ASSESSMENT OF CONSTRUCTION PROJECT MANAGEMENT MATURITY IN THE CASE OF CONDOMINIUM HOUSING PROJECT-HOUSING DEVELOPMENT CORPORATION

MSc THESIS

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ASSESSMENT OF CONSTRUCTION PROJECT MANAGEMENT MATURITY IN THE CASE ADDIS ABABA CONDOMIMUM HOUSE-HOUSING DEVELOPMENT CORPORATION.

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THESIS ADVISORS' APPROVAL SHEET

As Thesis Research advisor, I hereby certify that I have read and evaluated this thesis prepared under my guidance, by **THOMAS DEBELE ROBI**, entitled: **''ASSESSMENT OF CONSTRUCTION PROJECT MANAGEMENT MATURITY IN THE CASE ADDIS ABABA CONDOMIMUM HOUSE-HOUSING DEVELOPMENT CORPORATION.''** in partial fulfillment of the requirements for the Degree of Masters of Science in Civil Engineering (specialization: Construction Technology & Management), at Addis College. I certify that no part of the thesis has been submitted for any other degree or diploma and the assistance and help received during the course of this research have been duly acknowledged. Therefore, I recommend that it be submitted as fulfilling the thesis requirement.

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THESIS EXAMINERS' APPROVAL SHEET

We, the undersigned, members of the Board of Examiners of the final Thesis proposal open defense by **Thomas Debele Robi** have read and evaluated his research proposal entitled **''ASSESSMENT OF CONSTRUCTION PROJECT MANAGEMENT MATURITY IN THE CASE ADDIS ABABA CONDOMIMUM HOUSE-HOUSING DEVELOPMENT CORPORATION.''** and examined the candidate. This is, therefore,

to certify that the Proposal has been accepted in partial fulfillment of the requirements for the Masters of Science MSc degree.

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Declaration

I, the Author of this thesis, hereby declare and certify that this MSc thesis is my original work and has not been presented for a degree in any other university, and all sources of material used for this thesis have been duly acknowledged. neither the thesis nor the original work contained therein has been submitted to this or any other institution previously, in whole or in part, to qualify for any other academic award; To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due acknowledgement has been made.

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This MSc Specialty or equivalent thesis has been submitted for examination with my approval as Thesis/Dissertation advisor.

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ACRONYMS

AM	Asset Management
CMM	Capability Maturity Model
CMMI	Capability Maturity Model Integration
Con-PM3	Construction Project Management Maturity Model
DDGs	Deputy Director General
DPs	Development Partners
AAHDAB	Addis Ababa Housing Development and Administration Bureau
EO	Engineering Operations
EPD	Engineering Procurement Directorate
EPRDF	Ethiopian Peoples Revolution Democratic Front
AAHDC	Ethiopian Housings Corporation
GoE	Government Of Ethiopia
GTP	Growth & Transformation Plan
HRFM	Human Resource And Financial Management
ICT	Information Communication Technology
K-PMMM	Kerzner Project Management Maturity Model
MoFED	Ministry Of Finance & Economic Development
MoT	Ministry Of Transport
MSs	Mean Scores
MSP	Managing Successful Programs
ODE	Oxford Dictionary Of English
OPM3	Organizational Project Management Maturity Model
P3M3	Portfolio, Program, Project Management Maturity Model
PClmMP	Project Claim Management Practice
PCMP	Project Cost Management Practice
PEMP	Project Environmental Management Practice
PFMP	Project Financial Management Practice
PHRMP	Project Human Resource Management Practice
PIMP	Project Integration Management Practice
PM	Project Management

PMBOK	Project Management Body Of Knowledge
PMI	Project Management Institute
PMMM	Project Management Maturity Model
PMS	Project Management System
PPD	Planning And Programming Directorate
PPMP	Project Procurement Management Practice
PQMP	Project Quality Management Practice
PRINCE	Project In Controlled Environment
PRMP	Project Risk Management Practice
PSafMP	Project Safety Management Practice
PSMP	Project Scope Management Practice
PTMP	Project Time Management Practice
RSDP	Housing Sector Development Program
SEI	Software Engineering Institute
SPSS	Statistical Programming For Social Science
UNDP	United Nations Development Program
URRAP	Universal Rural Housing Access Program
WBS	Work Breakdown Structure

