Project management maturity Level in Oromia construction sectors: the case of Oromia Construction Corporation

By

Ashebir Hailu

A Thesis submitted to: Department of Civil Engineering, School of Civil Engineering and Architecture

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

Office of Graduate Studies

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DECLARATION AND RECOMMENDATION

Declaration

I hereby declare that this Master Thesis entitled "**Project management maturity Level in Oromia construction sectors: the case of Oromia Construction 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. It is being submitted for the partial fulfillment for the award of the degree of Master of Science in Civil Engineering (Specialization in Construction Engineering and Management) at Adama Science and Technology University school of Civil Engineering and Architecture.

Ashebir Hailu _____ _____

Name of student Signature Date

Recommendation

I/we, the advisor(s) of this thesis, hereby certify that I/we have read the revised version of the thesis entitled "**Project management maturity Level in Oromia construction sectors: the case of Oromia Construction Corporation**" prepared under my/our guidance by Ashebir Hailu submitted in partial fulfillment of the requirements for the degree of Master of science in Civil Engineering (Specialization in Construction Engineering and Management).

Therefore, I/we recommend the submission of revised version of the thesis to the department following the applicable procedures.

Bahiru Bewekt (PhD) _____ _____

Major Advisor Signature Date

APPROVED SHEET

I/we hereby certify that all the correction and recommendation suggested by the board of examiners are incorporated into the final thesis entitled "**Project management maturity Level in Oromia construction sectors: the case of Oromia Construction Corporation**" by Ashebir Hailu.

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We, the undersigned, members of the Board of Examiners of the thesis open defense by Ashebir Hailu.have read and evaluated his thesis entitled "**Project management maturity Level in Oromia construction sectors: the case of Oromia Construction Corporation**'' and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirement of the degree of Master of Science in Civil Engineering (Specialization in Construction Engineering and Management).

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ABSTRACT

This study is conducted to assess the project management maturity level and identify project maturity model appropriate to Oromia Construction Corporation with specific objectives of measuring and identifying actual project maturity level of the organization. The scope of the study is limited to be focused on measuring project management maturity of some Survey questionnaire taking random samples of staff members in the organization. The maturity assessment is based on a five-level project management maturity model devised by PM Solutions. The study's research design is descriptive and the research approach is mixed (qualitative and quantitative). The sample size of the study is sixty-four respondents of the questionnaire that are project managers, Engineers, Planner and others who participate for the implementation of projects. The sampling technique used is non-probability purposive sampling. Hence, Survey questionnaire and interview is prepared based on PM Solutions assessment check list to assess the project management maturity of Oromia Construction Corporation. Primary and secondary method of data collection is used from respondents and detail literatures respectively. Then the data collected is analyzed using statistical software package (SPSS V.26) and Microsoft excel. Results indicate that the project management maturity level of the organization is found to be at level 3.15. This shows that the organization is at good performance level but needs improvement on each project management knowledge areas in order to level up the maturity level to the next and the highest maturity level of the organization.

***Key words**: Project Management Body of Knowledge, Maturity Level, Maturity Model*

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LIST OF ACRONYMS

CMM	Capability maturity Model
CMMI	Capability maturity Model integrated
GDP	Growth domestic product
HSSE	Health, Safety, Security and Environment
K-PMMM	Kerzner Project Management Maturity Model
MM	Maturity Model
OCC	Oromia Construction Corporation
OGC	Office Of Government Commence
OPM3	Organization Project Management Maturity Model
PD	Process Definition
PM	Project Management
PMBOK	Project Management Body Of Knowledge
PMI	Project Management Institute
PMMM	Project Management Maturity Model
P3M3	Project, Program, Portfolio Management Maturity Model
(PM)2	Project Management Process Maturity
PP	Process Practice
SEI	Software Engineering Institute
UK	United Kingdom
WBS	Work Breakdown Structure

CHAPTER ONE

1. INTRODUCTION

1.1. Background of study

Project maturity is a concept used in an organizational context to describe the level of project management capability within an organization. The concept of Maturity derives from the root word 'mature' which equates to becoming fully grown and developed. According (Moutawei et al., 2017) , an organizations project management maturity is an indicator of the extent to which it possesses capability to continuously accomplish what it sets out to undertake to the level and quality it intended, or it desired through the use and practice of appropriate project management methodology(Hailemarkos, 2019). suggested that the state of organizational project maturity ascribes a meaning that equates an organization to a state of being perfectly conditioned to undertake implementation of its projects and deal with attendant challenges as it strives to achieve the intended goals and objectives for which the project was being implemented (Nenni et al., 2014)

Assessing of project management maturity enables organizations to identify on how to improve project implementation (Hadgu, 2018) and to identify where project management improvements are required, give clear indications of strengths and weaknesses, lead to significant competitive advantages, and benchmark an organization against its competitors(Woldegebriel, 2020). The significance of assessing project management maturity is also best understood in the context of the increasing preference and use of project management approaches and techniques in the delivery of projects and programs in both public and private sectors globally(Tembo & Rwelamila, 2018). The key features and attributes of project management maturity include the presence and use of standard methods to manage the knowledge areas of scope, time, cost, quality, communication, human resources, procurement integration, risk, safety and environment (PwC., 2007; Burke, 2003; Cooke & Tate, 2011; Ibbs&Kwak, 2002).

The construction industry is one of the largest industries in the world and plays significant role in the economy of both developed and developing countries. In leading industrial countries,

construction investment, expressed as percentage of gross national product ranges from approximately 4% in USA and 6 % in Canada to 7% in UK and 10% in Japan. For developing countries, major construction activities account for approximately 80 % of the overall capital assets, 10 % of their GDP, and greater than 50% of the wealth invested in fixed assets. Additionally, the construction business offers great employment opportunity, possibly next after agriculture [Ofori, G. (2006). Construction in developing countries: A research agenda, Journal of Construction in Developing Countries]. Moreover, the construction industry provides physical facilities satisfying a wide variety of social, economic and technical needs. In addition, it is the backbone of a variety of secondary feeding industries through which it acts as a major source of employment and upgrading of specialized skills.

One way of assessing project management maturity of an organization is deploying of an assessment tool by using different project management maturity models and structured standard questionnaires. Project Management Maturity models are also closely linked to project management maturity, which in turn, shows different concepts and ideas as they try to advance an organization towards being a mature organization. The aim of the models is to express maturity as a specific process of explicitly defining, managing, measuring and controlling the evolutionary growth of an entity. Maturity models therefore serve as a benchmark to determine whether its project management processes are adequate; enable it to compare its management of projects with best practice or against its competitors (Hillson, 2003). Project Management Maturity models define a set of maturity levels used for the management of projects. Most typically have five maturity levels, each comprising some process areas (or focus areas), which are necessary for the management of projects. Project management maturity (PMM) is a level of maturity to which an organization has applied project management techniques and is using them in a proper and mature way (Moutawei et al., 2017a). A project management maturity model provides the progressive development of an enterprise-wide project management approach, methodology, strategy and decision-making process (PM Solutions, 2011). An organization has achieved full project management maturity (the highest level) when it has met the requirements and standards for project management effectiveness and can demonstrate improvements such as on-time project delivery, cost reductions, organizational efficiency and profitability (PM Solutions, 2011).

1.2. Statement of the Problem

Maturity in organizational context is a state that creates perfect condition for an organization to achieve its desired objectives (Mateen, 2015). Mateen (2015) provides perfect condition to handle projects. According to Ferreira and Pereira (2015) maturity models used in the diagnosis of Project Management culture in organizations are helpful to define a set of actions and measures to better its performance as an organization.

Based on this fact, various researches were conducted and the studies found out that organizations with a more established project management practice such as engineering based organizations exhibit a more mature project management practice as compared to organizations in other industries(Moutawei et al., 2017a).

Assessment of project management maturity of Ethiopian construction sector by Abadir (2011) found out that the overall maturity level of the sector was low. The research also showed that project management practices are largely informal. As indicated by different researchers, construction industry's substantial involvement in the overall economy of developing countries and the critical role it plays in the development of these countries, the performance of the industry still remains generally low. (Spalek, 2014), noted. Given the low level of project management maturity and gap in literature, it is better to assess the project management maturity of Oromia Construction Corporation (OCC) in Oromia Construction Industry Sectors. Many organizations conduct a periodic research to perform a health check (assess) of its level of project management maturity to properly ascertain the current state of project management and make corrections for any deficiencies noted. Measuring project management maturity through a formal assessment process gives an organization a benchmark on their current environment, how project management is being used, and most importantly, where to focus improvement efforts in order to advance to higher levels of maturity and improve project success. Given such a worldwide diffusion of research on project management maturity and its importance, it is hard to get evidence or research aimed at studying its current level of project management maturity, highly matured and least matured knowledge areas (strength or weakness) in OCC even though the company is managing

and implementing many construction projects as main contractor in the country supported by Oromia Nation Government since it established by Regional Government.

To fill the gap and as well as to level the maturity of the organization for their performance of project implementation, this research will be identified where the organization is matured and/or immature with project management knowledge of areas.

1.3. Research Questions

The research will try to answer the following questions:

- What is the level of maturity with respect to each of the project management knowledge areas?
- Which maturity Level more appropriate for the organization?
- How are PMBOK's Project Management knowledge areas being practiced by OCC?

1.4. Objectives of the Study

1.4.1. Main Objective

The general objective of this study is to assess the project management maturity level and identify project maturity model appropriate to Oromia Construction Corporation.

1.4.2. Specific Objectives

1. To propose the most selected project maturity model works for Oromia Construction Corporation.

2. To identify the level of project management maturity at Oromia Construction Corporation.

3. To compare project maturity level of Oromia Construction Corporation with Industrial Bench mark.

1.5. Significance of the Study

Mainly, this research has significance for Oromia Construction Corporation as it helps the organization to understand its current status regarding project management maturity and provide a road map for improvement action by identifying priority for project management knowledge areas. In addition, the study will grant an opportunity for the organization to compare itself with an industry standard, to set out its bench mark or a baseline for future improvement of the capability and sustainability of the organization.

1.6. Scope of Study

Oromia Construction Corporation can be set up to handle many activities related with projects undertaken and they can be established strategic plan and individual project plan for each project. For the sake of quality of the research and time as well as resource constraints, this study will be focused on measuring project management maturity of some projects taking random samples in the organization. The structured questionnaires and interview questions will be limited to the PMBOK 7th edition's fourteen project management knowledge areas.

- To study existing Levels of the project management
- To compare the different maturity Levels according to their process area and application in particular field
- To implement the one Level among the existing Level to the organization.

1.7. Limitation of the Study

Due to different constraints such as finance and resource, the study is limited both in scope and depth. Because of the constraints questionnaire and interview were used to get responses of the company. In addition to this, information regarding to the fourteen knowledge areas and including many questionnaires the experts who gave respondents may exhausted in some time to respond timely.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Introduction to Literature Review

In this part of the research work, literature related to the concepts of projects and project management, Project and Non-Project organizations, and Project Management Maturity are discussed in detail. Previous empirical studies regarding Project Management Maturity are reviewed, analyzed and compared.

2.2. The Concept of Project

A variant of definitions has been given to projects by different authors. The definition given by PMI for a project is a temporary endeavor undertaken to create a unique product, service, or result (PMI Standards Committee & Project Management Institute, 1996). A more elaborate definition states a project is a sequence of unique, complex, and connected activities that have one goal or purpose and that must be completed by a specific time, within budget, and according to specification (Wysocki, 2014). Likewise, Kerzner (2009) stated that a project can be considered to be any series of activities and tasks that have a specific objective to be completed within certain specifications, have defined start and end dates, have funding limits (if applicable), consume human and non-human resources, are multifunctional (i.e., cut across several functional lines). Project has also been defined as a unique set of coordinated activities, with definite starting and finishing points, undertaken by an individual or organization to meet specific performance objectives within defined schedule, cost and performance parameters' (PMI Standards Committee & Project Management Institute, 1996).

The common theme of these definitions revolves around some important features of projects. The features include a defined time frame (temporary), an objective from the inception, resources and their limitations, and specifications and others. According to (PMI Standards Committee & Project Management Institute, 1996), a project has a definite beginning and end. But this does not necessarily mean the duration is short, it does not also apply to the product, service, or result

created by the project. The project comes to an end at the end of the duration (when the project's objectives have been achieved) or prior to the scheduled duration (when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists). Wysocki (2014),(Abadir, 2011) also stated that Projects have a specified completion date. This date can be self-imposed by management or externally specified by a client or government agency. Being able to give a firm completion date requires that a start date also be known.

The task of the project is to deliver a particular product, service or result (Maylor, 2010). Projects must have a single goal. However, very large or complex projects may be divided into several subprojects, each of which is a project in its own right (Wysocki, 2014). Nicholas and Steyn (2012) also stated that, a project involves a single, definable purpose and well-defined end items or deliverables.

2.3. Project Management

The foundation of the project management can be traced back to as early as beginning of civilization. But the modern project management has its roots in the Second World War and is developed in construction and defense industry during the industrial revolution(Mateen, 2015a). Since then, the concept of project management has been showing improvement and associations and institutions focused on project management have contributed a lot.

According to the Project Management Institute, project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (PMI, 2013). Likewise the Association for Project Management also defined project management as the application of processes, methods, knowledge, skills and experience to achieve the project objectives (Moutawei et al., 2017). These two definitions are oriented towards application of various means to achieve project objectives.

On the other hand, project management has been defined from management functions perspective by Kerzner (2009). stated that, project management is the planning, organizing, directing, and controlling of company resources for a relatively short-term objective that has been established to complete specific goals and objectives.

2.4. Construction Projects and Their Management

The nature and characteristics of construction projects have some differences from other kinds of projects. The Construction extension to the PMBOK Guide by (PMI Standards Committee & Project Management Institute, 1996), described the generally accepted principles for construction projects that are not common to all general project types. Inherently, construction projects more often occur in an ever-changing, complex environment, and often with a high degree of risk. PMI (2016) further added that construction projects simultaneously address the geography, physical environments, existing infrastructure, communities, site conditions, and a wide range of stakeholder requirements. Moreover, PMI (2016) noted that construction projects typically carry large penalties or damages for projects that are completed late.

Construction plays a major role in both economic and social development. However, according to Guangshe et al. (2008), one major problem in the construction industry is its large-scale investment which is in a high contrast with its low benefit and inferior management. This problem magnifies in developing countries like Ethiopia. Therefore, project management is vital in order to implement and control the construction projects efficiently.

The major task of project management in construction projects is to coordinate various professionals working in the project, so that they have a maximal contribution to the project (Chartered Institute of Building, 2002). According to Hendrickson (2008), in addition to the knowledge of general and project management, the management of construction projects requires an understanding of the design and construction processes. Hendrickson (2008) summarized the functions of project management in construction as follows:

- Specifying project objectives and plans, which includes: defining the scope, preparing the budget and schedule, setting performance requirements, and selecting project participants,
- Maximum utilization of resources through labor, materials and equipment procurement in accordance with a plan and schedule.

- ❖ Implementing multitude of operations by properly coordinating and controlling the processes of planning, estimating, designing, contracting and construction.
- ❖ Developing effective communications and mechanisms for conflict resolutions among various stakeholders.

2.5. Program and Program Management

According to (Spalek, 2014) a collection of related projects is called a program. A program is a group of related projects, subprograms, and program activities managed in a coordinated way to obtain benefits not available from managing them individually (PMI Standards Committee & Project Management Institute, 1996).

Program management is the co-ordinate management of related projects, which may include related business-as-usual activities that together achieve a beneficial change of a strategic nature for an organization(Seelhofer& Graf, 2018).

2.6. Portfolio and Portfolio Management

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

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

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

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

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

2.7. Project Management Knowledge Areas

Knowledge Area represents a complete set of concepts, terms, and activities that make up a professional field, project management field, or area of specialization and they are used on most

projects most of the time (PMI, 2013). Most of the knowledge areas in the PMBOK guide are applicable to construction projects with modifications to address the unique attributes, practices, and applications. The Construction Extension of the PMBOK Guide (PMI, 2016) provides these modifications and additional knowledge areas applicable to construction projects. The added knowledge areas are Project Health, Safety, Security, and Environmental (HSSE) Management; and Project Financial Management. Project Equipment Management and Materials Management are incorporated under Project Resource Management knowledge area beside Human Resource Management in the Guide. But in this research, the fourteen Resource knowledge areas were treated individually for the sake of clarity. Furthermore, according to Sharma (2002), equipment and material costs account for up to 70% of the costs of a construction project. Therefore, the two knowledge areas were given due attention. The HSSE management knowledge areas were generalized to Project Safety Management. In total, there were 14 knowledge areas of construction project management evaluated in this research endeavor.

2.7.1. Project Scope Management

According to PMI (2013), Project Scope Management includes the processes required to ensure that the project covers all the work required, and only the work required, to complete the project successfully. According to Wysocki (2014), this knowledge area focuses in identifying and documenting of client requirements. In the construction industry, contract documents, and design drawings define the scope (PMI, 2016). The processes involved in this knowledge area are: Plan Scope Management; Collect Requirements; Define Scope; Create WBS; Validate Scope; and Control Scope (PMI, 2013).

2.7.2. Project Time Management:

Project time management includes the processes required to manage the timely completion of the project (PMI, 2013). It provides time estimates for both the duration of a project task and the actual effort or labor time required completing the task. It also involves comparing estimated times to actual times as well as managing the schedule and cost variances (Wysocki, 2014). The overall purpose of time management is to develop the project schedule, manage that schedule, and ensure the timely completion of the project (Crawford, 2002; PMI, 2013). Since construction is heavily

dependent on time restrictions within contracts, there is an added emphasis to finish the project within the given schedule. As a result, this knowledge area in construction involves complex challenges mainly due to the magnitude of stakeholders involved (PMI, 2016). The processes involved in this knowledge area are: Plan Schedule Management; Define Activities; Estimate Activity Resources; Estimate Activity Durations; Develop Schedule; and Control Schedule (PMI, 2013).

2.7.3. Project cost management:

Project Cost Management involves identifying required resources, estimating the cost of those resources, developing a project baseline to set a target and comparing progress against the target baseline (Crawford, 2002). Project Cost Management in construction includes cost estimating, cost budgeting, cost monitoring & control, and further entails managing the day-to-day project costs (PMI, 2013). The knowledge area is of vital importance to a construction project's success as it impacts the organization's profitability. According to (PMI, 2013), challenges to cost management in construction include the vast number of stakeholders involved, quality and availability of skilled labor in a particular area, weather impact on productivity, transportation in remote areas and fluctuations in material prices. Tracking and managing these costs involve detailed planning, monitoring and control. The processes involved in this knowledge area are: Plan Cost Management; Estimate Cots; Determine Budget; and Control Costs (PMI, 2013).

2.7.4. Project quality management:

According to (PMI, 2013), Project Quality Management includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project requirements are met and validated. The knowledge area is integral to risk, safety and environmental management, and applies to all attributes of project management as it manages the quality of both process and product of a construction project (PMI, 2016). The processes involved in this knowledge area are: Plan Quality Management; Perform Quality Assurance; and Control Quality (PMI, 2013).

2.7.5. Project human resource management:

The overall purpose of Project Human Resource Management is to identify and define the required set of skills for specific project activities, to identify individuals who are entitled with those skill sets, to assign roles and responsibilities for the project, to manage and ensure high productivity, and to forecast future resource needs (Crawford, 2002). Generally, it includes the processes that organize, manage, and lead the project team. The processes involved in this knowledge area include: Plan Human Resource Management; Acquire Project Team; Develop Project Team; and Manage Project Team PMI (2013).

