepared with customer input throughout the development process	5	30	30	26.7	8.3	100

3	A Documented change Control Process in place for managing Change to the project Scope	11.7	21.7	46.7	20	0	100
4	All Project participants indorse the Scope Statement.	15	23.3	25	33.3	3.3	100
5	Approved changes to the scope statement are communicated to the project team and the client	1.7	21.7	26.7	38.3	11.7	100
6	The Management, the project team, and the client review all project progression on a regular basis.	1.7	21.7	33.3	38.3	5	100
7	A work Breakdown document (WBD) containing detailed description of the project's work is created for each project.	8.3	23.3	33.3	30	5	100

Appendix C

(Responses on Importance levels and correlation with maturity)

1. Responses on Importance levels of PM knowledge areas

<i>No</i>	<i>Variables</i>	<i>Much less important</i>	<i>Less important</i>	<i>Equally important</i>	<i>More important</i>	<i>Much more important</i>	<i>Total</i>
1	Integration Management	0	5	15	47	33	100
2	Scope Management	2	8	20	50	20	100
3	Time Management	2	8	15	28	47	100
4	Cost Management	0	5	20	25	50	100
5	Quality Management	0	5	12	40	43	100
6	Human Resource Management	3	7	22	40	28	100
7	Communication Management	2	12	25	42	20	100
8	Risk Management	0	7	23	42	28	100
9	Procurement Management	0	8	23	42	27	100

2. Importance versus maturity levels of PM knowledge areas

<i>No</i>	<i>Variables</i>	<i>Importance</i>	<i>Maturity</i>
10.1	Integration Management	4.1	3.10
10.2	Scope Management	3.8	3.14
10.3	Time Management	4.5	2.94
10.4	Cost Management	4.3	2.68
10.5	Quality Management	4.2	3.07
10.6	Human Resource Management	3.8	3.10
10.7	Communication Management	3.7	3.23
10.8	Risk Management	3.9	2.81
10.9	Procurement Management	3.9	3.11
Average Importance Level		4.0	3.02

Appendix D

(Maturity and importance index formula)

■ Mean value of PM knowledge criterion 1=

$$\frac{[(\text{No of respondents selecting 'NEVER'}) \times (1)] + [(\text{No of respondents selecting 'SOMETIMES'}) \times (2)] + [(\text{No of respondents selecting 'USUALLY'}) \times (3)] + [(\text{No of respondents selecting 'FREQUENTLY'}) \times (4)] + [(\text{No of respondents selecting 'ALWAYS'}) \times (5)]}{\text{Number of the sample size}}$$

■ Maturity level of PM knowledge 1 =

$$\frac{[\text{Mean value of criterion 1}] + \dots + [\text{Mean value of criterion n}]}{\text{Number of criteria for PM knowledge area 1}}$$

■ Overall maturity level of the company =

$$\frac{[\text{Maturity level for PM knowledge area 1}] + \dots + [\text{Maturity level for PM knowledge area 9}]}{9}$$

■ Relative importance index of PM knowledge area 1=

$$\frac{[(\text{No of respondents selecting 'Much less important'}) \times (1)] + [(\text{No of respondents selecting 'Less important'}) \times (2)] + [(\text{No of respondents selecting 'Equally important'}) \times (3)] + [(\text{No of respondents selecting 'More important'}) \times (4)] + [(\text{No of respondents selecting 'Much more important'}) \times (5)]}{\text{Number of criteria for PM knowledge area 1}}$$

■ Rank Spearman correlation formula

$$r_R = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

Where n = number of data points of the two variables

d_i = difference in ranks of the “ i th” element

The Spearman Coefficient, ρ , can take a value between +1 to -1 where,

A ρ value of +1 means a perfect association of rank

A ρ value of 0 means no association of ranks

A ρ value of -1 means a perfect negative association between ranks.

Closer the ρ value to 0, weaker is the association between the two ranks (MM Mukaka, 2012)

■ Kothari’s sampling formula

$$n = \frac{z^2 \cdot p \cdot q \cdot N}{e^2(N - 1) + z^2 \cdot p \cdot q}$$

Where

Z = z score level of confidence of estimate (in the case of 95% = 1.96): e = marginal error, 5%

P = Proportion of the sample successfully collected ($p=0.7$)

Q = Failure of sample ($1-0.7=0.3$)