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ABSTRACT

Successful PM is becoming increasingly important for any organization to remain competitive in today's dynamic world; hence, all companies desire to achieve a level of maturity and excellence in project management. Companies involved in construction sector fail to achieve common objectives in delivering effective and successful project outcomes because of the fact that the standard project management processes and practices have been least implemented for accomplishing successful project work. Project management maturity provides a path for improvement and framework which enable firms to achieve excellence in project management. Measure of project management maturity enables organizations to identify on how to improve project performance. In the light of this, the research was conducted, To develop a new generic maturity assessment model for construction project management; To explore the level of implementation of PM practices and process in AAHDC, To assess and determine AAHDC current Project Management Maturity level; and finally to suggest areas of improvements based on measured attributes for better and efficient project delivery. The study employed a mixed method research approach. To assess and determine the current AAHDC PMS maturity level, the study made a comprehensive AAHDC lecture review and developed a new generic maturity model called "Con-PM3". In addition, using a questionnaire, a raw data was collected from 50 AAHDC project management practitioners and analyzed statistically using a software called SPSS-version 20. The result identified strengths and weaknesses in implementing PM processes. AAHDC PMS is strong in implementing the initiation and closing process groups; whereas weak in the planning & Design, execution and monitoring & controlling PM process groups; where processes were found at "poor" level of implementation. Due to the fact that processes under the project management knowledge areas were poorly implemented, among the maturity assessment result of the 14 project management knowledge areas, 7 of them such as project Integration, Scope, Time, Cost, Quality, Risk and Safety management knowledge areas showed relatively lower level of maturity; Consequently, AAHDC current project management system is at Maturity "level 2". From the findings, this study finally recommends actions and areas need special condition AAHDC to step up AAHDC current maturity level to the next immediate level.

Key words: Project Management Maturity, Project Management Maturity Model and Maturity Improvement, AAHDAB AAHDC, AAHDCs' PMS, AAHDC Condominium Housing Projects.

CHAPTER ONE

1. INTRODUCTION

1.1. Background

In today's dynamic business environment, organizations find themselves in a need to manage different projects for the success of their strategies or their mere survival (Kerzner, 2009; Callahn and Brooks, 2004; Larson and Gray, 2000). Now a days Non-Project driven organizations have also embarked in project management since projects have become a common phenomenon for many businesses according to Kerzner (2009) and Wysocki (2014). However, according to Gray and Larson (2000), project management is not without problems. Because projects have different characteristics than ongoing operations, they pose a brand new set of challenges according to Verzuh (2005).

Since Addis Ababa condominium housing projects its establishment in 1996/7Ethiopian Calendar , it has been going under different reforms and institution namely Addis Ababa housing and construction development office (including GTZ, habitat), AA housing development office (10/90, 20/80) until 2005 EC and AA saving housing development Enterprise (40/60) finally according to proclamation 64/2011 it become AA Housing Development corporation.

Linking an organization's strategies to its projects helps to focus and reinforce its strategies (Grundy & Brown, 2002). Callahan and Brooks (2004) also stated that strategic projects are essential for the success of an organization's overall strategies. Hence the success of these strategic projects being undertaken by the corporation is vital for the success of the corporation's overall strategies and hence its vision. The success of these projects largely depends on successful project management which in turn depends on the proper overseeing and integration of the specific project objectives to the corporation's overall strategy (Grundy & Brown, 2002).

With low organizational experience in previous project undertakings due to its nature of operation, the problems that haunt the success of projects may be exacerbated when the corporation tries to implement multiple projects at once. Hence the establishment of PMO will have a significant importance for the success of the projects. This is due to the fact that PMO is assigned various responsibilities related to the centralized and coordinated management of those projects under its domain (Munyoki and Njeru, 2014; PMBOK, 2013).

Given the challenges posed by the nature of projects and experience of the corporation, establishing a PMO seems a prudent decision since, according to Callahn and Brooks (2004) PMOs are becoming a very popular cure for the firm's project management ills. According to Pemsel & Wiewiora (2013) and Spalek (2013) the PMO is a key organizational element in a company's performance because it can influence specific project outcomes. Verzuh's (2005) review, stating that by 2004 nearly every Fortune 500

company had attempted to implement a PMO in one or more parts of their organization, further strengthens the importance of PMOs for project success.

Project Management Offices currently are associated with functions such as project support; consulting and mentoring project managers and project teams; devising methods and standards for project management; providing software tools; provision of training; and management of both human and material resources of projects (Crawford, 2010). The responsibility of PMOs towards developing standards, processes, and methods is also stated by Desouza & Evaristo (2006) and Hurt & Thomas (2009) as well. Hill (2008) classified these and other functions of PMOs as practice management. Practice management, according to Hill (2008), includes functions of Project Tools; Project Management Methodology; Standards and Metrics; and Project Knowledge Management. All PMOs and a PMO through time will practice these functions with a varying degree (Wysocki, 2014).

The development and implementation of increasingly more complete and comprehensive project management processes and practices is brought by increased project management maturity (Hill, 2008). An insight towards increasing maturity levels of the PMO will help envision what increments the PMO can bring towards the project management practice and finally project success. As stated by various researchers, the maturity level of project management has a huge impact on the success of projects (Brookes and Clark, 2009; Grant and Pennypacker, 2006). The more mature the organizations, the more benefits the organizations realize due to their project portfolio management practices according to PM Solutions (2014a).

Hence various means of assessing the project management maturity level of an organization were formulated and are being implemented. Mateen (2015) stated that various models are in use to assess maturity levels in project management and the models are also being improved through time. According to Brookes and Clark (2009), the current experience of the use of project maturity management models highlights several differences in the ways in which they are currently used.

Considering availability of various models to assess project management maturity level of organizations, this research project to measure the project management maturity level of condominium house project at Addis Ababa. It also attempted to investigate possible ways of improving project management practice and forward recommendations as a means of improvement.