2.7.6. Project Equipment Management:

Project Communications According to Sharma (2002), the cost of equipment in a construction project varies from 10 to 30 % of the total project cost, depending upon the extent of mechanization. Proper planning, selection, procurement, installation, operation, maintenance and equipment replacement policy plays an important role in equipment management (Sharma, 2002). Sharma (2002) added that the main task for equipment management is to reduce downtime, achieve optimum equipment utilization and increase production at minimum cost. The processes involved in this knowledge area include: Equipment Acquisition; Assignment Planning; Equipment Tracking and Monitoring; and Equipment Maintenance (Yimam, 2011).

2.7.7. Project Materials Management:

As Sadiwala (2007) put it, "materials management is the process by which an organization is supplied with the goods and services that it needs to achieve its objectives of buying, storing and providing the appropriate material of right quality, right quantity at right place in right time so as to coordinate and schedule the production activity in an integrative way for an industrial undertaking." The processes involved in this knowledge area include: Material Planning; Managing Material Procurement Process; Monitoring and Controlling of Material use and Material Availability (Yimam, 2011).

2.7.8. Project communication management:

Project Communications Management includes the processes required for ensuring projects to plan, create, collect, distribute, manage, store, retrieve, control, monitor, and dispose project information in a timely and appropriate manner (PMI, 2013). Communication within construction environments presents special challenges because of the various stakeholders and the interdisciplinary nature of project teams (PMI, 2016). Furthermore, the information is used for decision making (Crawford, 2002). The processes involved in this knowledge area include: Plan Communication Management; Manage Communications; and Control Communications (PMI, 2013).

2.7.9. Project risk management:

Project Risk Management includes the processes of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project, with objectives of increasing the likelihood and impact of positive events, and decreasing the likelihood and impact of negative events in the project (PMI, 2013). Every construction project faces a variety of uncertain situations such as: complex technical processes, long duration and aggressive schedules, material shortages, changing environment, regulatory requirements, etc. (PMI, 2016). The processes involved in this knowledge area include: Plan Risk Management; Identify Risks; Perform Qualitative Risk Analysis; Perform Quantitative Risk Analysis; Plan Risk Responses; and Control Risks (PMI, 2013).

2.7.10. Project procurement management:

Project Procurement Management includes the processes necessary to purchase or acquire products, services, or results needed from outside the project organization in support of the project (PMI, 2013; Crawford, 2002). It also includes the contract management and change control processes required to develop and administer contracts or purchase orders issued by authorized project team members. Construction projects are mostly based on the procurement of contractual arrangements between sellers and buyers, and include the procurement of project equipment and materials (PMI, 2016). PMI (2016) added that typical contractual relationships exist between the

owner and the general contractor, and between the general contractor and its subcontractors and suppliers. The processes involved in this knowledge area include:

2.7.11. Project stakeholder management:

Project Stakeholder Management includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution, along with continuous communication with stakeholders to understand their needs and expectations, and manage conflicting interests (PMI, 2013). According to PMI (2016), in construction projects, the owner, consultants, and contractor are primary stakeholders who in turn bring other stakeholders to the group. The community, insurance providers, financial institutions, and regulatory agencies are also some of the most common stakeholders in construction projects (PMI, 2016). The processes involved in this knowledge area include: Identify Stakeholders; Plan Stakeholder Management; Manage Stakeholder Engagement; and Control Stakeholder Engagement (PMI, 2013).

2.7.12. Project Safety management:

Project Safety Management processes include all activities which determine safety policies, objectives, and responsibilities to ensure the project is planned and executed in a manner that prevents accidents so as to avoid personal injury, fatalities, or property damage (PMI, 2016). The safety of construction crews and project teams is a top challenge on construction projects and should be a priority in all levels of the organization (PMI, 2016). The processes involved in this knowledge area include: Plan Safety Management; Perform Safety Assurance; and Perform Safety Control (PMI, 2016).

2.7.13. Project financial management:

Project Financial Management determines how the project will be financed, including the processes to acquire and manage the financial resources for the project; it is more concerned with revenue sources and monitoring net cash flows for the construction project than with managing day-to-day costs (PMI, 2016). The processes involved in this knowledge area include: Perform Financial Planning; Perform Financial Control; Administration and Records (PMI, 2016).

2.7.14. Project integration management:

It includes the processes and activities to identify, define, combine, unify, and coordinate the various processes and project management activities within the Project Management Process Groups (PMI, 2013). This Knowledge Area addresses the glue that links all of the deliverables from the Process Groups into a unified whole (Wysocki, 2014).

2.8. Project Management Maturity

The Webster dictionary (1988) defines ‘‘mature’’ as being ripe or having reached the state of full maximum development; hence maturity is the quality or state of being fully developed. According to the definition of Paulk et al. (1993), maturity is the extent to which a specific process is explicitly defined, managed, measured, controlled, and effective. According to PMI (2003), maturity is the level of sophistication indicating an organization’s current project management processes and practices. Similarly, Kerzner (2009) defined maturity in project management as the implementations of a standard methodology and accompanying processes such that there exists a high likelihood of repeated successes.

Maturity implies a potential for growth in capability; it further indicates the richness and effectiveness of an organization’s process and how it’s consistently applied throughout the organization’s projects (Paulk et al. 1993; Crawford, 2002). Andersen & Jessen (2002) stated that maturity might refer to a state where the organization is in a perfect condition to achieve or reach its project objectives. Furthermore, a concept of maturity can also refer to the comparative level of advancement that an organization has, regarding any given activity or sets of activities (Gorecki, 2015). Andersen & Jessen (2002) measured maturity along three dimensions: capability to carry out different tasks (knowledge), willingness to carry them out (attitude), and actually doing them (actions).

Whereas, project management maturity is the progressive development of an organization-wide project management methodology, approach, strategy and decision-making process (Ofori & Deffor, 2013). According to the findings of (PM Solutions, 2014), organizations of different industries have seen significant value by increasing their project management maturity level,

showing: decreased number of failed projects, improved customer satisfaction, higher number of projects delivered under budget, and improved productivity.

Sarshar et al., (2000) compared mature and immature construction organizations by modifying the comparisons done by Paulk et al. (1993). "A mature organization possesses an organization-wide ability for management of design, construction and maintenance activities. The processes are accurately communicated to all employees and activities are carried out in accordance with the planned processes. The processes mandated are fit for use and consistent with the way the work gets done. Roles and responsibilities within the defined processes are clear throughout the projects across the organization. On the other hand, in an immature construction organization, processes are generally improvised by practitioners as well as project managers. Even if a process has been specified, it is not rigorously adhered or implemented. The immature organization is reactionary as managers usually focus on fire fighting. The quality assurance and quality review are often cut short when projects fall behind schedule, hence product quality is difficult to predict" (Sarshar et al., 2000).

According to Ahern et al. (2008), an organization matures by steadily improving its process capability, which is the inherent ability of a process to produce planned results. As the capability of a process increases, it becomes measurable and predictable, and the most significant causes of poor quality and productivity are controlled or eliminated (Ahern et al., 2008).

Generally, having a fully matured organization is just a theoretical concept. According to Andersen & Jessen (2002), in the real world, finding the fully matured organization is impossible; the authors concluded, "no one has reached the stage of maximum development and no one will."

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(Abadir, 2011). 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).

Project Management Maturity models are just one such means that organizations can use in their pursuit of improving their Project Management capability(Abadir, 2011).According to(Abadir, 2011),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 against the practice of its peers in the industry in general or best practice in the industry (Man, 2007). In addition, maturity models help frame improvement efforts by identifying priority area and suggesting improvement subjects.

What is common in most of Maturity definitions is the idea of consistent and repeated practice, measurement and improvement or advancement. According to (Paulk etal, 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; and the necessary information and database for doing that [(Office of Government Commerce (OGC)) (Supic, 2005)]. "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).

2.9. Project Management Maturity Models

2.9.1. Introduction

As most authors agree, the Crosby's model developed in 1979 was the basis for the development of maturity models. The model was based on 5 maturity levels, linked to quality standards in an organization. Based on this Crosby model, Capability Maturity Model (CMM) was developed to evaluate the management of software process (Moutawei et al., 2017).

Kerzner (2001) stated that the foundation for achieving excellence in project management can best be described as the Project Management Maturity Model (PMMM). A maturity model offers a framework with a number of defined levels of capability against which an organization's current position can be assessed objectively; it also defines the next level of capability to which the organization can aspire, creating an improvement target for development programs (Hillson, 2003).

Maturity Models are process models (measurement tools) that are developed to assess the maturity of organization's (can also be business unit, or department) processes and practices to identify opportunities for improvement and point out strengths and weaknesses. Maturity models are also used as a framework to guide improvement efforts [(Jugdev & Thomas, 2002), (Cleland & Ireland, 2002)]. Most of the current Maturity models have their origin in the field of total quality management. The concept is built on the Deming, Juran, and Crosby quality paradigm: "Quality products are a result of quality processes" [(Chrissis, Konrad, & Shrum, 2003), (Paulk etal, 1993)]. Further, Maturity models differ from one another in the concepts they embody and the suggestions

they make as to how the path to maturity looks like. Moreover, different maturity models for PM may define maturity differently and measure different things to determine maturity (Man, 2007). As (Paulk etal, 1993) puts clearly "(Maturity models) are not silver bullets and do not address all of the issues that are important for successful projects. The models are developed only to provide an orderly and disciplined framework within which to address (certain) management and engineering process issues".

A PMMM can be a roadmap showing an organization how it can systematically move to more mature levels of efficiently (Crawford, 2002). PMMMs identify organizational strengths and weaknesses, in addition to providing benchmarking information (Jugdev & Thomas, 2002). PMMMs provide a common set of process requirements that capture successful practices and practical knowledge in a format that can be used as a guide in setting priorities (Ahern et al., 2008). In general, Crawford (2002) put forward the following benefits of using PMMM in an organization:

Determining the maturity of the organization's project management processes
Mapping out a logical path to improve the organization's processes
Setting priorities for short-term process improvement actions
Tracking progress against the organization's project management plan
Building a culture of project management excellence

PMMMs can also be used as a basis for comparing different organizations. (Crawford, 2015) remarked that any model selected to measure project management maturity must devise a way for progressive development or improvement. That is, pointing what specific actions should be implementing to move the organization forward.

The PMMM's assessment methods can be "continuous" and "staged" models. The continuous model establishes a baseline for an organization through an assessment: specific elements are then used as criteria to establish what to be improved and at what rate (D. Arda BESET, 2007). The staged model uses a 5-step model that establishes criteria for each step where each is considered

essential to project maturity and given similar weight for improvements (Mateen, 2015b; Moutawei et al., 2017c). found out that most PMMMs use the staged method model.

According to (Moutawei et al., 2017c), framework provided by maturity model enables organizations to access and improve its processes. (Nikolaenko & Sidorov, 2023) argues that project maturity provides a path and framework which enables firms to achieve excellence in project management. Project management maturity models (PMMM) provides best practices and road map to improve project portfolio practices. (Marzouk et al., 2012)also argued that PMMM, if utilized successfully, provides framework on how to improve performance for projects repeatedly and systematically. Backlund, (2015 (Cooke-Davies & Arzymanow, 2003)also that successful implementation of improvement requires identification of strengths and weakness in project management capabilities. (Grant & Pennypacker, 2006)also described PMMM as a mode using which organization identifies its area of strength and weakness. Once these areas are identified then improvements are implemented to achieve excellence.

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

2.9.2. Project Management Maturity Levels

(Backlund et al., 2014a) cited the statement of Dinsmore (1998), “Companies demonstrate behaviors that reflect their maturity levels.” (Machado et al., 2021a) described it, a maturity level is a well-defined evolutionary plateau towards achieving mature processes and each maturity level, comprising a set of process goals, provides a foundational layer for continuous process improvement. Hence, achieving each level of the maturity framework results increment in the

process capability of the organization (Paulk et al., 1993). The levels also help an organization prioritize its improvement efforts (Sukhoo et al., n.d.).

Most of the maturity models assume that organizations progress through five stages of maturity adapted from the pioneer CMM model: initial level (where no established PM practices exist), repeatable level, defined level, managed level and optimizing level (where the company is fully mature) (Cooke-Davies & Arzymanow, 2003; Pretorius, et al., 2011). Grant & Pennypacker (2006) argue that there is no empirical support to assume that the effort and change required to progress from level 1 to level 2, is the same as that required to progress from level 2 to level 3, or any subsequent levels; which makes the difference between the levels of maturity non-uniform. The authors, therefore, used the median computation for maturity level assessment in their study.

Wysocki (2004) observed that level 3 is the transition between having a documented process and having all project teams using the process. Level 3 defines project management process practice (PP) level maturity; level 2 defines project management process definition (PD) level maturity; levels 1, 4, and 5 define both PD and PP level maturity (Wysocki, 2004).

In line with Grant & Pennypacker (2006), Cooke-Davies & Arzymanow (2003), defined the five levels as an ordinal scale for measuring the maturity of a process. According to Kerzner (2001), the five levels enable repeatability in terms of assessments and permit a measurement of progress over time; they also portray a firm's evolution from immature PM practices to solid practices. Hence, a progressive increase in maturity levels mostly needs major changes in any organization, which usually happens gradually (Crawford, 2002; Jugdev & Thomas, 2002). Generally, assessing Project Management Maturity level of an organization points out how good the organization is at managing its projects.

The maturity level for an organization is usually determined by a questionnaire and/or by conducting various in-depth interviews with relevant personnel; it can also be determined by collecting evidences of using project management methods and/or techniques, which are compared to outlined standards (Crawford, 2002; Jugdev & Thomas, 2002; Kerzner, 2001; PMI, 2003).

2.9.3. Limitations of PMMMs

Several criticisms and shortcomings of the PMMMs have been raised by different practitioners and researchers. However, many authors regard the criticisms by Jugdev & Thomas (2002) as the most thorough and critical ones, some of which are presented below:

> PMMMs emphasize explicit knowledge that can be codified and transferred readily, but they do not assess implicit knowledge or the organization's intangible assets (Jugdev & Thomas, 2002)
>
> PMMM assets are tangible, they are in the form of templates, documents, manuals, surveys or guidelines. They focus on the know-what within the firm, and moving to the next higher maturity level does not take the know-how into account (Jugdev & Thomas, 2002)
>
> PMMMs are not flexible when flexibility is needed for change management and in keeping with quality improvement principles (Jugdev & Thomas, 2002)
>
> PMMMs are usually oriented in identifying problems and increasing awareness but not solving problems (Jugdev & Thomas, 2002)
>
> The five maturity levels don't provide enough granularity in measuring progress over time (Jugdev & Thomas, 2002)
>
> With their emphasis on standard project management bodies of knowledge, they can be overly disciplinary, impractical and overwhelming as methodologies (Jugdev & Thomas, 2002)
>
> From a theoretical perspective, the field of PMMMs lacks empirical support for determining which competencies contribute most to project success (Jugdev & Thomas, 2002)
>
> PMMs are not difficult to imitate and do not lead to a sustained competitive advantage, rather they mostly lead to competitive parity or temporary competitive advantage (Jugdev & Thomas, 2002)

In line with Jugdev & Thomas (2002), (Pretorius et al., 2011; Labuschagne & Marnewick, 2009; and Isaacs, 2018) also argue that there is lack of empirical evidence that associates success with achieving a specific maturity level. Moreover, Andersen & Jessen (2003) added that there is

missing standardization among different PMMMs and assessments are vulnerable to a frequent subjective bias. Whereas, Hillson (2003) observed that the complex structure of PMMMs can make assessments ifficult to perform, interpret and implement. In addition, Yimam (2011) found two major limitations in PMMMs, which are: the bunching of project management practice maturity with process maturity, and neglecting the "Practice Maturity" dimension in the assessments.

Despite the aforementioned shortcomings, many authors believe that PMMMs have made a significant contribution to the field. According to Jugdev & Thomas (2002), PMMMs have heightened awareness on competences and offer an initial paradigm with which to assess organizations and their project management maturity.

2.10. Review of Different Project Management Maturity Models

Beginning to be developed in the 1990s, PMMMs of more than 30 are currently available (Grant & Pennypacker, 2006). In his PhD dissertation, Paisan (2011) listed 54 different maturity models, of which 11 were PMMMs. The majority of PMMMs are based on the Capability Maturity Model (CMM) comprising of five distinct levels. Most of them use project management body of knowledge for the maturity assessment.

This section summarizes the analysis of a set of different MM. Since the 1990s, more than 30 MM have emerged and most of them have a graduation chart set of five levels of maturity. Usually, the classification is aligned as level one—no practice of project management methodologies at all, to level five, the optimum stage of implementation of those methodologies (Pretorius et al. 2012). The authors summarize the MM in a wide range of areas, from software engineering to asset management, information governance and construction management. The goal was to select several maturity models to reflect a diverse approach without focusing on a single area. Table 1 summarizes the information collected from the literature review, the creation of which completes Stage 1, with 39 PMMMs identified.

Table 2.1 Synthesis of the identified maturity models. Source(Machado et al., 2021b)

No	Maturity Model	Area of implementation
1	ISO/IEC TS 33060:2020	Information System (IS)
2	CMMI	Construction/ Information System (IS)
3	MDD	Industry/Manufacturing/IS
4	MB-V2M2	IS
5	DPMM	IS
6	BPMM	Business Process (BP)/IS
7	OMG BPMM	BP/IS
8	MDM DGM	IS
9	Gartner BPM MM	BP/IS
10	Oracle DGMM	IS
11	GITC MM	Information Technology (IT)
12	IT-CMF	IT/IS
13	BITA MM	IT
14	The IT service CMM	IT
15	RMMM	Education/IS
16	Gartner EIM-MM	IS
17	RDM MM	IS
18	ECM MM	IS
19	Data Flux DGMM	IS
20	DAM MM	IS
21	EW Soutions DGMM	IS
22	AMMM	Asset Management/IS
23	RMM	BP
24	IBM Data Governance Council MM	IS
25	COBIT MM	IT

26	Knowledge Logistics DGM	IS
27	IGMM	IS
28	SDGMM	IS
29	FAA-CMM (SEI)	Aviation
30	OPM3	**Construction/ IT /BP**
31	P3M3 (OGC)	**Construction**
32	P2MM—OGC	**Construction/BP**
33	PMM (Kerzner)	**Construction/BP**
34	PM2 (Berkeley)	**Construction**
35	PMMM (Anderson)	**Construction**
36	SPICE	**Construction**
37	PMS-PMMM	**Construction**
38	MMGP Prado	**Construction/IS/IT**
39	P-CMM (People)	**Construction**

Table2. 2 Synthesis of the identified maturity models regarding construction management and Level of structure. Source(Machado et al., 2021b)

No	Maturity Model	Number of Levels	Maturity Definition
1	CMMI-SEI	5	Yes
2	OPM3 (PMI)	4	Yes
3	P3M3 (OGC)	5	Yes
4	Prince2 Maturity Model (PMM2-OGC)	5	Yes (medium)
5	PMM (Kerzner)	5	Yes (medium)
6	PM2 (Berkeley)	5	Yes (medium)
7	SPICE	5	Yes (medium)
8	PMS-PMMM	5	Yes
9	MMGP Prado	5	Yes
10	PMMM (Anderson)	5	Yes

The following PMMMs are reviewed in this subsection:

- Capability Maturity Model (CMM)
- Capability Maturity Model Integrated by Software Engineering Institute (SEI-CMMI)
- Project Management Maturity Model by H. Kerzner (K-PMMM)
- Project Management Maturity Model by PM Solutions
- Organizational Project Management Maturity Model by Project Management Institute
- Project Management Process Maturity (PM)2 by Kwak and Ibbs
- Hillson's Project Management Maturity Model (ProMMM)
- Project, Program, Portfolio Management Maturity Model (P3M3) by Office of Government Commerce (OGC)
- PMO maturity cube by Pinto, Cota and Levin

2.10.1 Capability Maturity Model (CMM)

The Software Engineering Institute (SEI) at Carnegie Mellon University developed the first project management maturity model (PMMM) called the Capability Maturity Model. The development of CMM began in 1987 and the initial version was released in 1991. The model was initially developed to evaluate software contractor's capability in contract awarding and administration purposes, it was then used for improvement of software development processes and extended for implementation in other areas as well. The model comprises of five maturity levels for evaluating 18 process areas, 52 objectives, and over 300 key practices (Paulk et al., 1993; Sarshar et al., 1999).

The characteristics of each maturity level of CMM are discussed as follows:

Level 1 (Initial): The processes are generally characterized as ad hoc, and sometimes chaotic. Only few processes are defined, and success is dependent on individual effort. The organization typically doesn't provide a conducive environment for developing and/or maintaining software. Planned procedures of projects are abandoned during crisis. Success depends entirely on having effective project team or an exceptional manager (Paulk et al., 1993).

Level 2 (Repeatable): Basic PM processes are established to track functionality schedule, and cost. There is a necessary process discipline to repeat earlier successes on similar projects. Policies are established for managing projects with procedures to implement the policies. New projects are planned and managed based on experience with similar prior projects. Institutionalizing effective management process is an objective in achieving this level. An effective process can be characterized as trained, practiced, documented, enforced, measured, and able to improve. The level can be summarized as disciplined because projects' planning and tracking are stable and prior successes can be repeated (Paulk et al., 1993).

Level 3 (Defined): There is a standard software process for the organization in which management and engineering activities are documented, standardized, and integrated. All projects use an approved and tailored version of standard software process for development and maintenance in the organization. The level can be summarized as consistent and standard because of the stable and repeatable software engineering and management activities (Paulk et al., 1993).

Level 4 (Managed): There is a collection of product quality and detailed measures of organization's software process. Quantitative understanding and controlling exist for the software process and products. An organization-wide database of software process is used to collect and analyze data from defined software processes of projects. Well defined and consistent measurements are applied to software processes. The level can be summarized as predictable because there is a measured process operating within measurable limits (Paulk et al., 1993).

Level 5 (Optimizing): Continuous process improvement is enabled by a quantitative feedback from the process as well as from piloting innovations. There is a means to identify weaknesses and strengthen the process, with the purpose of reducing frequency of defects. The level can be characterized as continuously improving because the organization is continuously striving to improve the process capability range. Improvement typically occurs by incremental advancements (progressions) for existing process and by innovations using new methods and technologies (Paulk et al., 1993).

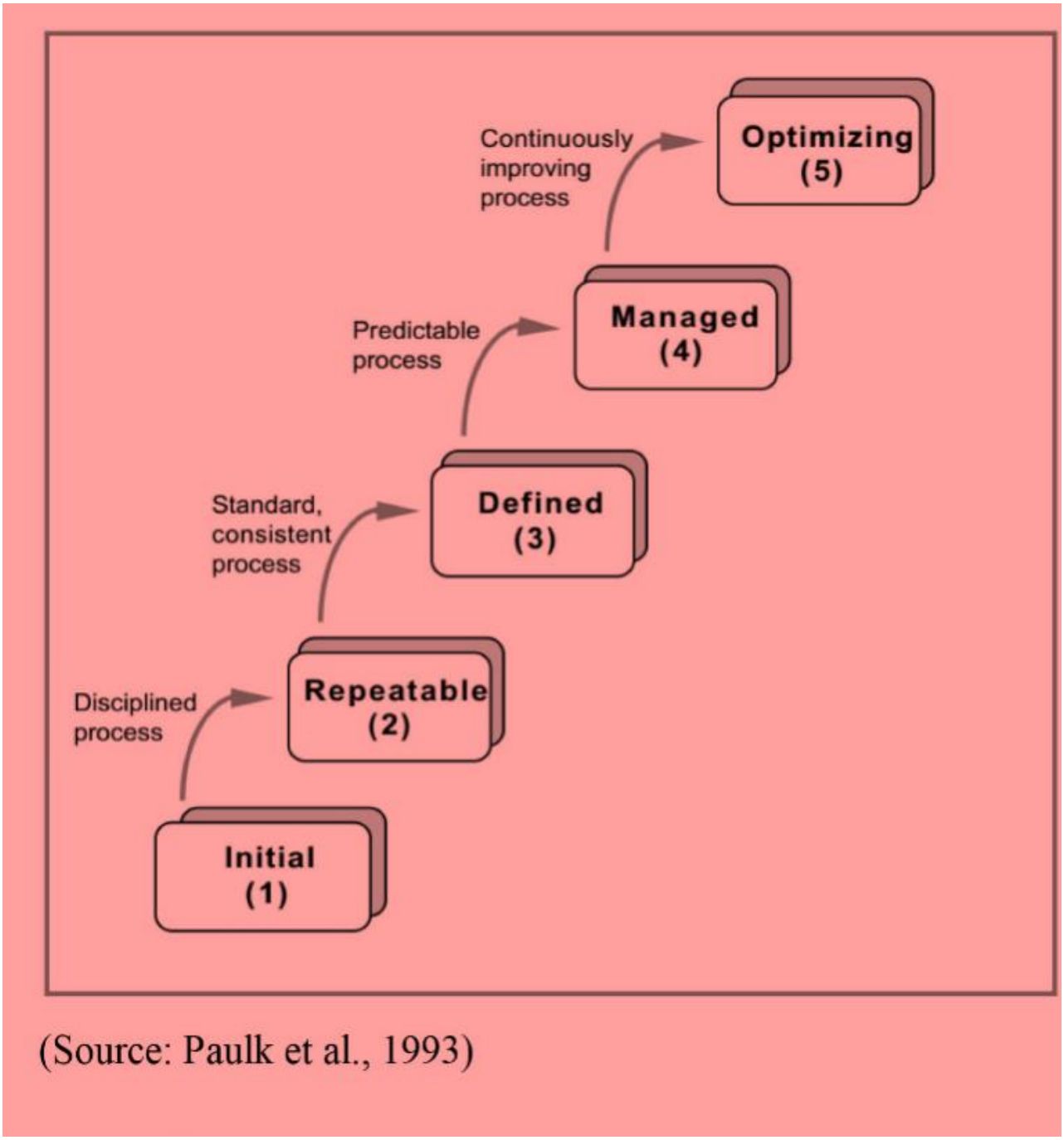


Figure2.1 CMM'S Five maturity level

2.10.2 Capability Maturity Model Integrated (CMMI)

Succeeding the Capability Maturity Model, CMMI was built from a combination of CMM's components of individual disciplines; it was published in 1993 and aimed for the improvement of software development processes (de Souza & Gomes, 2015; Yimam, 2011). Analyzing 135 research papers, de Souza & Gomes (2015) found that CMMI is the most frequently used project management maturity model by researchers, but applied mostly in the Information Technology industry.

The CMMI model posit two approaches: staged and continuous representation unlike the CMM that used only staged model. The staged approach provides the improvement path for organizations by defining the order for each process area implementation at maturity levels ranging from the initial level to optimizing level.Whereas, the continuous representation, unlike the staged one, provides a flexible approach to progressive improvement of processes by allowing an organization to choose specific process areas for improvement. Consequently, the organization can improve different processes at varying rates (Ahern et al., 2008; Yimam, 2011).

The continuous representation model has 6 capability levels defined by Generic Goals. The Generic Goals are in turn organized by Generic Practices. In similar manner, each process area is defined by Specific Goal and Specific Practices. A process area attains a certain capability level when it achieves all the specific goals within the process area and the generic goals of the corresponding capability level (Ahern et al., 2008).

The characteristics of each maturity level of CMMI are discussed as follows:

Level 0: Incomplete Process A process that is partly performed or not performed at all. A specific goal/s of a process area is/are not met.

Level 1: Performed Process A process that accomplishes/completes the works needed to obtain work product. Specific goals defined for each process area are satisfied.

Level 2: Managed Process A performed process having the basic tools to support the process. It is planned and executed according to policy; involves relevant stakeholders; includes skilled people producing controlled outputs; and is evaluated whether it adheres to its process description.

Level 3: Defined Process A managed process that is tailored in accordance with the set of standard processes of the organization; has maintained process description; and contributes process improvement information.

Level 4: Quantitatively Managed Process A defined process which is quantitatively or statistically controlled. Attributes such as product & service quality, and process performance are controlled and measurable throughout projects. The sub processes are also statistically managed.

Level 5: Optimizing Process A quantitatively managed process that is adapted to satisfy business objectives. It focuses on innovative and incremental improvements for process performance. Improvement of processes addressing problems such as common causes of process variation and defects, are identified, and evaluated. The improvements are chosen with a basis of quantitative understanding of their speculated contribution to meet improvement objectives and compared against their corresponding cost and impact. (Source: Summarized from Yimam (2011))

2.10.3 Kerzner's Project Management Maturity Model (K-PMMM)

K-PMMM was developed by Harold Kerzner. The model is briefly discussed in his book published in 2001. Like most of the maturity models, K-PMMM is made up of five levels of maturity. Kerzner (2001) described the characteristics of the maturity levels along with roadblocks, risks and actions needed to accomplish each level. Moreover, at the end of each maturity level discussion, an assessment instrument is included. The assessment technique differs for each level. The maturity levels of KPMMM are summarized below:

Level 1 (Common Language): The organization recognizes the need and importance of PM and understanding its basic knowledge as well as its language or terminology. Characteristics include: No executive-level support; Sporadic use of PM Virtually; No attempt to recognize the benefits of PM; No investment in PM training and education. Completion of this level is based upon gaining a knowledge of the fundamental principles of PM (Kerzner, 2001).

Level 2 (Common Processes): The organization recognizes the need for common processes definition and development such that one project's success can be repeated on others. Characteristics of this level include: Organizational support at all levels; Recognition of benefits of PM; Recognition of need for processes and/or methodologies; Acknowledgment of the need for controlling cost; Development of a PM training plan (Kerzner, 2001).

Level 3 (Singular Methodology): The organization gives recognition to the synergistic importance of consolidating methodologies in to a singular methodology within the organization, with project management being the center. Characteristics include: processes are integrated into one process incorporating all other processes; cooperative culture; management support at all levels; guidelines and checklists, rather than rigid policies and procedures, are a basis for the singular methodology; financial benefits from PM training; behavioral excellence (Kerzner, 2001).

Level 4 (Benchmarking): The organization recognizes that process improvement is necessary in the organization in order to maintain a competitive advantage. Benchmarking must be continuously performed by the company, after deciding whom and what to benchmark. Characteristics include: establishment of a project office; dedication to benchmarking with the performance of qualitative and quantitative benchmarking (Kerzner, 2001).

Level 5 (Continuous Improvement): The organization continuously evaluates the information gained by the benchmarking process and decides whether or not the information strengthens the singular methodology developed. Characteristics include: creation of lessons learned files at the end of projects; learned knowledge transfer to other projects and project teams through Project Office; a corporate-wide understanding that strategic planning for PM is a continuous and ongoing process (Kerzner, 2001).

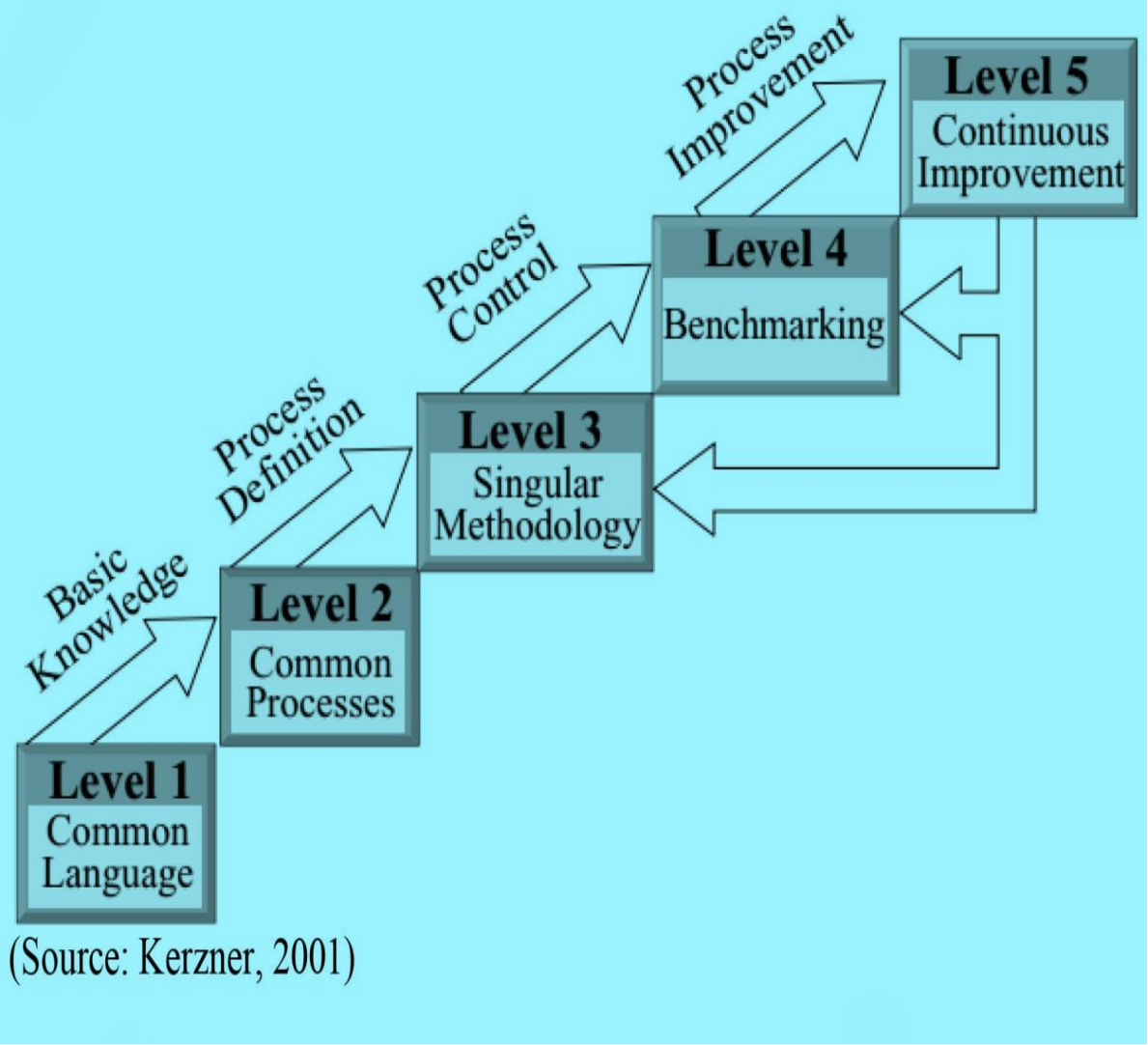


Figure2.2 K-PMMM'S Five level of maturity

2.10.4 PM Solutions' Project Management Maturity Model

Crawford (2002) developed the PM Solutions' PMMM in 2002. The model is based on the combination of PMBOK's knowledge areas and CMM's five levels of maturity. Each knowledge area is first broken down into key components. Hence, the real measurement of maturity takes place on these components and will be summarized to the corresponding knowledge area. In addition, there were three areas where the model has found significant influence on adapting project management practices. These are **management oversight**, **project office**, and **professional development**. Regarding assessment, the model suggested that any thorough assessment would include the following: personal or group interview; artifact collection and evaluation; widespread survey input; benchmark comparison to established standards (Crawford, 2002).

The book by Crawford (2002) incorporates detailed descriptions of the components of knowledge areas for each maturity level. The general descriptions of the maturity levels are summarized below.

Table 2-3 Summary of PM Solutions' Maturity Levels

Maturity Level	Key Attributes
Level 1: Initial Process	✓ Ad hoc processes ✓ Management awareness for the need of project management ✓ No established practices or standards & loose documentation
Level 2: Structure Process and Standards	✓ Basic processes; not standard on all projects; used on large projects ✓ Management supports and encourages project management use ✓ Mix of intermediate and summary-level information ✓ Estimates, schedules based on expert knowledge and generic tools ✓ Mostly a project-centric focus
Level 3: Organizational Standards and	✓ All processes, standard for all projects, repeatable ✓ Management has institutionalized standards and processes with formal documentation.

Institutionalized Process	✓ Summary and detailed information ✓ Baseline and informal collection of actual ✓ Estimates, schedules may be based on industry standards and organizational specifics ✓ More of an organizational focus ✓ Informal analysis of project performance
Level 4: Managed Process	✓ Processes integrated with corporate processes ✓ Management mandates compliance ✓ Management takes an organizational entity view ✓ Solid analysis of project performance ✓ Estimates, schedules are normally based on organization specific ✓ Management uses data to make decisions
Level 5: Optimizing Process	✓ Processes to measure project effectiveness and efficiency ✓ Processes in place to improve project performance ✓ Lessons learned are regularly examined and used to improve project management processes, standards, and documentation ✓ Management focuses on continuous improvement

(Source: Crawford, 2002)

2.10.5 Organizational Project Management Maturity Model (OPM3)

OPM3 was developed in 2003 by the Project Management Institute (PMI). Similar to the PM Solutions' model, OPM3 is comprised of three elements: knowledge, assessment, and improvement. The knowledge element presents the contents of the standard; the assessment part provides a method for comparison with the standard; and the improvement element sets the stage for possible changes in the organization (PMI, 2003). The standard lets organizations understand the organizational project management and helps in measuring their maturity against a comprehensive set of Best Practices of organizational project management (PMI, 2003).

Unlike other PMMMs, the progression of increasing maturity designed in this model comprises of several dimensions, meaning that organization's maturity is looked from different ways. One

dimension is viewing the Best Practices in terms of their association with process improvement progressive stages (PMI, 2003), which are:

- **Level 1: None** – such practice doesn't exist
- **Level 2: Standardize** – standardized processes in the organization have been communicated and documented, but the practices are used only for few projects.
- **Level 3: Measure -** standardized processes in the organization are used by all the projects and effectiveness is evaluated by measuring processes.
- **Level 4: Control** – a correction of measured process for poor standardized practice application exists. Process is analyzed by establishing upper and lower limits.
- **Level 5: Improve** – there exists a continuous improvement of processes.

Other dimensions for the progression of increasing maturity of OPM3 include:

- The progression of the Best Practices associated with the three domains: Project Management, Program Management, and Portfolio Management (PMI, 2003).
- Incremental Capabilities progression leading to each of the Best Practices (PMI, 2003).
- Association of capabilities with the five project management process groups, which are, Initiating, Planning, Executing, Controlling, and Closing process groups (PMI, 2003).

Hence, the model was designed without a general system of maturity "levels" as the progression of maturity is multi-dimensional and cannot be established straightforward. Maturity is assessed and reported as percentage of best practices through the entire dimensions. Multiple perspectives or dimensions for assessing maturity level allow flexibility in the model's application to unique needs of a given organization; it also provides a more rigorous body of information compared to that of a simpler and linear system of levels, supporting decisions and plans for improvement by giving the organization a greater detail (PMI, 2003).