Project Management has gained popularity as a distinct management concept used to drive not only business objectives, but also the economic development agenda of a country. Current project management practices of organizations in the construction industry do not always ensure project success.

Successful construction project greatly depends on how the project has been managed and controlled. The main problem with project management practices have always been

mentioned as planning, project implementation, cost and time overruns and quality non-achievement.

Construction projects are known for continual problems and the companies involved have a continual record of poor performance. The Ethiopian construction industry, faced with a myriads of project management challenges both technical and non-technical; the housing construction sector can be mentioned as a typical illustration.

In Ethiopia there are different stakeholders involved in the housing construction sector. One of them is the Ethiopian housings Corporation (AAHDC) which controls mainly the AAHDC housing construction projects. Since its establishment the Corporation is holding a single point of responsibility of managing the AAHDC housing construction projects carried out in Addis Ababa cites.

Although AAHDC is established with the objective of a remarkable change towards a successful accomplishment of housing construction projects, apparently construction projects fail to achieve basic project goals and objectives. In this regard, as highlighted earlier, the Ethiopian construction industry is said to harbor many inefficiencies and ineffectiveness in its successful delivery system.
This is supported by deferent researchers in the area; Wubishet (2004) concludes in his research on the performance for public construction projects in developing country that the Ethiopian construction industry faced challenges in achieving its Objectives of meeting the Schedule, budget, quality issues and consequently stakeholders' satisfaction.

A survey result by Wubishet (2004) also indicated that, 75.5% of respondents in the housing construction projects, acknowledged that the performances of their Projects and the level of implementation of project management practices were rated fair and below. Although he didn't mention the characteristics and level of fairness and below in accordance with their attribute to the success or failure of projects.

In addition, the world Bank (2014), and AAHDC (2009) on their report confirmed that because of defects in the level of implementation of project management practices, projects delivered significantly fail under the conventional project success criteria of on time, within budget and to the required performance delivery. For example, according to Solomon S., (2015) out of the twenty-four rehabilitation and trunk housing upgrading projects completed up to 2009 under the RSDP, only seven were completed within budget. The remaining seventeen were completed, on average, 165% over budget.

Therefore, all the aforementioned failures are associated to the output of a defective/inefficient project management system; organizations, practices, or procedures. No one can deny that all failures are system failures in the sense that they are actually the output of a particular system. That is to say, there are features or defects in the management system that allowed or caused the failure. Al-Ahmad, (2009) in his research work described that the root cause of many project inefficiency is not intractable technical problems, nor uncontrollable forces, nor the user, but simply inefficient project management system.

Housing construction is one of the infrastructure development programs in Ethiopia that needs heavy emphasis on the use of systematic project management for a better performance and increasing the rate of project success. Therefore, making improvement in the project management maturity in construction sectors of our country will have a significant impact on economic and social development issues as well.

Knowing the welfares, the GoE began to diversifying its investments on housing infrastructure projects allocating titanic amount of capital for its accomplishment; consequently, there is also a need to modernize and transform the construction industry through the use of standardized project management processes and practices.

One important new idea is that of maturity concept of the project management system to improve organizational project management performance for successful project delivery is primary importance. To characterize the organizational attitude towards change, one would need to determine if the current level of project management maturity is at some lower level. This research also focuses on the maturity of the AAHDC project management System, and the purpose of the study is to evaluate the level of implementation of project management practices and processes.

There is a need to look at an organization's "complete" picture of PM effectiveness and therefore assessment frameworks have become increasingly prevalent, in particular, the development and application of PM3s (Crawford, 2015). To this end, this study is aimed at the assessment of the AAHDC overall current PMS maturity in implementing the previous housing construction projects.

A typical approach for measuring project management maturity begins with measurement and assessment of the implementation level of the current project management processes; which requires the application of structured approach or tool, known as "Maturity Model" (Andersen and Jessen, 2003).

According to Cooke-Davies, (2005), assessment of project management maturity by using maturity models provides a framework for purposeful and progressive development of project management capability. Generally, maturity assessment helps an organization know how mature its project management practice is (Timur, 2015); that is, it helps the organization measure the degree to which it is executing project management processes against the standard practice (Crawford, 2015).

To the researcher's knowledge, no previous studies have been conducted on developing a model and assessing AAHDC project management maturity, nor have there been any generic evaluations of the level of implementation of the standard project management processes and practices. It is also the first attempt that focuses on AAHDC project management maturity level determination based on the level of implementation of the standard PM practices and processes.

This research carried out on the premise that an understanding of the level of maturity of AAHDC project management system and identifying areas of improvement in Ethiopian previous housing construction sector, could be regarded as a good step forward to make

improvement on the applications of project management processes and practices leading to next better/immediate maturity level.

1.2. Statement of the Problem

The World Bank project appraisal report 2014 also confirmed that AAHDC project management system is at lowest level in it's capability for achieving successful project objectives. In addition to this the Ethiopian federal housing corporation (EFBC) documentary program (2015) report, based on different studies confirmed and reported the fact that ineffective/inefficient project management practice is the major contributing cause of cost overruns, quality non conformity and late deliveries of projects. AAHDC assessment of the major problems of the RSDP for example, indicates Project management process and system based problems contributing significantly to the poor project performances (Solomon, 2015).

Since its establishment, AAHDC current project management maturity level neither been assessed nor defined either by certified assessor or using standard assessment maturity models. Few studies, Despite an increased interest in project management maturity assessment, it is astonishing that so little empirical research has actually been conducted on the topic, especially from the perspectives of contractors. Wubishet (2004) mentioned in his research that there is insufficient project management practice that resulted "lowest level" project management system. And also the World Bank (2014) report claimed AAHDC project management capability is at "low level".

However, this study considered both classifications are subjective judgment which are not supported by scientific assessment evidence; none of the authors used any of the standard maturity assessment models to decide on that specific level of efficiency nor they show where the organization's current exact level is. Perhaps, the authors would have make a thorough maturity assessment to determine and define the level. In spite of this facts, their decision on classifying the "level" deemed to have a visible gap. However, this problem was addressed and the gaps were filled in this research.

This research uses the PMI's project management body of knowledge standard guide with the purpose of identifying the level of implementation of Project management processes, practices and overall project management system maturity level of AAHDC PMS. This is because of the fact that once it is understood what level of the maturity a project management system is, it becomes easy to find the areas of improvement in the project management practices in order to see a progressive and successful project management system to be maintained.
With this general objective in mind, the intent of this research was aimed at conducting assessment of the maturity level of AAHDC PMS in managing the previous housing construction projects in Ethiopia. In order to undertake the research work, the Addis Ababa Housings Corporation (AAHDC), which is in charge of the administration of the housing construction projects under the previous government supervision, is selected as a case study organization.

1.3. Objectives of the Study

1.3.1. General objective of the study

The general objective of this study is project management maturity of AAHDC in the current PMS and develop project management maturity model that can be used for periodic assessment so that the organization improve processes applying in the cites, Housing Construction Projects.

1.3.2. Specific objective

1. To develop a suitable theoretical/conceptual maturity model to be applied in assigning AAHDC project movement system.

2. To Assess AAHDC current project management maturity level based on the level of implementation of components under PMI's standard PM knowledge areas

3. To evaluate the level of implementation of the standard PMI's Project Management Knowledge Areas' components in AAHDC project management system.

4. To suggest areas of improvements based on measured attributes for better and efficient projects delivery.

1.4. Research Questions

1. What maturity assessment model is appropriate to be applied in the assessment of project management in housing construction projects?

2. What is the extent of implementation of the PMI's standard knowledge areas components in the AAHDC project management system?
3. What is the current project management maturity level of AAHDC in managing Housing construction projects?

4. What areas of improvements are needed for better and efficient projects delivery in

   Housing construction projects?

1.5. Significance of the Study

The overall aim of this study was to develop a model and assess the maturity level of project management practices implemented by AAHDC. Developing a new generic maturity model is the major contribution of this research. Stakeholders involved in managing construction projects in Ethiopia might use this model for measuring their PM maturity levels with respect to the standard PM processes and practices.

According to Crawford (2015), maturity assessment enables an organization to identify areas that need immediate actions. The result and findings of the assessment provides the necessary information for the project management professionals to improve their project management processes and practices.

It would also inform project management practitioners at the project formulation or initiation stage, guide at the planning stage, direct at the execution and improve project implementation efficiency, lead in conducting effective monitoring & controlling and in successful project closing processes. It was considered likely that the results of this research would be very important, not just to academic research, but to the understanding and development of project management best practice in Ethiopian construction sectors as well. This helps AAHDC prioritize its improvement actions and plan for continuous improvement. The benefits of a structured assessment of project management maturity lie in setting direction, prioritizing actions, and beginning cultural change rather than in understanding the current level at which AAHDC is performing. Also with known PM processes & practices and recommended successful tools and techniques, it is expected that there will be a likelihood of overall improved project effectiveness and efficiency.

Therefore, the essence of the project management maturity assessment is, but not limited to: Assist in setting process improvement objectives and priorities, Provide a platform to start improving an organization's processes and systems, Provide a framework for organizing and prioritizing activities, Provide a way to define what improvement means for an organization, Provide a means to emphasize the alignment of process improvement objectives with organizational business objective, Help ensure stable, capable and mature processes, Guide improvement of project and organizational processes, Provide an appraisal method to diagnose the state of an organization's current practices, and Provide a platform for improving organizations' processes and systems.

1.6. Scope and Limitation of the Study

The main focus of the research is on how project management is going on in Ethiopian Housing Construction Projects. The first reason the researcher would like forward remarkable limitations was that this research is the first of its kind in Ethiopia on such a research level in AAHDC PMS. Therefore, the generalizations that arise from the research have to be limited to the context of AAHDC.

The research and its output in this paper specifically focused on the maturity assessment of the case of the Ethiopian housings Corporation project management system only. Besides, Since the AAHDC is a construction project based organization, the assessment is conducted on the engineering and technical departments concerned and involved in the construction project management functions.