The steps for measuring maturity in PMI's OPM3 framework cycle can be summarized as follows:

- **Acquire Knowledge** – involves preparation for assessment of project management maturity and comprehending the contents of OPM3 and understanding the organization for its project management practices (PMI, 2003).
- **Perform Assessment** – all the data needed are gathered for measuring the maturity assessment. The data results are put in graphs depicting the maturity level of the organization for project management, program management and portfolio management. The self-assessment questionnaire contains 151 questions (PMI, 2003).
- **Manage Improvements** – the results from the previous stage are compared against the best practices standard of project management, program management and portfolio management. A set of best practices are defined for the purpose of comparing and improving. The result of comparison of existing practices against best practices allows the organization to devise improvement recommendations (PMI, 2003).
- **Repeat the Process**

This model has 3 interlocking elements:

1. The Knowledge element describes organizational project management and organizational project management maturity, explains why they are important and how project management maturity can be recognized
2. The Assessment element presents methods, processes and procedures that an organization can use to self-assess its maturity
3. The Improvement element provides a process for moving from its current maturity to increased maturity.

Figure2.3 OPM3 the three Interlocking Elements

OPM3 framework cycle can be used in three different ways to perform maturity assessment of project management practices. The three different ways are:

i) Comparative model
ii) Design Model
iii) Improvement Mode

Comparative model

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

i.e. acquires knowledge. Based on comparison, organization decides to proceed for further OPM3 framework steps and determine steps to implement for improvement purposed. Finally, OPM3 framework cycle is repeated according to needs.

Design Model

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

Improvement Mode

In this model, organizations use Best Practice Standard to determine what practices are required for organization ‘s strategy execution. In this model, OMP3 framework cycle starts at Manage Improvement step.

2.10.6 Project Management Process Maturity Model (PM2)

The PM2 model was developed by Young Kwak and William Ibbs in 1997 first and later updated in 2002. The model was developed by integrating previous maturity models that measure PM levels across different industries. Like most of other PMMMs, this model constitutes five levels of maturity. Similar to PM solutions’ maturity model, PM2 model breaks PM processes and practices into PMBOK’s PM knowledge areas. Along with the knowledge areas, the model also further incorporates the five PM processes to assess and evaluate organization’s PM maturity. The maturity model questionnaire consists of 148 multiple choice questions covering the knowledge areas and PM processes (Kwak & Ibbs, 2002).

Each maturity level’s key PM processes, organization’s characteristics, and focus areas are summarized from Kwak & Ibbs (2002) as follows:

Table 2-4 Summary of the PM2 Model

Maturity Level	Key PM Processes	Major Organizational Characteristics	Key focus areas
Level 1: Ad-hoc	PM processes or practices are not available in a consistent manner. PM data are not collected or analyzed in a consistent manner.	Functionally isolated and no senior management support Project success is dependent on individual efforts	Understanding and establishing of basic PM processes.
Level 2: Planned	PM process definition, PM problem identification and PM data collection are informal.	Weak teamwork Organizations possess strengths in performing similar work	Individual project planning.
Level 3: Managed at Project Level	Project planning and controlling systems as well as PM data are managed formally.	Medium team work Training of PM practices and skills are informal	Structured project planning and controlling for few projects.
Level 4: Managed at Corporate Level	Multiple program management. PM processes and data are integrated, quantitatively measured, analyzed, and stored.	Strong teamwork PM training for project team is formal	Professional planning and controlling in multiple projects.
Level 5: Continuous Learning	A continuous improvement and full understanding of PM processes. An optimized and sustained PM data	Project driven organization. Dynamic, and energetic organization. Continuous improvement of PM practices and processes.	Innovative ideas to improve PM practices and processes.

(Source: Kwak & Ibbs, 2002)

2.10.7 Hillson's Project Management Maturity Model (ProMMM)

ProMMM was developed by David Hillson in 2001. Like most of the PMMMs, this model adopts established concepts from CMM and other models. The majority of the models discussed in this review compare project management capability against standards, focusing on knowledge areas and process groups. ProMMM focuses on additional elements that contribute to project management capability, which includes vital areas of organizational culture, practical issues of implementation, and human aspects such as skills and experience levels. Regarding assessment, the model allows highlighting of key strengths and weaknesses for further attention, and covers a several performance indicators within its hierarchical structure (Hillson, 2003).

The ProMMM, unlike most PMMMs, describes four levels of increasing PM capability, termed as Naïve, Novice, Normalized and Natural. Each ProMMM level is defined in terms of 4 attributes: culture, process, experience and application. The maturity levels defined by the model are summarized as follows:

Level 1 – Naïve: The attributes are at the lowest level; the need for PM is not recognized and the culture has resistance to change. There are no PM processes, as well as no experience of using and applying project management (Hillson, 2003).

Level 2 – Novice: The organization at this level is not fully convinced of PM benefits and may consider it as an overhead. PM processes are ad hoc, and their effectiveness is dependent on the experience of few employees presumably having little prior formal training. PM application is not consistent (Hillson, 2003).

Level 3 – Normalized: The organization has Normalized PM into its way of operating, along with a culture recognizing the importance of projects and expects to be benefited from the proper management of them. Generic as well as formal processes are in place. Necessary resources are available, and the project team is equipped with enough experience to practice an effective project management. There is routine and consistent project management application across all projects (Hillson, 2003).

Level 4 – Natural: The organization is driven by a project-centric culture into proactive project management which seeks to obtain the maximum advantages of the dynamic business conditions. There is an implementation of best practice processes, with active lesson learning and regular updating from prior projects. The project team, in its entirety, has experiences of implementing PM processes in assisting tasks, and PM application is widespread across all areas (Hillson, 2003).

2.11. Uses and benefits of Project Management Maturity Models

Maturity models are designed to provide a framework that an organization needs to develop its capabilities, in order to deliver projects successfully in the long term (Jugdev& Thomas, 2002; Mittermaier&Steyn, 2009 cited in Backlund et al, 2014). Backlund, et al (2014) also stated the following points as importance of using PM maturity models and assessment:

- To set direction, prioritize actions, and begin cultural change rather than primarily identifying the current level at which an organization is performing.
- To compare project capability between organizations, or between a specific organization and industry norms as a means to benchmark their maturity relative to others.
- PM maturity assessment can be utilized as a "checkup" tool to measure progress and to identify the next logical steps forward and hence support organizations to view PM as a strategic enabler.

Maturity models are designed to provide a framework that an organization needs to develop its capabilities, in order to deliver projects successfully in the long term(Backlund et al., 2014b). According to Crawford (2006) the benefits of PM maturity assessment lie in setting direction, prioritizing actions, and beginning cultural change rather than primarily identifying the current level at which an organization is performing. Another purpose of using a PM3 is to compare project capability between organizations, or between a specific organization and industry norms (Mittermaier&Steyn, 2009), as a means to benchmark their maturity relative to others (Cooke-Davies &Arzymanow, 2003; Grant and Pennypacker, 2006). But only to make comparisons is not enough, any model selected to measure PM maturity must point out a logical path for progressive development (Crawford, 2006). Also, each organization has to

look at its own results and find out where the organization has a great deal to gain in increased project maturity (Hillson, 2003). It is important that the assessment itself to be repeatable, provide consistent measurements and results, and provide for some degree of benchmarking with other organizations. This provides the basis for any assessment to be utilized as a "checkup" tool to measure progress and to identify the next logical steps forward (Crawford, 2006) and hence support organizations to view PM as a strategic enabler (Mullaly, 2006).

2.12. Empirical Review

In this section, different studies regarding assessment of project management maturity of organizations are reviewed.

Yimam (2011) conducted an extensive research on project management maturity in the construction industry taking the case of Ethiopian contractors. The researcher used 40 grade-I contractors as a research sample, among which 32 were local contractors and 8 were international. Unlike other researchers, the author proposed a new maturity assessment model that aimed to fit with the context of developing countries. The new model (modified from CMMI) consisted of two dimensions of maturity, namely: "**Practice Maturity**" and "**Process Maturity**." Using the proposed framework, the assessment showed that the PM process maturity and practice maturity of the Ethiopian grade-I contractors were at low level, 1.3 and 0.99 respectively. Yimam (2011) also found that the knowledge areas of time, procurement, cost, financial, material and HR management had shown comparatively higher maturity than other PM knowledge areas. Furthermore, the researcher found out that the PM maturity of road contractors is higher than that of building contractors, 1.75 and 1.15 respectively.

A study conducted by Kwak & Ibbs (2000), which required 2 years to complete, used the PM2 maturity model to assess the project management maturity of 38 companies across different industries. 15 of the companies were Engineering-Construction firms. The assessment framework consisted 148 questions covering 8 knowledge areas and 6 project phases of the PM life cycle (Project-driven Organization Environment was a phase added by the authors apart from the commonly known 5 phases). Integrating the maturity of the 6 project phases makes the research

unique from other empirical researches reviewed in this section. (Ofori & Deffor (2013) used the 5 project phases of the PM life cycle as a basis to assess the maturity of organizations without using the PMBOK's knowledge areas). Kwak & Ibbs's (2000) PM maturity assessment for all companies averaged 3.26. The Engineering-Construction industry had the highest score (3.6), and the Information Systems application area has the lowest (3.06). Risk Management and the Project Execution Phase are areas of low maturity and Cost Management and the Project Planning Phase were areas of high maturity. The researchers also found out that an average of 6% of project costs is expended on PM services. In contrary to Kwak & Ibbs, the Software Project Management studies by Sukhoo et al. (2005) and Labuschagne & Marnewick (2009) revealed that the Initiating phase had the least maturity level, while the Controlling phase was the highly matured one.

Grant & Pennypacker (2006) provided a benchmarking survey of project management maturity over various industries. A total of 126 organizations in 17 different industries were included in the survey and PM solutions maturity model was used as a framework for assessment. In contrast to other empirical studies reviewed in this section, Grant & Pennypacker (2006) treated the maturity levels as ordinal level, rather than interval level. Thus, the research relied on medians and proportions, rather than computing mean levels of maturity. According to the authors, the ordinal level treatment was used because there was no empirical support to assume that the effort and change required to progress from level 1 to level 2, is the same as that required to progress from level 2 to level 3, or any subsequent levels. The research used 42 components of PMBOK's 9 knowledge areas for comparison of maturities across the industries. The findings indicated that the median project management maturity across industries was level 2 (out of 5) in 36 of the 42 components. One component (change control component of project integration management) had median maturity of level 3. Project Risk Management was the least matured of all knowledge areas. The research also made comparisons across 4 industries, (Professional, Scientific & Technical services, Information, Finance & Insurance, and Manufacturing) and only three component areas were found to have a statistically significant difference. Hence, the researchers concluded that there is a high consistency of project management maturity among industries with limited number of exceptions.

PM Solutions (2014) also conducted a benchmarking survey across multitude of industries in the world. Project management maturity of 293 organizations were assessed. The research found that there is a significant correlation between the PM maturity of an organization and its overall performance. Moreover, the authors concluded organizations see significant value by increasing their PM maturity level. The research also found an average level of 2.5 for the organizations. The organizations are generally most mature in project integration management with a score of 2.7 and least mature in project risk management with 2.3. Similarly, Mateen (2015) found that project management maturity in an organization has a direct and significant impact on its project performance after studying a company found in Pakistan. OPM3 maturity model was used as a framework for the assessment. Justifications for using OPM3 were described and a framework for comparison of the maturity models was established before selecting the model. The finding of the study showed that the company had a maturity level of 2.51. Project time management was the highest matured knowledge area; whereas Project risk management was the least matured one.

A study by Yazici (2009) also investigated the relationship between maturity levels on eight PMI knowledge areas and perceived organizational performance. The study consisted of 75 US companies mostly from service industries. Overall maturity was found to be 2.27. It was also shown that with higher project maturity, organizations can achieve substantial savings, show better competitiveness, and increase sale growth compared to competitors and best practices in their industry. Consistent with (Yazici, 2009; Mateen, 2015; PM Solutions, 2014), a survey of 200 respondents in 30 countries conducted by PricewaterhouseCoopers (PWC, 2004) concluded that as an organization's project management maturity increases, the positive impact on overall project performance increases.

Gorecki (2015) summarized the findings of construction project maturity assessments done by the "Deloitte's" researchers. The survey included 39 polish construction companies and an overall maturity level of 3.4 was found. Project safety management displayed the highest degree of maturity, followed by project quality, procurement, and financial management knowledge areas. Project communication management was the least matured knowledge area that the companies were capable to deal with.

Pretorius et al. (2011) studied the project management maturity of 255 South African engineering and construction industries. CMM was used as a framework and the average maturity level was found to be 2.88. The paper also investigated the relationship between PM maturity and project success in the industries. In contrary to the findings of (PM Solutions, 2014; Mateen, 2015; Yazici, 2009; Schiltz, 2003; PWC, 2004), the study failed to establish any statistical correlation between project management maturity and the perceived outcome of the projects. The authors concluded that higher project management maturity does not automatically lead to project success and projects can be successful irrespective of the maturity level of the organization. This statement is in line with the findings and conclusion forwarded by Labuschagne & Marnewick (2009).

A study by Isaacs (2018) also surveyed 108 project managers in South Africa to investigate the impact of project maturity on project performance. The study revealed that there is a relationship between some of project management knowledge areas and project success. However, the author concluded, the relationship doesn't appear to be as strong as would be expected as most of the positive correlations found were low to moderate.

Moutawei et al. (2017) surveyed construction contractors in Egypt to assess their PM maturity. A total of 116 respondents from different construction contractors participated in the survey. The authors came into conclusion that Egyptian contractors are generally not aware of the importance and value of PMMMs for appraisal and improvement of project management practices. Furthermore, the study indicated that the organizations were not formally using any international project management methodologies or standards. Using the PM2 framework, the average maturity level of the organizations was found to be 1.44. Most of the knowledge areas have a score above level 1 except for project risk management.

Weldemariam (2013) used the PM solutions PMMM to assess the maturity of an Ethiopian organization, "Mesfin Industrial Engineering PLC." Findings from the assessment indicated that, the overall project management capability of the organization is at maturity level 2. The results indicated that some project management processes were defined but not consistently applied to all projects. Project scope, time, and cost management knowledge areas, with maturity level of 2.5,

2.3 & 2.3 respectively, showed higher maturity compared to other knowledge areas. Whereas, the remaining knowledge areas were below level 2.

The 10 studies reviewed are summarized in table 2-4.

Table 2-5 Summary of Studies Reviewed

Researcher	Area of Research	PMMM Used	Average Maturity Level	Knowledge area with highest maturity	Knowledge area with lowest maturity
1, Yimam (2011)	Construction	CMMI	1.16	Project Time Management	Project Safety Management
2, Kwak & Ibbs (2000)	Different Industries	PM2	3.26	Project Cost Management	Project Risk Management
3, Grant & Pennypacker (2006)	Different Industries	PM Solutions	2	Project Integration Management	Project Risk Management
4, PM Solutions (2014)	Different Industries	PM Solutions	2.5	Project Integration Management	Project Risk Management
5, Yazici (2009)	Different Industries	PM Solutions	2.27	Project Quality Management	Project Risk Management
6, Gorecki (2015)	Construction	Modified from CMM	3.4	Project Safety Management	Project Communication Management
7, Pretorius et al. (2011)	Engineering & Construction	CMM	2.8	Project Time Management	Project Risk Management
8, Isaacs (2018)	Different Industries	Modified from PM Solutions	3.7	Project Cost Management	Project Risk Management
9, Moutawei et al. (2017)	Construction	PM2	1.44	Project Quality Management	Project Risk Management
10, Weldemariam (2013)	Electro Mechanical	PM Solutions	1.8	Project Scope Management	Project Risk Management

(Source: Own Summary)

2.13. Project Management Maturity Model Selection

The researcher tried to compile and review list of maturity models which have been developed so far by different organizations and individuals above. And made a comparison of maturity models to select most appropriate PMMM for carrying out research for this thesis used the criteria developed by Grant and Pennypacker in 2006. Grant and Pennypacker (2006) conducted a survey on project management maturity assessment. In this survey, questions about 42 components of project management maturity were asked to 126 participants from different organizations. Grant and Pennypacker (2006) used following criteria and others as depicted in Table 2.5 below to select project management maturity model for their survey:

1 Scope covered by project maturity model,

2 Alignment of project maturity model with organization's project management methodology,

3 Ease and comfort ability to use

Table 2-6 Comparison of Project Management Maturity models

Criterion	**PM solution**	**OPM3**	**CMM**	**K-PMMM**
Publisher	PM Solutions Institute	PM Solutions Institute	SEI	ILL
Scope	PM	PM	Software	PM
Maturity level	1-5	1-5	1-5	1-5
Refer to Standard	PMBOK	PMBOK	-	PMBOK
Project Management process	Yes	Yes	Yes	Yes
Program Management process	No	Yes	Yes	No
Portfolio Management Process	No	Yes	No	No
Assessment difficulty	Low	Low	High	Low
Assessment Cost	Low	Low	High	Low
Quantitative Results	Yes	Yes	Unknown	Yes

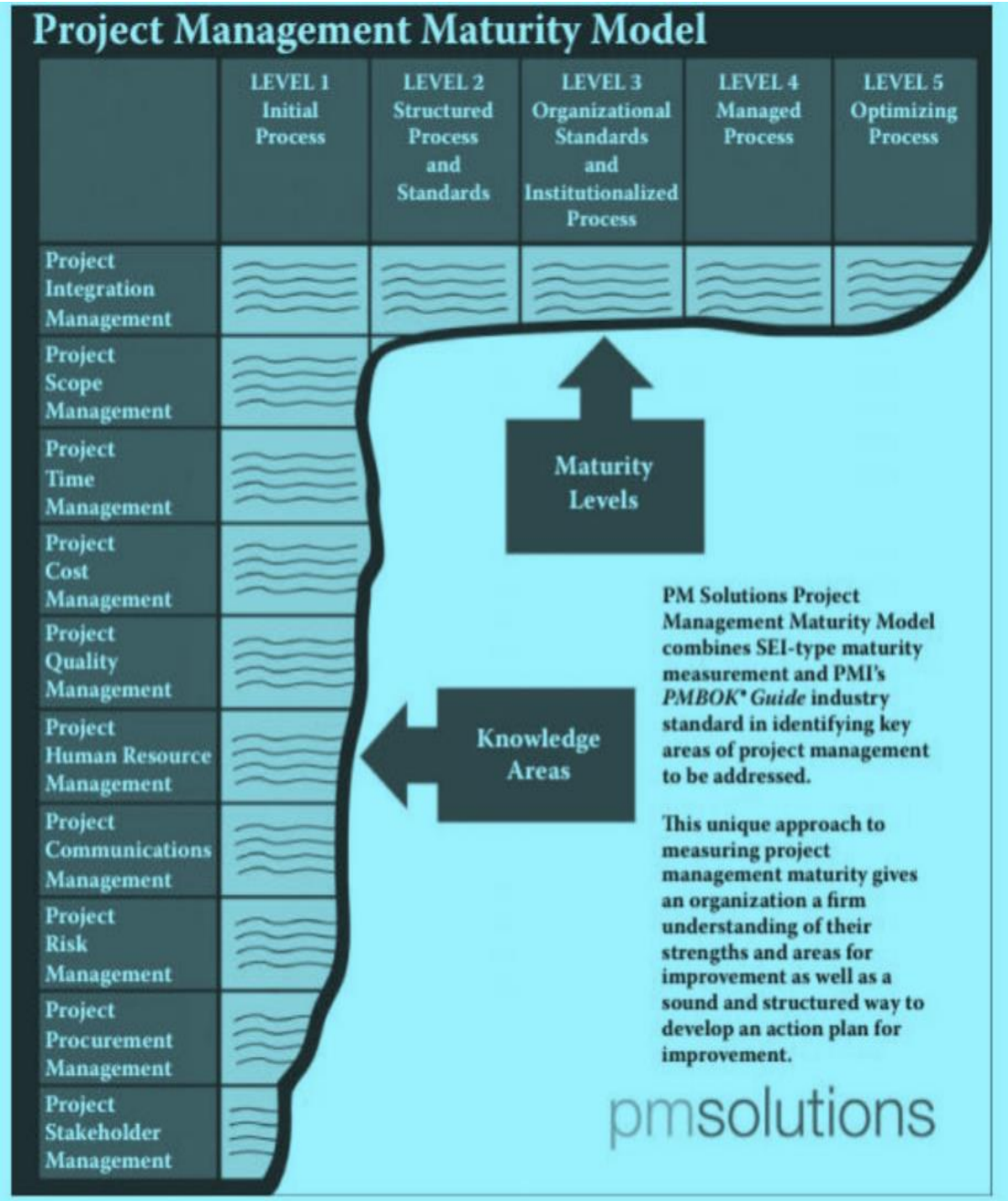
Tangible of results	Yes	Yes	Yes	Yes
Identifying weakness and strengths	Yes	Yes	Yes	Yes
Continuous Assessment	Yes	Yes	Yes	Yes
Training Difficulty	Low	Low	High	Medium
Commitment for Continuous improvement	Yes	Yes	Yes	Yes
Suggestion of Alternative for improvement	Yes	Yes	Yes	Yes
Priority of improvement	Medium	Medium	Medium	Medium
Easy for Execution	Yes	Yes	Yes	Yes
Simple and Understandable	Yes	Yes	Medium	Yes

Source: Adopted from Khoshgoftar and Osman, 2009 and PM Solutions 2014

From table 2-5 above PM Solution's model and OPM3 models are almost the same except in their areas of focusing or covering in assessing the level of maturity. According to Špundak (2010) The PM solution's model has focus only on **project management** without taking into consideration other organizational aspects such as **program or portfolio management**. The OPM3 model focuses not only in projects but also in program and portfolio management which is beyond the scope of this research.