But, since the maturity assessment model developed in this study is generic in its nature, it can reliably be applied specifically to the maturity assessment of any organization which is involved in construction project management system.

While doing this research work, the absence of prior researches in the area in the context of AAHDC PMS and lack of readymade data (and difficulty to explicate data or previous assessment result) were one of the limitations compelled the study to rely on primary data; However, as explained in chapter three, methodology section, some efforts have been taken to minimize the impact.

It also forced the study to concentrate on housing context of the construction project management knowledge area such as presenting and assessing overall project management processes (so as to evaluate the overall framework of the level of implementation first and determine the overall level of maturity) rather than address specific issues in detail, that could not make sense in looking for the overall maturity level of an organization

The research therefore tried to focus on the AAHDC overall management system; this attempt also made a scope scramble to dive in such a housing area of research hardly be covered in masters' degree level that took a considerable time and resource to address all the issues in the study.

All these realities with aforementioned scopes accompanied with the limitations made the findings and the result of the assessment in this study a preliminary framework for looking forward to the improvement to the current Project Management System of the organization. Therefore, the study was required to be an eye opener to the many issues; basically besides involving in further maturity assessment, extending the research in looking for factors which affect the level of implementation of Project Management processes in each Project Management Knowledge areas of the organization revealed for further study.

1.7. Overview of the research methodology and method

A case study was found a deliberate attempt by the researcher and utilized a survey method of data collection from the project management practitioners in the case organization in order to determine the current project management maturity status of the organization with respect to the globally accepted standard practices.

Accordingly, AAHDC who manage all the housing construction projects in the country, is selected as a case study organization. In this regards, the research design applied in this study would help in achieving the research objectives and adequately address research questions. This research used both qualitative and quantitative research methods in that it followed a mixed method approach. On the other hand, it adapted also an exploratory and descriptive type approach.

A five level construction specific generic maturity model called **Con-PM3** have been developed in support of maturity assessment. This assessment tool is mainly a direct customization with specifically considered modifications on a pre-designed/developed assessment model developed by PM Solutions.

Based on the literature review, a standardized self-administered survey questionnaire which was designed as a compulsory document to be used hand in hand with the newly developed model serving as a data collection tool in the maturity assessment of an organization; (Appendix A) was developed based on variable measure method proposed by PMI's OPM3; in supplement of collection of quantitative data.

Survey questionnaire was disseminated to project management practitioners in two of AAHDC purposely selected directorates and who are working in different project management levels in order to make them scale the level of implementation of project management processes/practice applied in housing construction project. Quantitative data was scrutinized statistically using a software package called SPSS version 20 in order to help and generate quantitative results to be used in the assessment & determination of the overall level of the current project management system.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Project Management Basic Concepts and Definitions

2.1.1. Project Management

Many and different definitions were given for project management. Project management is widely recognized as a benchmark method by which projects are executed and has become the managerial approach that organizations have adopted to manage projects and achieve specific goals (Hillson 2003; Pitagorsky 2001). As Kerzner (2009) also mentioned it is the process of applying skills, knowledge, techniques and tools to ensure that a project meets the required standards.

On the other hand, Müller and Turner (2005) not only state that project management is the tools techniques, and knowledge based practices applied to achieve organizational goals but further state thatproject management has an integral role in managing organizational assets. Summarizing those definitions, PMI (2013) defines project management as: The application and integration of modern management and project management knowledge, skills, tools & techniques to the overall planning, directing & coordinating, monitoring & control of all dimensions of a project from its inception to completion, and the motivation of all those involved to produce the product, service or result of the project on time, within authorized cost, and to the required quality and requirement, and to the satisfaction of stakeholders. These skills enable project managers to achieve the targeted goals and objectives.

Generally, in addition to knowledge of project management, successful management of project demands knowledge of general management and working knowledge of application areas (for example for a construction project knowledge of construction) (Cleland & Ireland, 2002), (Project Management Institute (PMI), 2013), (Hendrickson, 2003).

2.1.2. Project Management Body of Knowledge (PMBoK)

There are a number of approaches to managing project activities. Regardless of the methodology employed, careful consideration must be given to the overall project

Objectives, timeline, cost, quality as well as the roles and responsibilities of all participants and stakeholders. This section discusses the project management institute's PMBOK Guide approach to PM.

Project management body of knowledge describes a complete set of concepts, terms, and activities that make up a professional field, project management field, or area of specialization that the overall knowledge within the profession of project management and includes tools and techniques used to manage project management process and

practices (PMI, 2013). The focus of the guide is to provide a well-defined scope of knowledge for the project managers to understand and use it in practice.

The guide provides definitions of some basic PM concepts, and descriptions of key knowledge areas–termed project management practices in this study, with which a project manager should be familiar. The purpose of the guide is to record and make available the sum of knowledge in the project management field that is frequently used in projects and generally accepted as applicable to most projects, and widely recognized as valuable by practitioners and academics.

The guide also stipulates a basic reference for all the stakeholders involved in a project management, as well as for educators and trainers. The PMBOK Guide may be used as a resource in managing a project while considering the overall approach and methodology to be followed or tailored/adapted for a project.

According to the Construction extension to a guide to the project management body of knowledge, there are additional four knowledge areas other than the ten knowledge areas specified on the PMBoK guide. The newly developed maturity model in this study structure encompasses all the 14 key knowledge areas with inclusions of the four knowledge areas specifically considered for project management in construction. Each of the ten knowledge areas contains the processes that need to be accomplished within its discipline in order to achieve effective project management. Each of these processes also falls into one of the five process groups, creating a matrix structure such that every process can be related to one knowledge area and one process group. The ten knowledge areas, each of which contains some or all of the project management processes, are:

1. **Project integration management:** The purpose of project integration management is to initiate the project, to coordinate its activities and integrates all efforts into a project management plan, to integrate, analyze and report the project results in carrying out the project management plan, to control the change to the baseline, to collect, integrate and organize project information system, to close the project in an orderly and disciplined system. (PMBOK, 2013).

2. **Project scope management:** To ensure that only the necessary work is involved to successfully complete the project, Effective scope management throughout the project is part of project success factors (PMBOK, 2013). Collins and Baccarini (2004) concluded from their research that well defined and controlled scope provides a path to meet customer expectations.

3. **Project time management:** To guarantee the project is completed in time Project time management ensures necessary processes and procedures required for completion of project on time. These procedures include an activity list from time management, activity resources and time estimates, developing schedule and control procedures (PMBOK, 2013 (Maylor, 2013)

4. **Project cost management:** To provide management with an opportunity to know that the approved budget is enough for the completion of the project. According to

Maylor (2013), the costing process has resemblance with Project Cost Management process. Project Cost Management ensures procedures for planning, estimating, budgeting and expending cost to carry out project activities (PMBOK, 2013).

5. **Project quality management:** To be sure that the needs of the customers were met by the project, as well as the quality requirements (PMBOK, 2013).

6. **Project human resource management:** To guarantee that people, who are the part of the project, perform in the most efficient way (PMBOK, 2013).

7. **Project communications management:** To ensure an effective running of the following processes of the information of the project: generation, gathering, distribution, storage, and allocation (PMBOK, 2013).

8. **Project risk management:** To identify, analyze, risk and create alternative courses of action Project Risk Management involves procedures for risk identification, risk analysis, planning responses for identified risks and risk control (PMBOK, 2013; Maylor, 2010).

9. **Project procurement management:** To guarantee the effective purchase of services and goods beyond the borders of the organization (PMBOK, 2013; Maylor, 2010).

10. **Project stakeholder management:** To identify stakeholders, communicate and engage them, manage expectations and focus on satisfaction (PMBOK, 2013; Maylor, 2010).

2.1.3. Project Management Processes and Process Groups

Abdomerovic & Blakemore (2002) state that there can be no process without product nor process interactions in the absence of processes. A process is defined as ‘an activity or group of activities that produce required outputs by taking a variety of inputs and adding value from the perspective of internal or external customers’ (George, 1996, Jeong et al., 2006).

This definition can be further qualified by applying system approaches to processes. A process can therefore be defined as a set of inter-related resources and activities, which transform inputs into outputs (ISO 10006, 1997). The authors divide processes as product oriented processes and project management processes, respectively.

Process thinking’ is used to address problems in the construction industry including uncertainties from various sources. Since a process is a specific serious of actions that brings about a specific result, the management processes for construction projects can be understood as a series of managerial and administrative actions, functions, changes or operations performed in the creation, making or all treatments of products involving civil works.

This research is concerned with the project management processes. Each project management process can then be described in terms of its *Inputs* – Resources, Antecedents & Objectives. Project management processes are concerned with describing (specifying) and organizing the work of the project (PMBOK, 2013, Abdomerovic and Blakemore, 2002).

Project management processes apply globally and across industry groups. Good practice means there is general agreement that the application of project management processes has been shown to enhance the chances of success over a wide range of projects. Good practice does not mean that the knowledge, skills, and processes described should always be applied uniformly on all projects.

Project management is an integrative undertaking that requires each project and product process to be appropriately aligned and connected with the other processes to facilitate coordination. Actions taken during one process typically affect that process and other related processes. For example, a scope change typically affects project cost, but it may not affect the communications management plan or level of risk. As PMI (2013) described Successful project management includes actively managing process interactions to meet sponsor, customer, and other stakeholder requirements.
In some circumstances, a process or set of processes need to be iterated several times in order to achieve the required outcome (PMI, 2013). These process interactions often require tradeoffs among project requirements and objectives, and the specific performance tradeoffs will vary from project to project and organization to organization.

The PMBOK Guide defines the important aspects of each Knowledge Area and how it integrates with the five Process Groups. Although the processes are presented here as discrete elements with well-defined interfaces, in practice they are iterative and can overlap and interact each other. This application of knowledge requires the effective management of the project management processes.

Table 2-1: below developed by The PMBOK Guide describes the nature of project management processes in terms of the integration between the processes, their interactions, and the purposes they serve. According to PMI (2013), Project management processes are grouped into five categories known as Project Management Process Groups (or Process Groups):

- **Initiating Process Group.** Those processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase.