Thus, as this research focuses on assessing the level of project management maturity and identify the appropriate models in managing projects for Oromia construction sectors in the case of Oromia Construction Corporation rather than programs and portfolios, I selected the Project Management Maturity Model (PMMM) that was presented by PM Solutions to assess the level of project management maturity and the level maturity across each project management knowledge areas of Oromia Construction Corporation. And some of the model's characteristics make it ideal for use in the current study are also; This model is based on the fourteen knowledge areas of the PMBOK® Guide as shown figure 2-6 below, which is related with the objectives of the research and it also used the structure of the SEI Capability Maturity Model. The indicated assessment method is not

very cumbersome and can easily be used to determine organizations' current level of project management maturity.

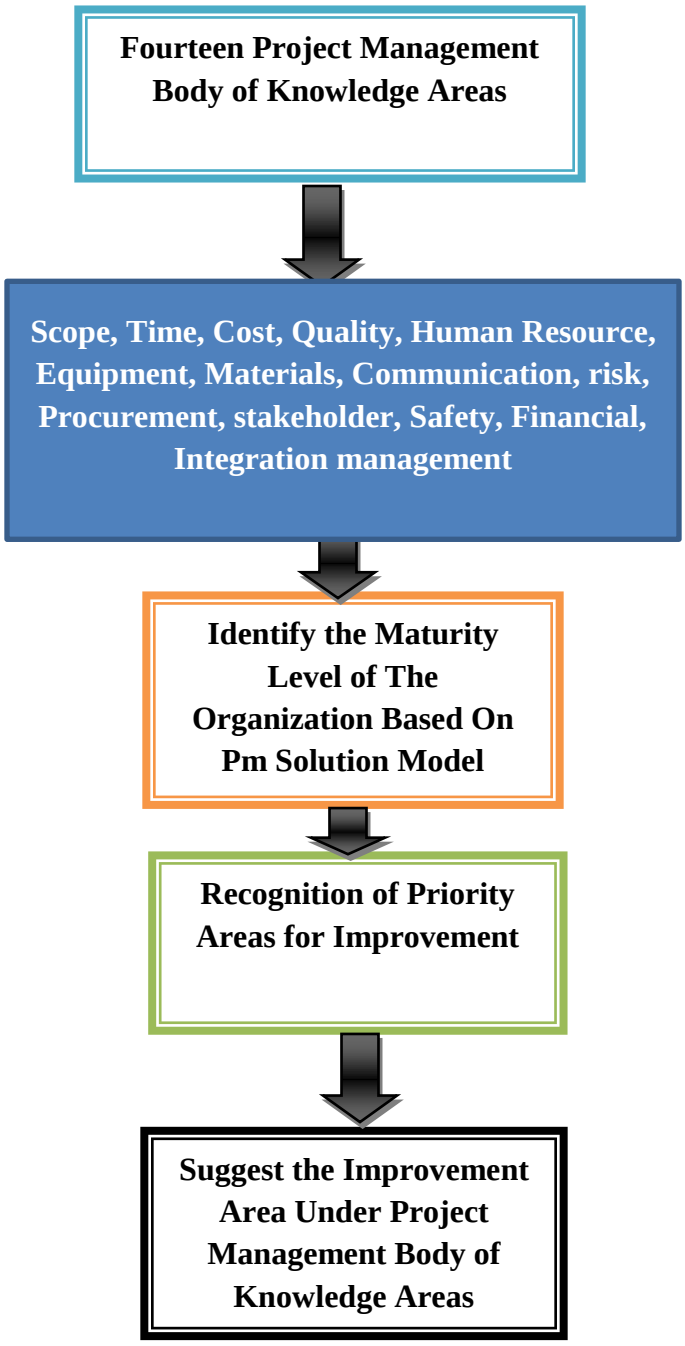


(Source: Crawford, 2015)

Figure2.4 PM Solutions' PMMM

2.14. Conceptual Framework

Based on the reviewed literature, this research aimed to assess project management maturity level of Oromia Construction Corporation used fourteen Project management body of knowledge areas mainstreamed PM solutions model to assess the maturity level of the organization. Those are Project Scope, Time, Cost, Quality, Human Resource, Equipment, Materials, Communication, Risk, Procurement, Stake Holder, Safety, Financial and Integration Management. Based on maturity level of each knowledge area the final maturity level will be determined as an average of the fourteen knowledge areas. Procedure to evaluate the maturity Level of the Organization as follow: First, maturities of components (processes & practices) of each PMBOK's knowledge area were investigated to find the maturity level of the corresponding knowledge area. The maturity levels of the knowledge areas were aggregated to find the organizational maturity. Then, priority areas or gaps on PM practices were identified. Finally, suggestions for improvement under each knowledge area were provided based on the assessment.



(Source: Own Development)

Figure2.5 Project management conceptual frameworks

CHAPTER THREE

3. METHODOLOGY

3. 1. Research Methodology

This chapter of the research report provides an outline of the research methodology that is employed in the measurement of the Project Management Maturity level and project management practices of the OCC for the success of internal projects of Oromia Construction Corporation. This part describes the research design, Source of Data, Sampling and sampling techniques, Instrument of data collection and methods and procedures of data analysis.

Relevant data were gathered through questionnaires distributed to project managers, Engineers, Planner and others who participate for the implementation of projects, from various reports and project documents, as well as personal observation. All of the questionnaires will be filled and will be returned. Data obtained through the distributed questionnaires will be analyzed using SPSS and interpreted using descriptive statistics. Data gathered through document review will be analyzed qualitatively. Then major findings will be summarized and presented as charts.

3.2. Systematic investigation towards increasing the sum of knowledge.

Research is diligent, systematic inquiry or investigation to validate old knowledge and generate new knowledge (Burns & Grove, 1987). Research does not occur in a vacuum, research projects take place in context – of researcher's interests, expertise and experiences; of human contacts; of the physical environment, etc. (Fellows & Liu, 1997).

Data analysis involves a number of closely related operations which are performed to summarize the collected data and organize these in such a manner that they are able to answer the research questions (Kothari, 2004). This study used descriptive data analysis methods to statistically describe, aggregate, and present the data. The data analysis was done using the SPSS.

Prior to the data analysis, data preparation was undertaken as per the processing operations described by Kothari (Sears et al., 2008)), including data editing, data coding, data entry into a spreadsheet, and looking for missing values.

As the PM Solutions' Level insists, the maturity level of each knowledge area was calculated by aggregating the maturity level of the components of each knowledge area. This was done by taking the mean rating of each component within a knowledge area as filled by the respondents. The questionnaire contained a five-point rating scale for each component, ranging from "very low" to "very high" which represent maturity levels of level 1 up to level 5, respectively. Then, the maturity level of the organization was found by taking the mean of the maturity level of the 14 knowledge areas. In doing so, equal weight will be given to each knowledge area as it assumed that all the knowledge areas have equal contribution. Similarly, equal weight will be given to the components of each knowledge area in finding the maturity level of the corresponding knowledge area. Yimam (2011) concluded that the knowledge areas had equal contribution to the overall maturity of an organization after analyzing the judgment of various practitioners and academicians.

3.3. Research Design

Research design is a blue print for selecting the sources and types of data relevant to the research questions and provides the basic direction for carrying out a research project to obtain answers to research questions (Zikgmund et al., 2010). One of the types (classifications of research) is descriptive research, and according to Kothari (2004) descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group. Since this study tries to describe the project management maturity level, it employs a descriptive study research design.

The research work is conducted by taking the OCC as a case. Thus, case study method is considered to be more appropriate for the research, because it allows collecting highly detailed data about the subject issue. Moreover, case study gives the researcher the following advantages; the research questions can be modified during the research process if the original questions are found to be less relevant or salient, derive richer, more contextualized, and more authentic

interpretation of the subject under study (Bhattacherjee, 2012). The drawback often associated with case studies are lack of rigor and fairness, as well as hey give little basis for scientific generalization while their goal is to expand and generalize theories.

According to Kothari (2004), the research design is a conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data. There are various research designs, among which is descriptive research study. This type of research study is concerned with describing the characteristics of a particular individual, or a group (Kothari, 2004). According to Bhattacherjee (2012), descriptive research is directed at making detailed documentation of a phenomenon of interest.

In line with the above definitions, assessing project management maturity seeks to describe the current state of an organization with respect to project management practices. Hence, this research falls into a descriptive type research study.

Kothari (2004) remarked that the design must be rigid and not flexible; it must focus on: formulating the objective of the study, designing the methods of data collection, selecting the sample, collecting the data, processing and analyzing the data, and reporting the findings. These points are discussed in the forthcoming sections.

3.4. Population and Sampling

Bhattacherjee (2012) defines sampling as the statistical process of selecting a subset, called a sample, of a population of interest for purposes of making observations and statistical inferences about that population. The sampling process comprises stages of: defining the target population, choosing a sampling frame, and choosing a sample using a sampling technique (Bhattacherjee, 2012).

3.4.1 Target Population

Target population can be defined as the full set of cases from which a sample is taken (Saunders et al., 2009). The target population for this study was the employees of Oromia Construction Corporation, who were assumed to have a comprehensive knowledge about the corresponding

project they have been assigned to. These consisted of: Department Manager, Office Engineers, Project Manager, Project supervisor Engineer, Planner and Others who are working in project managing department. The total number of these key personnel were 120.

3.4.2 Sample Frame

A Sample Frame is an accessible section of the target population from where a sample can be drawn (Bhattacherjee, 2012). The Sample Frame for this study were the key personnel of Oromia Construction Corporation working in projects within different project areas. Projects undertaken by the company and working head office of the company.

Therefore, the sample frame was composed of 80 key personnel consisting of:

Eight Department Manager, thirty-two Office Engineers, twenty Project Manager, sixteen Project supervisor Engineer, and four Planner

These key personnel were assigned to work across the different construction projects undertaken by the Organization /OCC/.

3.4.3 Sample Size

Taro Yamane's (1967) sample size determination formula was used to calculate the sample size from the sample frame. The equation is applicable for 95% confidence level and 5% margin of error. The equation is depicted below:

$$n = \left[\frac{N}{1 + Ne^2} \right]$$

Where,

n = sample size

N = Population (the sample frame in this case), e = margin of error (0.05)

By using the above formula, and inserting the sample frame (80) into N, the sample size was found to be 67.

3.3.4 Sampling Design/Technique

A sample design is a definite plan for obtaining a sample from the sampling frame; it refers to the technique or the procedure the researcher would adopt in selecting some sampling units (Kothari, 2004). There are various sampling techniques presented by different authors, most of whom categorized the techniques into Probability and Non-probability sampling techniques (Kothari, 2004; Bhattacherjee, 2012; Bryman, 2012; Saunders et. al., 2009).

This research used the random sampling design, specifically the proportionate stratified random sampling technique. In stratified sampling, the sampling frame is divided into homogeneous and non-overlapping subgroups which are known as strata, and a simple random sample is drawn within each subgroup (Bhattacherjee, 2012). The technique is advantageous as it ensures the resulting sample to be distributed in the same way as the population with respect to the stratifying criterion (Bryman, 2012).

The main reason to adopt this technique was to ensure all job positions of the key personnel were part of the research. This study used the job positions of the sample frame (the 80 key personnel) to construct strata. From each stratum, a sample was drawn in proportion to its corresponding stratum sample frame. Sample size for each stratum was calculated by the following formula:

$$n\,(stratum) = \frac{N(stratum)}{N\,(Total)} * n\,(Total)$$

Where, n = sample size & N = sample frame

Table 3-1 Summary of Stratum Sample Size

Stratum (Job Position)	Sample Frame	Sample Size
Department Manager	8	7
Office Engineer	32	27
Project manager	20	17
Project supervisor engineer	16	13
Planner	4	3
Total	**80**	**67**

3.4. Source of Data and Instrument of Data Collection

To collect all relevant information for the research, both primary and secondary data sources were used. To collect relevant primary data for the study, questionnaire will be used as an instrument of data collection. The questionnaires were administered to a sample of project managers, engineers, planner and other workers who are selected from different projects being undertaken currently by OCC. In addition, review of relevant documents, personal observation of the project site manager and projects' working environment will be carried out**.**

The questionnaire was developed based on reviewed literature and tailored to the case under investigation based on observation of operational activities and documents. Researches by(Abadir, 2011), Mateen (2015), Simangunsong and Da Silva (2013) and Tahri and DrissiKaitouni (2006) and others were also used to reshape the questions as appropriate. The questionnaire will be validated by reviewing these and other literature that will be both empirical and theoretical. The questionnaire was divided into two parts. The first part is designed to capture general data about the respondents. The second part has questions develop from literature. The questions will be grouped into fourteen knowledge areas set by PMI in the project management body of knowledge (PMBOK) guide. Under these knowledge areas will be various questions devised to measure the degree of maturity of the project management practice**.**

Other secondary data sources including operational procedures, project plans, monitoring and periodical reports and other relevant sources related with projects will be reviewed as well. Secondary data obtained from such sources helpful to triangulate the data and further strengthen the analysis. The procedure using the analyzing of the data is establishing the relative importance of the various factors that contribute to causes of maturity and using descriptive, inferential, and . SPSS software is used to analyze the data.

3.5. Data Analysis Method

The data collected from primary source using questionnaire were analyzed using descriptive statistics method is employed in the data analysis. In the data analysis "Frequency Index", "Average Index", Percentage and mean score were used to calculate the project management

maturity level of the organization. Calculating the response rank were of each knowledge areas were undertaken for each respondent by calculating mean and taking the mean of all respondents finally indicate the maturity level of the organization.

As the PM Solutions' Level insists, the maturity level of each knowledge area was calculated by aggregating the maturity level of the components of each knowledge area. This was done by taking the mean rating of each component within a knowledge area as filled by the respondents. The questionnaire contained a five-point rating scale for each component, ranging from "very low" to "very high" which represent maturity levels of level 1 up to level 5, respectively. Then, the maturity level of the organization was found by taking the mean of the maturity level of the 14 knowledge areas. In doing so, equal weight was given to each knowledge area as it was assumed that all the knowledge areas had equal contribution. Similarly, equal weight was given to the components of each knowledge area in finding the maturity level of the corresponding knowledge area. Yimam (2011) concluded that the knowledge areas had equal contribution to the overall maturity of an organization after analyzing the judgment of various practitioners and academicians.

3.6. Validity and reliability

Reliability and validity are terms that refer to the quality of the measures used in a research study. Reliability refers to the internal consistency and validity refers to the accuracy of the measure.

3.6.1 Validity

Validity refers to the degree to which an instrument measures what it is supposed to be measuring. Validity has a number of different aspects and assessment approaches. There are two ways to evaluate instrument validity: content validity and statistical validity, which include criterion-related validity and construct validity:

Content validity test was conducted by consulting two groups of experts. The first was requested to evaluate and identify whether the questions agreed with the scope of the items and the extent to which these items reflect the concept of the research problem. The other was requested to evaluate that the instrument used is valid statistically and that the questionnaire was designed well enough to provide relations and tests between variables. The two groups of experts did agree that the

questionnaire was valid and suitable enough to measure the concept of interest with some amendments.

To ensure the validity of the questionnaire, two statistical tests should be applied. The first test is Criterion-related validity test (Pearson test) which measures the correlation coefficient between each paragraph in one field and the whole field. The second test is structure validity test (Pearson test) that is used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one field and all the fields of the questionnaire that have the same level of similar scale.

3.6.2. Reliability

The reliability of the questionnaire is tested by using Cronbach's alpha or called the alpha coefficient to show the internal consistency of questionnaires as stated by (Gliem & Gliem, 2003). And, again Gliem and Gliem (2003), stated the closer the reliability coefficient of 1.0 is the better. In general, they conducted reliabilities less than 0.60 are considered as poor, those in the range of 0.60 to 0.80 are considered good and acceptable. Greener (2008), stated that reliability is required of research studies. Similarly, Drost (2004), stated that internal consistency measures consistency within the instrument and questions how well a set of items measures a particular behavior or characteristic within the test.

3.7 Ethical Considerations

In the context of research, ethics refers to the appropriateness of the researchers' behavior in relation to the rights of the participants (Sathyanarayanan Rajendran et al., 2013). This study has considered of the commonly known ethical considerations in the data collection process. First, the consent of the participants was assured before delivering the questionnaires. The purpose of the study was clearly explained in the preface of the questionnaire in order to make the respondents free of pressure while giving information. Anonymity of the respondents was guaranteed as the research instrument didn't have any section that allowed to disclose participant identity. Moreover, the information gained from the participants was kept confidential and used only for the purpose of academic research.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

4.1 Introduction

This chapter includes the presentation of results as well as their interpretation and discussion. The discussion part is integrated under the result presentation of each knowledge area. The second section presents the general information of participants. The third and fourth sections present the maturity level of each knowledge area and the company; these sections answer the two research questions. The last section compares the maturity level results with industry benchmark values.

4.2 General Information of Respondents

As discussed in the "Data Collection" section of the previous chapter, out of the 67 questionnaires distributed, 64 were returned having a 96% response rate. The general information of these respondents is summarized in the table below.