- **Planning and Design Process Group.** Those processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve.

- **Executing Process Group.** Those processes performed to complete the work defined in the project management plan to satisfy the project specifications.

- **Monitoring and Controlling Process Group.** Those processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes.
- **Closing Process Group.** Those processes performed to finalize all activities across all Process Groups to formally close the project or phase.

Table 2-1: Project Management Process group interaction

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work	4.4 Monitor and Control Project Work 4.5 Perform Integrated Change Control	4.6 Close Project or Phase
5. Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
6. Project Time Management		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Resources 6.5 Estimate Activity Durations 6.6 Develop Schedule		6.7 Control Schedule	
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1 Plan Quality Management	8.2 Perform Quality Assurance	8.3 Control Quality	
9. Project Human Resource Management		9.1 Plan Human Resource Management	9.2 Acquire Project Team 9.3 Develop Project Team 9.4 Manage Project Team		
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Control Communications	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses		11.6 Control Risks	
12. Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	12.4 Close Procurements
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Management	13.3 Manage Stakeholder Engagement	13.4 Control Stakeholder Engagement	

(Source: PMI, 2013)

2.2. Construction project management

The purpose of project management in the construction is to add significant and specific value to the process of delivering successful construction projects. This is achieved by the systematic application of a set of generic project-orientated management principles

throughout the life of a project. Some of these techniques have been tailored to the sector requirements unique to construction projects (Blackwell, 2014).

Radosavljevic (2012) also defined Construction management as it is the practice of ensuring that construction actions are undertaken effectively and efficiently by taking responsibility for the performance of a construction organization. The management of construction projects has much in common with the management of similar types of projects in other industries (Hendrickson, 2003). “Much of the content of *PMBOK_ Guide* is also directly applicable to construction projects” (PMI 2013).

Even though, management of construction project is similar to management of other kind of project in many respects, it has also some peculiarities that differentiate it from managing other kind of projects such as software development. For example, unlike the management of many other projects, the project managers in construction project are often changed from one phase to another or some may specialize in only one phase of the construction project (PMI, 2013).

In acknowledgment of the difference, PMI has published a supplemental guide for managing construction project; The construction extension to a guide to project management body of knowledge third edition. In this guide, in addition to the the above ten, four additional knowledge areas such as project safety management, project environmental management, project financial management, and project claim management are specifically included to be considered for construction sectors.

2.3. Construction Project Management in Ethiopia

Developing countries like Ethiopia, spend substantial amount of their budgets in infrastructure development that involve significant construction works in projects such as construction of housings, buildings, water works, telecom civil works, etc. From project expenses in other sectors, the construction part accounts for the major part as most socio economic projects such as school and healthcare involve significant construction component.

Even though significantly large amount of money is being poured in to infrastructure development, the infrastructure of the country is still considered to be very poor, even when seen by the standards of the Sub-Saharan countries. For example, the country's passengers and freight traffic, housing density is one of the lowest compared to other Sub-Saharan Countries. From the huge hydropower potential, the country has, only less than 10% of it has been put in use (Ministry of Finance and Economic Development (MoFED), 2006).

These all mean, enormous volume of infrastructure (construction) works is coming to the industry. Nevertheless, the construction industry of the country looks unprepared for these huge volumes of works to come.

The construction sector in Ethiopia exhibits most of the classic warning signs of failure including instances of poor quality construction, inflated cost and cost overruns and

delays in implementation. Despite this, poor practices at operational level appear to be largely opportunistic and relative minor in nature capable of being kept under control through professionally managed systems and procedures.

“A detailed literature on the management practices of construction projects in Ethiopia is difficult to find. As a result, research works in such an industry is difficult” (Wubishet J,

2004). Generally speaking, according to Wubishet (2004), there is not enough project management capacity in the country. His study had revealed also low performances of project management practices for construction projects the case studies.

These low performances were found related to their Efficiency and Effectiveness criteria.

Efficiency because actual versus planned was compared and showed negative discrepancies. Effectiveness because realism of planning, fulfilment of immediate objectives on the bases of stakeholders' satisfaction and for its program objectives were analyzed and indicated that they were problematic. Accordingly, these were presented as Time and Cost performances for efficiency; and the performances of Quality and Program Objectives for effectiveness criteria.

The management of construction project is highly influenced by the utilization of scarce financial and physical resource with controlling activities limited to cost and time monitoring dimensions only. Stakeholders involved in construction management do not properly administer contract.

Studies in the area have indicated the need to improve the capacity of project management capability in areas such as financial management, project estimating and costing, total quality management, change management, claim management, general management skill, etc. which almost all can be included under the 14 PMI’s knowledge areas of construction project management (Yimam, 2011).

This shows that improving the project management capacity of stakeholders can

Significantly improve the current status of the construction industry in the country. This can be achieved by assessing the current level of project management system maturity and identifying specific areas that need improvement.