Table 4-1 General Information of Respondents

General Information	Responses	Frequency	Percentage
Job Position	Department Manager	6	9.4
	Office Engineer	40	62.5
	Project manager	4	6.3
	Project supervisor engineer	8	12.5
	Planner	6	9.4
Sex	Male	59	92.2
	Female	5	7.8
	1-2	5	7.8
	3-5	10	15.6

Work Experience	6-10	35	54.7
	11-15	10	15.6
	Above 15	4	6.3
Educational Level	Diploma	0	0
	Bachelor Degree	50	78.1
	Master's Degree	14	21.9
	Doctorate Degree	0	0

(Source: Field Survey)

As discussed in the previous chapter, the participants of this research were the company's key personnel who were assumed to have a comprehensive knowledge about the corresponding project they have been assigned to.

A majority of the participants (62.5%) were composed of project office engineers. 12.5% of the participants account for Project supervisor engineer; 9.4 of the participants accounts for department Manager and the same amount of percentage account for Planner. The remaining 6.3% of the respondents were Project manager working at the head office of OCC.

Regarding gender composition, 92.2% of the respondents were males, while the 7.8% were females. The majority of the males were project office engineers. This implies that, while the males are fairly distributed across the four job positions, the females were concentrated over one position (project office engineer).

Out of the 64 respondents, 21.2% had a work experience of 1-2 years, whereas, a relatively larger percentage of them 38.5% worked for 3-5 years. 30.8% of the respondents had a work experience of 6-10 years. Only 6.7% of respondents had 11- 15 years of work experience, while a minority of 2.8% were senior employees who worked for above 15 years. Regarding educational level, employees with a bachelor degree predominantly participated in this research as a majority of 84.6% of the participants had a bachelor degree, while the remaining 15.4% were at master's degree educational level.

4.3 Maturity Model Selection

From literature review and summarized of different models that use for the assessment of construction project maturity in table 2-5 PM Solution's model and OPM3 models are almost the same except in their areas of focusing or covering in assessing the level of maturity. According to Špundak (2010) The PM solution's model has focus only on **project management** without taking into consideration other organizational aspects such as **program or portfolio management**. The OPM3 model focuses not only in projects but also in program and portfolio management which is beyond the scope of this research.

Thus, as this research focuses on assessing the level of project management maturity and identify the appropriate models in managing projects for Oromia construction sectors in the case of Oromia Construction Corporation rather than programs and portfolios, I selected the Project Management Maturity Model (PMMM) that was presented by PM Solutions to assess the level of project management maturity and the level maturity across each project management knowledge areas of Oromia Construction Corporation. And some of the model's characteristics make it ideal for use in the current study are also; This model is based on the fourteen knowledge areas of the PMBOK® Guide as shown figure 2-6, which is related with the objectives of the research and it also used the structure of the SEI Capability Maturity Model. The indicated assessment method is not very cumbersome and can easily be used to determine organizations' current level of project management maturity.

4.4 Maturity Level Across Pm Knowledge Area

In this section, the maturity levels of the 14 knowledge areas are presented and discussed based on the quantitative data collected from questionnaire. Besides, the supportive qualitative method of document review is used to strengthen the discussion. Some of the knowledge area component descriptions presented in this section are in a shortened form; whereas the questionnaire contained further elaboration for each item.

The questionnaire contained a five-point rating scale for each component, ranging from "very low" to "very high" which represent maturity levels of level 1 up to level 5, respectively. The maturity

level of each knowledge area was calculated by aggregating the maturity level of the components of each knowledge area. This was done by taking the mean rating of each component within a knowledge area as filled by the respondents. Each component of a knowledge area was given equal weight in calculating the maturity level.

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 OCC, judgment-based scoring system was used using the rating scale. In this part, we will evaluate the Maturity level of each knowledge area by analyzing the detail responses of the respondents in comparison with the Maturity Level. Then, the overall Average Project Management Maturity level will be evaluated.

4.4.1 Maturity of Project 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(Project Management Institute, 2013).

This knowledge area consisted of 5 components, which were rated by the 64 respondents. Table 4-2 summarizes the responses and the maturity level of each component

Table 4-2 Project Scope Management Maturity Level

Knowledge Area			
No	**1.Project Scope Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Level of scope definition (of Contract Documents, Specifications, and Design Drawings) in the project	3.83	0.827
2	Computer applications or tools used in scope management process	2.50	0.667
3	Formal monitoring and controlling of scope in the project	4.06	0.794
4	Inspection to ensure or verify that all scope of the work is complete	3.66	0.912
5	Monitoring the status of the project and product scope and managing changes to the scope baseline	4.03	0.796
Knowledge Area Maturity Level		**3.62**	

(Source: Field Survey & the questionaries' from PM solution)

In Scope management formal monitoring and controlling of scope in the project was the highest level of maturity from the five components that score 4.06 but computer application or tools used in the scope management process is the least maturity level scored 2.50 the other three components maturity level were between of these two components.

4.4.2 Maturity of Project 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 (Project Management Institute, 2013).

This knowledge area consisted of 7 components, which were rated by the 64 respondents. Table 4-3 summarizes the responses and the maturity level of each component.

Table 4-3 Project Time Management Maturity Level

Knowledge Area			
No	**2.ProjectTime Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Preparation of updated schedule for project activities having fixed start and finish date	3.45	0.775
2	Application of computer tools such as Microsoft project, Primavera, Microsoft excel etc. in scheduling	3.91	0.750
3	Application of WBS (Work Breakdown Structure) when defining the schedule activities	3.95	0.765
4	Level of preparing resource estimates (Material, Labor, and Equipment resources)	3.72	0.863
5	Practice of using historical data (from prior projects) in estimating activity duration	3.38	0.807
6	Continuous monitoring and controlling of progress of project activities	3.41	0.830
7	Practice of using Earned Value Management (EVM) in controlling schedule	3.48	0.642
Knowledge Area Maturity Level		**3.61**	

(Source: Field Survey & the questionaries' from PM solution)

From the seven components of project time management "Application of WBS (Work Breakdown Structure) when defining the schedule activities" scored a maturity level of 3.95 as most of the respondents agreed that there was a moderate to high level of Application of WBS (Work Breakdown Structure) when defining the schedule activities. Similarly, the least maturity level of the respondents replied that Practice of using historical data (from prior projects) in estimating activity duration was 3.38 maturity level. The other five components ware in between these two components.

4.4.3 Maturity of Project 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 (Project Management Institute, 2013).

This knowledge area consisted of 8 components, which were rated by the 64 respondents. Table 4-4 summarizes the responses and the maturity level of each component.

Table 4-4 Project Cost Management Maturity Level

Knowledge Area			
No	**3.Project Cost Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Level of preparing cost estimates for resources (labor, material, Equipment)	3.64	0.784
2	Application of WBS (Work Breakdown Structure) in preparing the cost estimate	3.77	0.729
3	Consideration of organizational historical actual cost data in preparing the cost estimate	3.17	0.808
4	Application of cost-estimating software in managing cost or preparing the estimate	3.69	0.774
5	Preparation of updated and time phased budget allocated to activities and resources	3.58	0.956
6	Continuous monitoring and controlling of the project cost	4.09	0.750
7	Practice of using Earned Value Management (EVM) in controlling cost	3.31	0.588
8	Tracking of project cost against base line project budget	2.97	0.872
Knowledge Area Maturity Level		**3.53**	

(Source: Field Survey & the questionaries' from PM solution)

From the eight components of project cost management “Continuous monitoring and controlling of the project cost” scored a maturity level of 4.09 as most of the respondents agreed that there was a moderate to high level of Continuous monitoring and controlling of the project cost when defining the cost of project. Similarly, the least maturity level of the respondents replied that Tracking of project cost against base line project budget was 2.97 maturity level. The other six components ware in between these two components.

4.4.4 Maturity of Project 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(Project Management Institute, 2013).

This knowledge area consisted of 6 components, which were rated by the 64 respondents. Table 4-5 summarizes the responses and the maturity level of each component.

Table 4-5 Project Quality Management Maturity Level

Knowledge Area			
No	**4.Project Quality Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Availability of standard quality management policies, procedures and guidelines in your organization	4.03	0.734
2	Level of quality planning (including determination of requirements and quality standards & strategies) in the project	3.25	0.777
3	Quality assurance activities implemented in the project (performing processes and procedures to assure quality objectives are met)	3.69	0.924
4	Quality control in the project (determining whether project activities comply with relevant quality standards or plans)	3.59	0.849

5	Quality audits in the project (a review to check if each project activity complied with quality requirement and policy)	2.67	0.691
6	Quality control and inspection of subcontractors' work to ensure compliance with quality requirements	3.56	0.852
Knowledge Area Maturity Level		**3.47**	

(Source: Field Survey & the questionaries' from PM solution)

From the six components of project cost management "Availability of standard quality management policies, procedures and guidelines in the organization" scored a maturity level of 4.03 as most of the respondents agreed that there was a moderate to high level of Availability of standard quality management policies, procedures and guidelines in the organization when defining the quality of project. Similarly, the least maturity level of the respondents replied that Quality audits in the project (a review to check if each project activity complied with quality requirement and policy) was 2.67 maturity level. The other four components ware in between these two components.

4.4.5 Maturity of Project 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(Project Management Institute, 2013).

This knowledge area consisted of 6 components, which were rated by the 64 respondents. Table 4-6 summarizes the responses and the maturity level of each component

Table 4-6 Project Human Resource Management Maturity Level

Knowledge Area			
No	**5.Project Human Resource Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Planning for acquisition and management of human resource	3.70	1.019
2	Complying by standard process & procedure for recruitment and expulsion of project employees	3.39	0.953
3	Extent of definition of skill requirements, roles and responsibilities for all project job positions	3.16	0.781
4	Frequency of training (formal or informal) provided to project team members to improve competencies	3.13	0.968
5	Practice of formal tracking and controlling of human resource cost and work hour time	3.28	0.951
6	Practice of regular performance tracking of project team members and providing feedback for improvement	3.41	0.886
Knowledge Area Maturity Level		**3.35**	

(Source: Field Survey & the questionaries' from PM solution)

From the six components of project Human Resource management "Planning for acquisition and management of human resource" scored a maturity level of 3.70 as most of the respondents agreed that there was a moderate to high level of Planning for acquisition and management of human resource when defining the Human Resource of project. Similarly, the least maturity level of the respondents replied that Frequency of training (formal or informal) provided to project team members to improve competencies was 2.67 maturity level. The other four components ware in between these two components.

4.4.6 Maturity of Project Equipment Management

Equipment Management includes the processes that organize, managing and scheduling Project Equipment management involves the processes: Develop Equipment Plan, Acquire Project

Equipment, Develop Project Equipment and Manage Project Equipment. Project Equipment Management includes the processes of organizational planning, Equipment acquisition, and Equipment usage (Project Management Institute, 2013).

This knowledge area consisted of 6 components, which were rated by the 64 respondents. Table 4-7 summarizes the responses and the maturity level of each component.

Table 4-7 Project Equipment Management Maturity Level

Knowledge Area			
No	**6.Project Equipment Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Comprehensiveness of policy that guides equipment acquisition, use, maintenance and replacement decisions	3.03	0.750
2	Level of planning for acquiring and use of project equipment (the plan includes the details of what, how much and when equipment is needed)	2.97	0.755
3	Practice of economic and risk analyses done to decide between buy or rent options in acquiring equipment	2.55	0.754
4	Practice to track and monitor performance of project's equipment, including their time worked, productivity, and maintenance cost	3.36	1.089
5	Practice of using software tools to plan, assign and track equipment	3.58	0.686
6	Availability of formal procedures for equipment sharing among the organization's projects	3.3	1.178
Knowledge Area Maturity Level		**3.13**	

(Source: Field Survey & the questionaries' from PM solution)

From the six components of project Equipment management "Practice of using software tools to plan, assign and track equipment" scored a maturity level of 3.58 as most of the respondents agreed that there was a Practice of using software tools to plan, assign and track equipment of project. Similarly, the least maturity level of the respondents replied that Practice of economic and risk analyses done to decide between buy or rent options in acquiring equipment was 2.55 maturity level. The other four components ware in between these two components.

4.4.7 Maturity of Project Materials Management

Materials Management includes the processes that organize, managing and scheduling Project Materials management involves the processes: Develop Materials Plan, Acquire Project Materials, Develop Project Materials and Manage Project Materials. Project Materials Management includes the processes of organizational planning, Materials acquisition, and Equipment usage(Project Management Institute, 2013).

This knowledge area consisted of 7 components, which were rated by the 64 respondents. Table 4-8 summarizes the responses and the maturity level of each component

Table 4-8 Project Materials Management Maturity Level

Knowledge Area			
No	**7.Project Materials Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Level of planning done for acquiring (obtaining) and use of project materials	3.69	1.037
2	Considerations of purchase costs, order cost, holding cost unavailability cost, unavailability risk, and cost increase	3.95	0.862
3	Considerations of special planning and monitoring for critical items and materials requiring long lead-time	3.69	1.022
4	Formal process to track, monitor material purchases, in order to assure the timely supply of materials	3.50	1.008
5	Application of computer software tools in material planning, assignment and tracking	2.94	0.924
6	Efforts in monitoring and tracking material availability and use in the project	2.59	0.791
7	Practice of using a documented process to approve, check and test materials in the project site	3.11	0.838
Knowledge Area Maturity Level		**3.35**	

(Source: Field Survey & the questionaries' from PM solution)

From the seven components of project Materials management “Considerations of purchase costs, order cost, holding cost unavailability cost, unavailability risk, and cost increase in material planning” scored a maturity level of 3.95 as most of the respondents agreed that there was a Considerations of purchase costs, order cost, holding cost unavailability cost, unavailability risk, and cost increase in material planning of project. Similarly, the least maturity level of the respondents replied Efforts in monitoring and tracking material availability and use in the project was 2.59 maturity level. The other five components ware in between these two components.

4.4.8 Maturity of Project 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 (Project Management Institute, 2013).

This knowledge area consisted of 5 components, which were rated by the 64 respondents. Table 4-9 summarizes the responses and the maturity level of each component

Table 4-9 Project Communication Management Maturity Level

Knowledge Area			
No	**8.Project Communication Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Practice of using a formal system or procedure for handling project documents	3.17	0.918
2	Practice of using a formal system or procedure for collecting and distributing information within and outside the project	2.86	0.974
3	Availability of plan or strategy prepared to address communication needs with different stakeholders	2.56	0.687

4	Practice of preparing project performance reports and providing to relevant stakeholders	3.64	0.982
5	Availability of standard format for preparation of reports	3.75	1.008
Knowledge Area Maturity Level		**3.20**	

(Source: Field Survey & the questionaries' from PM solution)

From the five components of project Communication management "Availability of standard format for preparation of reports" scored a maturity level of 3.75 as most of the respondents agreed that there was an Availability of standard format for preparation of reports of project. Similarly, the least maturity level of the respondents replied Availability of plan or strategy prepared to address communication needs with different stakeholders was 2.56 maturity level. The other three components ware in between these two components.

4.4.9 Maturity of Project 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 (Project Management Institute, 2013).

The Project Risk Management knowledge area consisted of 9 components, which were rated by the 64 respondents. Table 4-10 summarizes the responses and the maturity level of each component

Table 4-10 Project Risk Management Maturity Level

Knowledge Area			
No	**9.Project Risks Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Extent of a formal risk management plan (the process of defining how to conduct risk management activities) in the project	3.25	1.024
2	Level of identifying and documenting risks in a risk register	3.33	0.778
3	Use of risk break down structure (RBS) to identify or plan risks	3.50	1.008
4	Application of risk analysis to determine their potential impact along with their likelihood of happening and prioritization	2.67	0.909
5	Development of updated risk response strategy (strategies include: risk avoiding, mitigating, transferring and accepting)	2.78	0.826
6	Contingency time allowance in the project's schedule for potential risk consequences	2.63	0.724
7	Contingency budget reserve for potential risk consequences	2.59	0.868
8	Level of monitoring and controlling risks (identifying new changing risks, closing outdated risks, and tracking already identified risks)	3.08	1.013
9	Level of risk auditing (examination and documentation of effectiveness of risk response strategies and risk management processes)	3.09	1.160
Knowledge Area Maturity Level		**2.99**	

(Source: Field Survey & the questionaries' from PM solution)

From the nine components of project Risk management "Use of risk break down structure (RBS) to identify or plan risks" scored a maturity level of 3.50 as most of the respondents agreed that there was a Use of risk break down structure (RBS) to identify or plan risks of project. Similarly, the least maturity level of the respondents replied Contingency budget reserve for potential risk

consequences was 2.59 maturity level. The other seven components ware in between these two components.

4.4.10 Maturity of Project Procurement Management

Procurement management includes the processes necessary to purchase or acquire products and services. 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. From Contractors perspective procurement management is concerned mainly with subcontract management, supply purchase management and administering the contract that it entered with the client (Project Management Institute, 2013).

This knowledge area consisted of 8 components, which were rated by the 64 respondents. Table 4-11 summarizes the responses and the maturity level of each component.

Table 4-11 Project Procurement Management Maturity Level

Knowledge Area			
No	**10.Project Procurement Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Degree of planning for procurement of goods and services needed for the project	3.00	0.909
2	Practice of identifying special construction items (like items required in large quantities, needing special manufacturing or longer lead-time)	3.19	1.082
3	Availability of standard procurement documents (like standard purchase order document, sub-contract document, and supplier/vendor agreement)	3.84	0.895

4	Level of supplier and subcontractor qualification screening in the project	2.42	0.773
5	Level of documented contract management or administration processes in your organization	3.13	0.951
6	Level of defined process for managing contract change	2.63	0.864
7	Level of defined process for payment review and authorization	2.48	0.979
8	Level of defined process for contract closing	2.34	0.739
Knowledge Area Maturity Level		**2.88**	

(Source: Field Survey & the questionaries' from PM solution)

From the eight components of project Procurement management "Availability of standard procurement documents (like standard purchase order document, sub-contract document, and supplier/vendor agreement)" scored a maturity level of 3.84 as most of the respondents agreed that there was a Availability of standard procurement documents (like standard purchase order document, sub-contract document, and supplier/vendor agreement) of project. Similarly, the least maturity level of the respondents replied Level of defined process for contract closing was 2.34 maturity level. The other six components ware in between these two components.

4.4.11 Maturity of Project Stake holder Management

Project stakeholder management includes the process required to identify people, groups, or organizations that could impact or impacted by the project, to analysis stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging and influencing stakeholders in project decisions and execution (Project Management Institute, 2013).

This knowledge area consisted of 4 components, which were rated by the 64 respondents. Table 4-12 summarizes the responses and the maturity level of each component

Table 4-12 Project Stake holder Management Maturity Level

Knowledge Area			
No	**11.Project Stake holder Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Practice of undertaking a formal stakeholder analysis in the project	2.33	1.169
2	Availability of a formal stakeholder management plan	2.45	1.181
3	Continuous effort to work and communicate with stakeholders for influencing their expectation, resolve issues and address their concern	3.14	1.096
4	Monitoring of overall project stakeholder relationships	2.72	0.899
Knowledge Area Maturity Level		**2.66**	

(Source: Field Survey & the questionaries' from PM solution)

From the four components of project Stake holder management "Continuous effort to work and communicate with stakeholders for influencing their expectation, resolve issues and address their concern" scored a maturity level of 3.14 as most of the respondents agreed that there was a Continuous effort to work and communicate with stakeholders for influencing their expectation, resolve issues and address their concern of project. Similarly, the least maturity level of the respondents replied Practice of undertaking a formal stakeholder analysis in the project was 2.33 maturity level. The other two components ware in between these two components.

4.4.12 Maturity of Project Safety Management

Project Safety management includes the processes of conducting Safety management planning, identification, analysis, response planning, and monitoring and control of project Safety. The objectives of Safety management are to increase the probability and impact of positive events, and decrease the probability and impact of negative events in the project. Safety management processes are: Plan Safety Management, Identify Safety, Perform and Safety Plan, Monitor and Control Safety(Project Management Institute, 2013).

The Project Safety Management knowledge area consisted of 8 components, which were rated by the 64 respondents. Table 4-13 summarizes the responses and the maturity level of each component.

Table 4-13 Project Safety Management Maturity Level

Knowledge Area			
No	**12.Project Safety Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Application of organizational policies, procedures and guidelines for safety management	3.34	0.877
2	Level of safety planning performed (includes determining safety standards & requirements, devising action plans or strategies, staffing, allocating budget)	2.70	0.973
3	Level of site neighborhood safety characteristics study done	2.52	1.039
4	Level of hazard analysis performed for project activities	2.72	0.576
5	Level of safety control process implemented (inspecting whether project activities comply with safety standards)	2.83	0.680
6	Application of safety audit (a review whether project activities complied with safety requirements)	1.89	0.928
7	Provision of personal protective equipment (such as helmets, safety shoes, safety clothes) for all workers in the project site	3.23	0.886
8	Level of safety training provided for workers	2.55	0.975
Knowledge Area Maturity Level		**2.72**	

(Source: Field Survey & the questionaries' from PM solution)

From the eight components of project safety management "Application of organizational policies, procedures and guidelines for safety management" scored a maturity level of 3.34 as most of the respondents agreed that there was an Application of organizational policies, procedures and guidelines for safety management of project. Similarly, the least maturity level of the respondents

replied Application of safety audit (a review whether project activities complied with safety requirements) was 1.89 maturity level. The other six components ware in between these two components.

4.4.13 Maturity of Project Financial Management

Project Financial management includes the process required to identify Financial resources, organizations all Financial resources that could impact or impacted by the project, to analysis Financial resources expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging and influencing Financial resources in project decisions and execution(Project Management Institute, 2013).

This knowledge area consisted of 9 components, which were rated by the 64 respondents. Table 4-14 summarizes the responses and the maturity level of each component

Table 4-14 Project Financial Management Maturity Level

Knowledge Area			
No	**13.Project Financial Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Level of preparing financial plan for projects including when and how much project funding is needed	3.19	0.924
2	Consideration of effects in changing exchange rate, escalating labor and material cost in the plan	3.11	0.875
3	Frequency of cash flow analysis done for the project	2.97	0.908
4	Effort in controlling the project finance to make sure that money is properly spent as planned and properly authorized	3.16	0.963
5	Frequency of preparing timely financial reports of the project	3.55	0.775
6	Level of established system or procedure for creating and handling financial documents	3.36	0.764
7	Reliability of financial audits done in the project	3.27	0.740

8	Practice of using a standard process and format to record, store and report financial information	3.03	0.992
9	Practice of using computer systems in filling and retrieval of financial information in the project	3.17	0.935
Knowledge Area Maturity Level		**3.20**	

(Source: Field Survey & the questionaries' from PM solution)

From the nine components of project Financial management "Frequency of preparing timely financial reports of the project" scored a maturity level of 3.55 as most of the respondents agreed that there was a Frequency of preparing timely financial reports of the project. Similarly, the least maturity level of the respondents replied Frequency of cash flow analysis done for the project was 2.97 maturity level. The other seven components ware in between these two components.

4.4.14 Maturity of Project Integration Management

Project Integration management includes the process required to identify people, groups, or organizations that could impact or impacted by the project, to analysis Integration expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging and influencing Integration in project decisions and execution(Project Management Institute, 2013).

This knowledge area consisted of 5 components, which were rated by the 64 respondents. Table 4-15 summarizes the responses and the maturity level of each component

Table 4-15 Project Integration Management Maturity Level

Knowledge Area			
No	**14.Project Integration Management**	**Mean Maturity Leve**	**Standard Deviation**
1	Defining, preparing, and coordinating all subsidiary plans and integrating them into a comprehensive project management plan.	3.00	0.926
2	Leading and performing the work defined in the project management plan and implementing approved changes to achieve the project's objective.	2.86	0.814
3	Racking, reviewing, and reporting project progress against the performance objectives defined in the project management plan.	3.45	1.007
4	Coordinating changes across the entire project	2.97	0.942
5	Finalizing all activities across all of the Project Management Process Groups to formally complete the phase or project.	3.00	0.926
Knowledge Area Maturity Level		**3.82**	

(Source: Field Survey & the questionaries' from PM solution)

From the five components of project Integration management "Racking, reviewing, and reporting project progress against the performance objectives defined in the project management plan." scored a maturity level of 3.45 as most of the respondents agreed that there was a Racking, reviewing, and reporting project progress against the performance objectives defined in the project management plan. Similarly, the least maturity level of the respondents replied Leading and performing the work defined in the project management plan and implementing approved changes to achieve the project's objective was 2.86 maturity level. The other three components ware in between these two components.

4.5 Project Management Maturity Level of the Company

As described in the previous section, the maturity levels of components under each knowledge area were first computed. From the total of 93 components 71.43% scored a maturity level below 4, of which 21.43% scored below maturity level 3 and 7.14% scored maturity below level 2. These components were then used to measure the knowledge area maturity level.

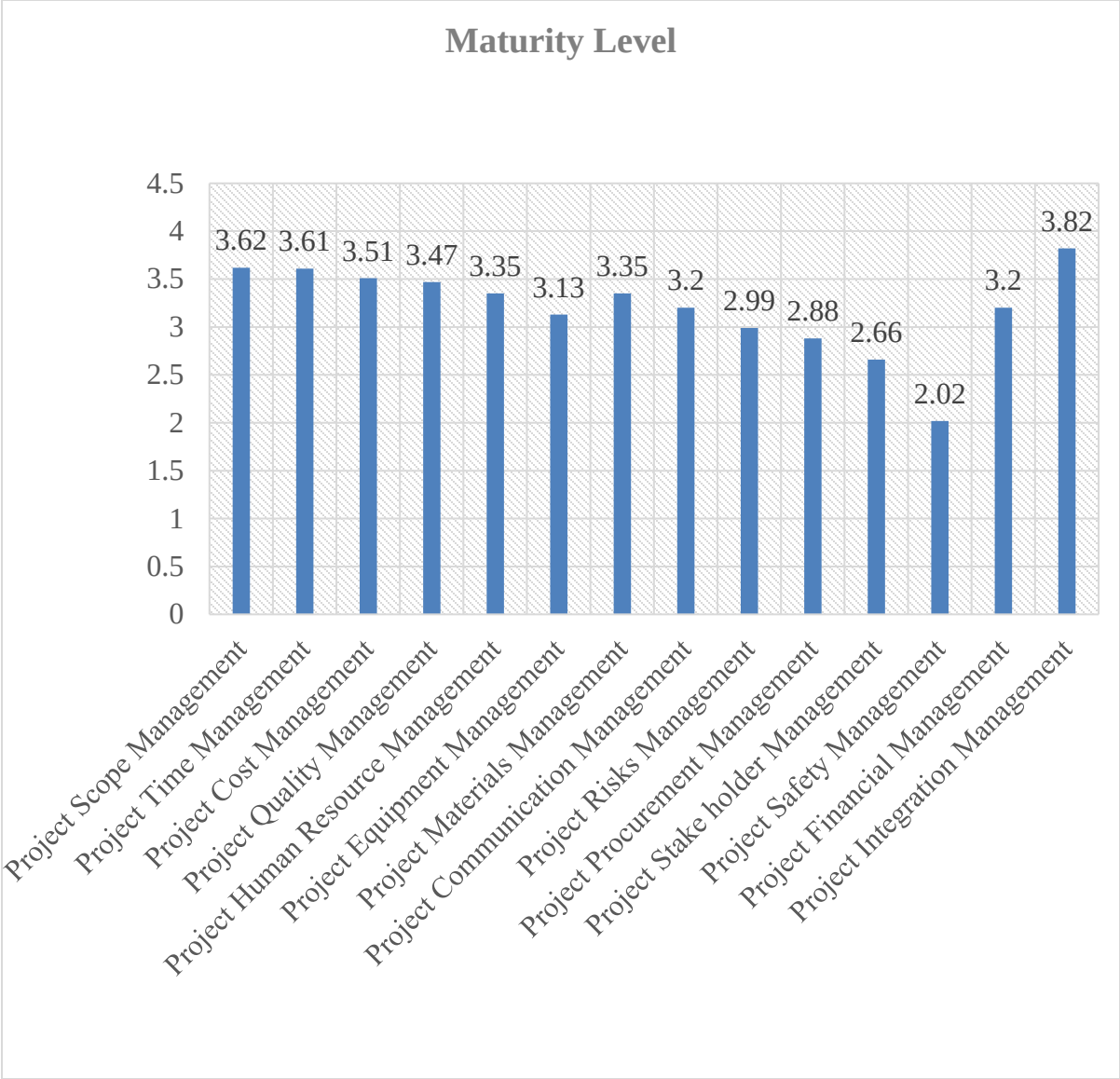
Project integration, scope, time and cost management were the highest matured knowledge areas with maturity levels of 3.82, 3.62, 3.61 and 3.51, respectively. Similarly, prior researchers (including on industries other than construction), such as Labuschagne & Marnewick (2009), Pretorius et al. (2011) and (Yimam, 2011), found out that the project time management knowledge area scored the highest maturity level in their studies; whereas, Sukhoo et al. (2005) and Weldemariam (2013) found the project scope management knowledge area ranking first.Project safety management was the least matured knowledge area in the company with a maturity level of 1.89.

The 14-knowledge area maturity level were aggregated to obtain the PM maturity level of the company, which was 3.15. Table 4-16 summarizes the knowledge area and company maturity levels.

Table 4-16 Company Project Management Maturity Level

No	Knowledge Area	Maturity Level	Rank
1	Project Scope Management	3.62	2
2	Project Time Management	3.61	3
3	Project Cost Management	3.51	4
4	Project Quality Management	3.47	5
5	Project Human Resource Management	3.35	6
6	Project Equipment Management	3.13	8
7	Project Materials Management	3.35	6
8	Project Communication Management	3.20	7
9	Project Risks Management	2.99	9
10	Project Procurement Management	2.88	10
11	Project Stake holder Management	2.66	11
12	Project Safety Management	2.02	12
13	Project Financial Management	3.20	7
14	Project Integration Management	3.82	1
	Company Project Management Maturity Level	**3.15**	

(Source: Field Survey)



(Source: Field Survey)

Fig 4-1 Summary of PM Knowledge Area maturity level of Oromia construction corporation

4.6 Range of Project Management Maturity Level launch by (PM Solution)

Each level represented a discrete organizational capability based on the organization maturity in each of the knowledge area components listed.

1) Level 1: Initial process range (0-1)
2) Level 2: structured process and standards (1.1-2.0)
3) Level 3: organizational standards & institutionalized management (2.1-3.0)
4) Level 4: Managed process (3.1- 4.0)
5) Level 5: Optimizing process (4.1-5.0)

A company-wide maturity level of **3.15** implies that the company is between level 3 and level 4 yet to fully attain a level 4 maturity. Hence, the company is assumed to incorporate the maturity characteristics of level 4 or "**Managed Process**." According to (Crawford, 2015), in such organizations: Projects are managed with consideration as to how they performed in the past and what is expected for the future; Management uses efficiency and effectiveness metrics to make decisions regarding a project and understands the impacts on other projects. All projects, changes, and issues are evaluated based upon metrics from cost estimates, baseline estimates, and earned value calculations. Project information is integrated with other corporate systems to optimize business decisions.

Processes and standards are documented and in place to support the practice of using such metrics to make project decisions. Management clearly understands its role in the project management process and executes it well, managing at the right level, and clearly differentiating management styles and project management requirements for projects of different sizes and complexities. Project management processes, standards, and supporting systems are integrated with other corporate processes and systems (Crawford, 2015).

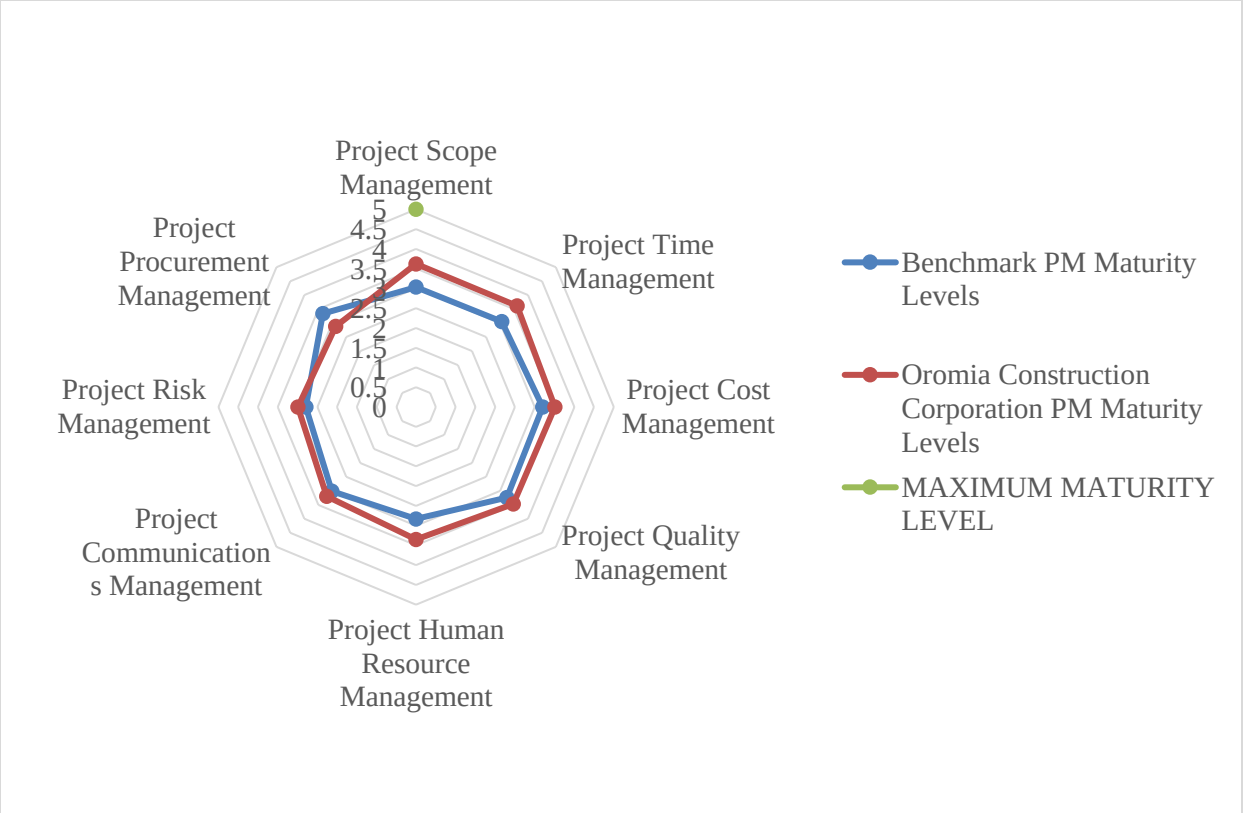
4.7 Comparison of Results with Industry Benchmark

One of the specific objectives of the research was to compare the project management maturity of Oromia Construction Corporation with industry benchmark in African context. For this purpose, the benchmark defined by "Prosperous Report: The African Edition" (authored by Labuschagne et al., 2013) was selected. The study covered 13 developing African countries to investigate the project management maturity of 218 construction projects found in those countries. Only 8 knowledge areas were analyzed in the report; therefore, only those knowledge areas were used for comparison. The following table and figure depict the comparison of the benchmark report's knowledge area maturity levels with that of Oromia Construction Corporation. Except for project procurement management, all knowledge areas had maturity levels greater than the corresponding industry benchmark values.

Table 4-17 Comparison of Results with Industry Benchmark Values

Knowledge Areas	Benchmark PM Maturity Levels	Oromia Construction Corporation PM Maturity Levels
Project Scope Management	3.03	3.62
Project Time Management	3.06	3.61
Project Cost Management	3.20	3.51
Project Quality Management	3.24	3.47
Project Human Resource Management	2.83	3.35
Project Communications Management	3.01	3.20
Project Risk Management	2.79	2.99
Project Procurement Management	3.34	2.88

(Source: Field Survey)



(Source: Field Survey)

Figure 4-2 Comparison of Results with Industry Benchmark Values in Spider diagram

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Based on a quantitative descriptive analysis, the result of research has tried to measure the project management maturity level of "Oromia construction corporation". The aim of the research was to contemplate possible ways, in which the maturity assessment can be used to improve the project management practice and measure the project management maturity at the OCC, a project management maturity Level devised by PM Solutions was used that selected model for this research objectives. The Level follows five levels of progressive process maturity and uses PM knowledge areas from the project management Institute's PMBOK guide. The Level is important to measure an organization's project management maturity and to direct organizations towards important project management practices that are important to achieve project management growth and excellence. As discussed on the literature review part of the study, organizations that practice project management in a formal and structured way tend to exhibit higher maturities and witness better achievement in project management.

The study concern is to measure the level of maturity and assess PMBOK practice of Oromia construction corporation. Based on the data gathered and analyzed practically ten of knowledge areas maturity level is 4, three of them are maturity level is 3 and one of from the fourteen-knowledge area maturity level is 2.

The project management maturity level of the core and facilitating project management knowledge areas is between level 3 and level 4. And the final maturity level of the fourteen project management knowledge areas is at 3.15. Summary of the project management knowledge areas maturity level is given below.

Project management core knowledge areas

- Project scope management- 3.62

- Project time management-3.61
- Project cost management-3.53
- Project quality management-3.47

Project management facilitating knowledge areas

- Project Human Resource Management-3.35
- Project Equipment Management-3.13
- Project Materials Management-3.35
- Project Communication Management-3.20
- Project Risks Management-2.99
- Project Procurement Management-2.88
- Project Stake holder Management-2.66
- Project Safety Management-2.02
- Project Financial Management-3.20
- Project Integration Management-3.82

The overall project management maturity level at Oromia construction corporation is a maturity between level 3 and level 4. This indicates that most organizational standards & institutionalized management and Managed Process were achieved by most of project management knowledge area and applied to all projects. However, in some cases, like project risk, procurement and stakeholder management elements are Organizational Standards and Institutionalized Process and only project safety management is under Structure Process and Standard**s** thus processes are not applied properly and effectively.

Project safety management maturity level of Oromia construction corporation is relatively lower than the rest of knowledge areas and it is at maturity level 2. Project Safety management includes the processes of conducting Safety management planning, identification, analysis, response planning, and monitoring and control of project Safety. In regard to this the project office uses all knowledge area of project management yet still needs to face the challenge of triple constraint.

In the comparison of the maturity level of OCC with industry bench marks the level of maturity of OCC more than the industrial bench mark except procurement maturity level which is below the industrial level. This result show OCC in good performance of project management practice.

5.2 Recommendations

Effective use of project management techniques at the Company level is critical factor for achieving success in projects execution. The following recommendations are considered to be important and fundamental to help Oromia Construction corporation to create an environment in which the Company can be more successful to improve its project management maturity level and be in line with the customer demand by giving timely response and complete solution.

The following points suggest possible improvement measures to be taken by the company to attain a higher maturity level on each knowledge area. These recommendations focus on components that scored lower maturity level under each knowledge area and hence, evaluated as practice gaps whose improvement efforts should be prioritized.

- Regarding project safety management, the company should give special attention in practicing Project Safety management includes the processes of conducting Safety management planning, identification, analysis, response planning, and monitoring and control of project Safety. The level of safety planning should also be improved by further determining requirements, safety standards and strategies. It is also recommended that the company establishes a formal safety management unit, consisting of employees who specialized in safety management, across all the projects.
- The project Stake holder management knowledge area was one of the least matured ones. The planning for acquiring and use of Project stakeholder management includes the process required to identify people, groups, or organizations that could impact or impacted by the project, to analysis stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging and influencing stakeholders in project decisions and execution: working shifts; The management is regularly involved in input provision and decision-making, processes are typically automated and there is

consistent use of tools and techniques for project management process and well-established formal documentation at organizational level for all projects.

- The project Procurement management knowledge area was one of the least matured ones. The planning for acquiring and use of Procurement management includes the processes necessary to purchase or acquire products and services. 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. From Contractors perspective procurement management is concerned mainly with subcontract management, supply purchase management and administering the contract that it entered with the client.
- Project risk management was one of the least matured knowledge areas in the company. Thus, it's imperative to apply fundamental improvement measures to risk management practices and processes. Formal risk management plan should be devised for all projects; risk registers should be updated regularly; formal risk analysis should be undertaken regularly; contingency time and budget allowance should be reserved for risk impacts; risk monitoring, controlling, and auditing activities should be applied in timely manner to all projects.
- Encourage the organization to attain least high level of process maturity and practice maturity in order to obtain successful result and ensure control of their projects. As indicated in the problem statement part showed (Yimam, 2011) reveled in his study project management maturity in Ethiopian construction sector the overall maturity level of the sector was low. The research also showed that project management practices are largely informal. At formal level of process maturity; structured approach, guides and standards are used, expectation is more or less clarified, thus helping create clarity and lowering risks assumed by subordinates and increase their confidence to make decision. Further, the use of guides ensures consideration of important aspects, thus significantly contributing to the performance of the knowledge areas. The use of generic guides such as PMBOK in this

regard may significantly help. The attainment of higher level of practice maturity means that the organization is performing all the practices of that are must to attain the goal of the knowledge areas, thus maximizing the chance of attaining knowledge area goals and hence, attainment of project objectives.

5.3. Recommendations for Further Research

Since, the idea of project management maturity is relatively new and not practiced in Ethiopia, it would be valuable to conduct further research in the topic. In addition, that this research is based on one case, further study can be conducted on many organizations and sectors. This will allow for greater reliability to provide important statistical generalizations. A study on similar case will also be interesting since it will help to visualize the progress made in project management maturity and practices by the project office. Conduct in-depth research regarding each by each project management knowledge area for the organization to determine PM knowledge area level of maturity and for detailed outcomes.

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APPENDICES

Appendix-1: Questionnaire for Respondents

ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

SCHOOL OF CIVIL AND ARCHITECTURE ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

Dear Respondent:

I'm a graduate student in School of Civil and Architecture engineering, Adama Science and Technology University. Currently, I am undertaking a research, titled "**Project management maturity Level in Oromia construction sectors: the case of Oromia Construction Corporation**" in partial fulfillment of the requirements for the degree of Master of **Construction Engineering and Management.**

You are one of the respondents who have been selected to participate in this research. I would like to kindly request you to take few minutes of your time and fill the following attached questionnaire. All of the questions included are multiple choices with a five-point scale. Your innocent cooperation in providing honest information is very important for the successful accomplishment of the research project. I would like to guarantee you that your responses will be held private, confidential and used only for academic research purpose.

I thank you in advance for your time and effort. If you have any question for clarification, you can contact me through: **0970164847**

Sincerely,

Ashebir Hailu

Adama, Ethiopia

Part I – Personal Information

1. Your current position in the organization, please mark “X” on the space

A, Department Manager ☐ C, Office Engineer ☐

B, Project Manager ☐ D, Project supervisor Engineer ☐

E, Planner ☐ F, Other ☐

2. Sex

Female ☐ Male ☐

3. Years of Working experience

A, 1-2 ☐ B, 3-5 ☐ C, 6-10 ☐

D, 11-15 ☐ E, Above 15 ☐

4. Educational level

Diploma ☐ Bachelor Degree ☐

Master’s Degree ☐ Doctorate Degree ☐

Other ☐

Part II – Project Management Maturity Questions

General Direction: There are 14 project management knowledge areas to be assessed. Try to respond to all the practice by marking 'X' on the space provided. If a practice doesn't exist in your organization, choose the **"very low"** option. If you have any additional comment, please write it on the space provided under each table.

1. Project Scope Management

No	Description	Very Low	Low	Ave rage	High	Very High
1	Level of scope definition (of Contract Documents, Specifications, and Design Drawings) in the project					
2	Computer applications or tools used in scope management process					
3	Formal monitoring and controlling of scope in the project					
4	Inspection to ensure or verify that all scope of the work is complete					
5	Monitoring the status of the project and product scope and managing changes to the scope baseline					

Additional comments: _____

2. Project Time Management

No	Description	Very Low	Low	Aver age	High	Very High
1	Preparation of updated schedule for project activities having fixed start and finish date					
2	Application of computer tools such as Microsoft project, Primavera, Microsoft excel etc. in scheduling					
3	Application of WBS (Work Breakdown Structure) when defining the schedule activities					
4	Level of preparing resource estimates (Material, Labor, and Equipment resources)					
5	Practice of using historical data (from prior projects) in estimating activity duration					
6	Continuous monitoring and controlling of progress of project activities					
7	Practice of using Earned Value Management (EVM) in controlling schedule					

Additional comments: _____

3. Project Cost Management

No	Description	Very Low	Low	Average	High	Very High
1	Level of preparing cost estimates for resources (labor, material, Equipment)					
2	Application of WBS (Work Breakdown Structure) in preparing the cost estimate					
3	Consideration of organizational historical actual cost data in preparing the cost estimate					
4	Application of cost-estimating software in managing cost or preparing the estimate					
5	Preparation of updated and time phased budget allocated to activities and resources					
6	Continuous monitoring and controlling of the project cost					
7	Practice of using Earned Value Management (EVM) in controlling cost					
8	Tracking of project cost against base line project budget					

4. Project Quality Management

No	Description	Very Low	Low	Average	High	Very High
1	Availability of standard quality management policies, procedures and guidelines in your organization					
2	Level of quality planning (including determination of requirements and quality standards & strategies) in the project					
3	Quality assurance activities implemented in the project (performing processes and procedures to assure quality objectives are met)					
4	Quality control in the project (determining whether project activities comply with relevant quality standards or plans)					
5	Quality audits in the project (a review to check if each project activity complied with quality requirement and policy)					
6	Quality control and inspection of subcontractors' work to ensure compliance with quality requirements					

Additional comments: _____

5. project Human Resource Management

No	Description	Very Low	Low	Average	High	Very High
1	Planning for acquisition and management of human resource					
2	Complying by standard process & procedure for recruitment and expulsion of project employees					
3	Extent of definition of skill requirements, roles and responsibilities for all project job positions					
4	Frequency of training (formal or informal) provided to project team members to improve competencies					
5	Practice of formal tracking and controlling of human resource cost and work hour time					
6	Practice of regular performance tracking of project team members and providing feedback for improvement					

Additional comments: _____

6. Project Equipment Management

No	Description	Very Low	Low	Average	High	Very High
1	Comprehensiveness of policy that guides equipment acquisition, use, maintenance and replacement decisions					
2	Level of planning for acquiring and use of project equipment (the plan includes the details of what, how much and when equipment are needed)					
3	Practice of economic and risk analyses done to decide between buy or rent options in acquiring equipment					
4	Practice to track and monitor performance of project's equipment, including their time worked, productivity, and maintenance cost					
5	Practice of using software tools to plan, assign and track equipment					
6	Availability of formal procedures for equipment sharing among the organization's projects					

Additional comments: _____

7. Project Materials Management

No	Description	Very Low	Low	Average	High	Very High
1	Level of planning done for acquiring (obtaining) and use of project materials					
2	Considerations of purchase costs, order cost, holding cost (cost of storing materials), unavailability cost, unavailability risk, and cost increase in material planning					
3	Considerations of special planning and monitoring for critical items and materials requiring long lead-time (long process to acquire)					
4	Formal process to track, monitor and follow up material purchases, in order to assure the timely supply of materials					
5	Application of computer software tools in material planning, assignment and tracking					
6	Efforts in monitoring and tracking material availability and use in the project					
7	Practice of using a documented process to approve, check and test materials in the project site					

Additional comments: _____

8. Project Communication Management

No	Description	Very Low	Low	Average	High	Very High
1	Practice of using a formal system or procedure for handling project documents					
2	Practice of using a formal system or procedure for collecting and distributing information within and outside the project					
3	Availability of plan or strategy prepared to address communication needs with different stakeholders					
4	Practice of preparing project performance reports and providing to relevant stakeholders					
5	Availability of standard format for preparation of reports					

Additional comments: _____

9. Project Risk Management

No	Description	Very Low	Low	Average	High	Very High
1	Extent of a formal risk management plan (the process of defining how to conduct risk management activities) in the project					
2	Level of identifying and documenting risks in a risk register					
3	Use of risk break down structure (RBS) to identify or plan risks					
4	Application of risk analysis to determine their potential impact along with their likelihood of happening and prioritization					
5	Development of updated risk response strategy (strategies include: risk avoiding, mitigating, transferring and accepting)					
6	Contingency time allowance in the project's schedule for potential risk consequences					
7	Contingency budget reserve for potential risk consequences					
8	Level of monitoring and controlling risks (identifying new changing risks, closing outdated risks, and tracking already identified risks)					
9	Level of risk auditing (examination and documentation of effectiveness of risk response strategies and risk management processes)					

Additional comments: _____

10.Project Procurement Management

No	Description	Very Low	Low	Average	High	Very High
1	Degree of planning for procurement of goods and services needed for the project					
2	Practice of identifying special construction items (like items required in large quantities, needing special manufacturing or longer lead-time)					
3	Availability of standard procurement documents (like standard purchase order document, sub-contract document, and supplier/vendor agreement)					
4	Level of supplier and subcontractor qualification screening in the project					
5	Level of documented contract management or administration processes in your organization					
6	Level of defined process for managing contract change					
7	Level of defined process for payment review and authorization					
8	Level of defined process for contract closing					

11.Project Stake holder Management

No	Description	Very Low	Low	Average	High	Very High
1	Practice of undertaking a formal stakeholder analysis in the project					
2	Availability of a formal stakeholder management plan					
3	Continuous effort to work and communicate with stakeholders for influencing their expectation, resolve issues and address their concern					
4	Monitoring of overall project stakeholder relationships					

Additional comments: _____

12.Project Safety Management

No	Description	Very Low	Low	Average	High	Very High
1	Application of organizational policies, procedures and guidelines for safety management					
2	Level of safety planning performed (includes determining safety standards & requirements, devising action plans or strategies, staffing, allocating budget)					
3	Level of site neighborhood safety characteristics study done					
4	Level of hazard analysis performed for project activities					
5	Level of safety control process implemented (inspecting whether project activities comply with safety standards)					
6	Application of safety audit (a review whether project activities complied with safety requirements)					
7	Provision of personal protective equipment (such as helmets, safety shoes, safety clothes) for all workers in the project site					
8	Level of safety training provided for workers					

Additional comments: _____

13.Project Financial Management

No	Description	Very Low	Low	Average	High	Very High
1	Level of preparing financial plan for projects including when and how much project funding is needed					
2	Consideration of effects in changing exchange rate, escalating labor and material cost in the plan					
3	Frequency of cash flow analysis done for the project					
4	Effort in controlling the project finance to make sure that money is properly spent as planned and properly authorized					
5	Frequency of preparing timely financial reports of the project					
6	Level of established system or procedure for creating and handling financial documents					
7	Reliability of financial audits done in the project					

8	Practice of using a standard process and format to record, store and report financial information					
9	Practice of using computer systems in filling and retrieval of financial information in the project					

14.Project Integration Management

No	Description	Very Low	Low	Average	High	Very High
1	Defining, preparing, and coordinating all subsidiary plans and integrating them into a comprehensive project management plan.					
2	Leading and performing the work defined in the project management plan and implementing approved changes to achieve the project's objective.					
3	Racking, reviewing, and reporting project progress against the performance objectives defined in the project management plan.					
4	Coordinating changes across the entire project					
5	Finalizing all activities across all of the Project Management Process Groups to formally complete the phase or project.					

Additional comments: _____

Thank You for Your Cooperation

Appendix-2 Component SPSS V.26 Detail Statistical Output

1.Project Scope Management						
		Level of scope definition	Computer applications or tools used in scope management	Formal monitoring and controlling of scope in the project	Inspection to ensure or verify that all scope	Monitoring the status of the project and product scope
N	Valid	64	64	64	64	64
	Missing	0	0	0	0	0
Mean		3.83	2.50	4.06	3.66	4.03
Std. Deviation		.827	.667	.794	.912	.796

2.ProjectTime Management								
		Preparation of updated schedule for project	Application of computer tools such as Microsoft	Application of WBS (Work Breakdown	Level of preparing resource	Practice of using historical data	Continuous monitoring and controlling of	Practice of using Earned Value Management
N	Valid	64	64	64	64	64	64	64
	Missing	0	0	0	0	0	0	0
Mean		3.45	3.91	3.95	3.72	3.38	3.41	3.48
Std. Deviation		.775	.750	.765	.863	.807	.830	.642

3.Project Cost Management									
		Level of preparing cost	Application of WBS (Work Breakdown	Consideration of organizational historical actual	Application of cost-estimating software in	Preparation of updated and time phased	Continuous monitoring and controlling of	Practice of using Earned Value	Tracking of project cost against base line
N	Valid	64	64	64	64	64	64	64	64
	Missing	0	0	0	0	0	0	0	0
Mean		3.64	3.77	3.17	3.69	3.58	4.09	3.31	2.97
Std. Deviation		.784	.729	.808	.774	.956	.750	.588	.872

4.Project Quality Management							
		Availability of standard quality management policies	Level of quality planning (including determination	Quality assurance activities implemented	Quality control in the project	Quality audits in the project	Quality control and inspection of subcontractors'
N	Valid	64	64	64	64	64	64
	Missing	0	0	0	0	0	0
Mean		4.03	3.25	3.69	3.59	2.67	3.56
Std. Deviation		.734	.777	.924	.849	.691	.852

5.Project Human Resource Management							
		Planning for acquisition and management	Complying by standard process	Extent of definition skill requirements	Frequency of training (formal or informal)	Practice of formal tracking and controlling	Practice of regular performance
N	Valid	64	64	64	64	64	64
	Missing	0	0	0	0	0	0
Mean		3.70	3.39	3.16	3.13	3.28	3.41
Std. Deviation		1.019	.953	.781	.968	.951	.886

6.Project Equipment Management							
		Comprehensiveness of policy that guides equipment	Level of planning for acquiring and use of project	Practice of economic and risk analyses done	Practice to track and monitor performance	Practice of using software tools to plan, assign	Availability of formal procedures for equipment
N	Valid	64	64	64	64	64	64
	Missing	0	0	0	0	0	0
Mean		3.03	2.97	2.55	3.36	3.58	3.30
Std. Deviation		.755	.755	.754	1.089	.686	1.178

7.Project Materials Management								
		Level of planning done for acquiring	Considerations of purchase costs, order cost	Considerations of special planning and monitoring	Formal process to track, monitor material purchases	Application of computer software tools	Efforts in monitoring and tracking material	Practice of using a documented process
N	Valid	64	64	64	64	64	64	64
	Missing	0	0	0	0	0	0	0
Mean		3.69	3.95	3.69	3.50	2.94	2.59	3.11
Std. Deviation		1.037	.862	1.022	1.008	.924	.791	.838

8.Project Communication Management						
		Practice of using a formal system or procedure	Practice of using a formal system or procedure	Availability of plan or strategy prepared	Practice of preparing project performance reports	Availability of standard format for preparation
N	Valid	64	64	64	64	64
	Missing	0	0	0	0	0
Mean		3.17	2.86	2.56	3.64	3.75
Std. Deviation		.918	.974	.687	.982	1.008

9.Project Risks Management

		Extent of a formal risk management plan	Level of identifying and documenting risks	Use of risk break down structure	Application of risk analysis to determine	Development of updated risk response	Contingency time allowance in the project's schedule	Contingency budget reserve for potential risk	Level of monitoring and controlling risks	Level of risk auditing
N	Valid	64	64	64	64	64	64	64	64	64
	Missing	0	0	0	0	0	0	0	0	0
Mean		3.25	3.33	3.50	2.67	2.78	2.63	2.59	3.08	3.09
Std. Deviation		1.024	.778	1.008	.909	.826	.724	.868	1.013	1.16

10.Project Procurement Management									
		Degree of planning for procurement	Practice of identifying special	Availability of standard procurement	Level of supplier and subcontract	Level of documented contract	Level of defined process for managing contract	Level of defined process for payment	Level of defined process for contract closing
N	Valid	64	64	64	64	64	64	64	64
	Missing	0	0	0	0	0	0	0	0
Mean		3.00	3.19	3.84	2.42	3.13	2.63	2.48	2.34
Std. Deviation		.909	1.082	.895	.773	.951	.864	.976	.739

11.Project Stake holder Management					
		Practice of undertaking a formal stakeholder analysis	Availability of a formal stakeholder management plan	Continuous effort to work and communicate	Monitoring of overall project stakeholder relationships
N	Valid	64	64	64	64
	Missing	0	0	0	0
Mean		2.33	2.45	3.14	2.72
Std. Deviation		1.169	1.181	1.096	.899

12.Project Safety Management									
		Application of organizational policies	Level of safety planning performed	Level of site neighborhood safety	Level of hazard analysis performed	Level of safety control process implemented	Application of safety audit	Provision of personal protective	Level of safety training provided
N	Valid	64	64	64	64	64	64	64	64
	Missing	0	0	0	0	0	0	0	0
Mean		3.34	2.70	2.52	2.72	2.83	1.89	3.23	2.55
Std. Deviation		.877	.937	1.039	.576	.680	.928	.886	.975

13.Project Financial Management										
		Level of preparing financial plan for projects	Consideration of effects in changing exchange rate	Frequency of cash flow analysis done for the project	Effort in controlling the project finance	Frequency of preparing timely financial reports	Level of established system or procedure	Reliability of financial audits done in the project	Practice of using a standard process and format	Practice of using computer systems in filling
N	Valid	64	64	64	64	64	64	64	64	64
	Missing	0	0	0	0	0	0	0	0	0
Mean		3.19	3.11	2.97	3.16	3.55	3.36	3.27	3.03	3.17
Std. Deviation		.924	.875	.908	.963	.775	.764	.740	.992	.935

14.Project Integration Management						
		Defining, preparing, and coordinating all subsidiary	Leading and performing the work defined in the project	Racking, reviewing, and reporting project progress	Coordinating changes across the entire project	Finalizing all activities across all of the Project
N	Valid	64	64	64	64	64
	Missing	0	0	0	0	0
Mean		3.80	3.65	3.90	3.90	3.85
Std. Deviation		.926	.814	1.007	.942	.926