2.3.1. Housing Construction Sector in Ethiopia –Addis Ababa

In the Ethiopian construction industry, the housing construction sector is one of the basic infrastructure development programs intended for their significant contribution towards the economic development of the country.

This publication is part of a series that documents country experiences of designing and implementing affordable housing programs, and seeks to provide up-to-date information on country specific housing programs that address housing shortages, thus reducing slum formation and growth and improving housing conditions.

This volume documents the government-led, low- and middle-income housing program that started in 2005 with the aim of finding practical solutions to the country's previously uncoordinated and inefficient housing sector. This initiative, the Integrated Housing Development Program (IHDP), aims to build at least 400,000 housing units and create 200,000 new jobs, and support up to 10,000 micro and small enterprises to enhance the capacity of the construction industry.

A brief history of the housing sector, describing the state of Ethiopian housing prior to the setting up of IHDP. The authors point out that due to the government's lack of national commitment to land and housing development for the low-income sector, there was no coherent approach or action towards land and housing provision. This often led to ad hoc policies and measures that resulted in the proliferation of informal and unauthorized housing. The government tried to improve the situation by nationalizing urban land and housing in 1975, but although this helped to bring down the cost of rentals, it did not improve the poor's access to affordable housing. Part I further provides a detailed overview of the current Ethiopian housing sector, highlighting the challenges it faces and helping to put into perspective the significance of the IHDP.

The origins, design, implementation and importance of the Integrated Housing Development Program. The program is significant for a number of reasons, including the large-scale nature of the housing intervention, the targeting of poor people, the potential of improved access to homeownership acting as an effective way of preventing slums, and the stimulus to the national economy from improved housing. Two case studies, in Bole Gerji and Lideta, both in Addis Ababa, are presented to enable the readers to get an appreciation of how the IHDP projects are implemented on the ground. Bole Gerji was the first condominium project to be built in Ethiopia and was built on a brownfield site; Lideta was an inner-city upgrading project and the first to use a ground floor plus seven storeys condominium design.

The positive impact of the program so far on the housing sector in Ethiopia, and how it has contributed to the physical improvement of the housing and urban environments. The authors also observe that the IHDP has had a significant impact on the capacity of the construction industry, on skilled labour, the manufacturing industry and on transport. The project has managed to deliver at least 271,000 housing units at low cost, and the government suggests that the program has contributed significantly to GDP. Despite the successes, the program has also faced a number of challenges: the high cost of units for low-income households; the unsustainable nature of the project finance; beneficiary consultation and management; project-specific issues related to location, design and quality; and lack of post-occupancy monitoring and evaluation.

The positive lessons are that there is a need for political commitment and for tenure security for low-income households. The challenges faced in the implementation of large-scale, low-cost housing projects are highlighted – for instance, the inability of the poorest people to afford the condominium housing – as is the need for serious attention to be given to the affordability problem, to prevent low-income households from being excluded.

The housing construction sector in Ethiopia recognizes the need to adopt strategies that will enhance the efficiency with which public resources are utilized and ensure sustainability of the housing network. AAHDC was relatively better with regard to this but it did also possess serious constraints with its capacity to manage and administer its projects.

These are largely related to the overall national and developmental associated problems mainly low contract administration capability, lack of information management system, and less delegator and empowerment practices. The construction sector largely shares similar management processes with other sectors, Housing projects do require more extensive reimplementation and preliminary design services (Wubishet, 2004).

According to the world bank (2014) report, most of the housing construction projects experience delays and are completed well beyond the original time for completion. The report generally associated all the low performances with defects in the management system of applied in projects. Recently, the GoE has given a priority to improving the housing sector in support of the second phase of the Growth and Transformation Plan (GTP), which prioritizes focusing on key sectors especially in the development of infrastructures through construction industry.

This research report corresponds to the maturity level of project management system entitled

"Assessment of project management maturity in housing construction sector". The intent was to provide a review and evaluation of the level of implementation of the project management processes/practices and assessment of the current institutional project management system maturity level of the housing sector in Addis Ababa.

2.4. Project Management Maturity Assessment Concepts & Definitions

2.4.1. Maturity Concept and Definition

"Maturity is the level of sophistication that indicates organization's current project management practices and processes" (Crawford, 2015). Many resources (dictionaries and researches) have defined the word "maturity" in different ways and perspectives. For instance, the word maturity is defined as "the state or conditions of being mature, ripe, fully developed, and approaching perfection" (Webster's dictionary) and having reached the most advanced stage in a process" (the Oxford Dictionary of English (ODE 2010), in other words maturity is the quality or state of being mature. Lester (2006) on the other hand defined maturity as an amalgam of education, ability, confidence and willingness to take responsibility. Until recently, the concept of "maturity" was seldom used to describe the state of an organization's effectiveness at performing certain tasks.

Today, this maturity concept used increasingly to map logical ways to improve an organization's services. In general, its concept has been the subject of a tremendous number of studies, and this concept evolved into what is now known as maturity (Dinson,

2003). PMI OPM3 (2013) defines the maturity concept as "**the degree to which an organization practices organizational project management".**

2.4.2. Project Management Maturity

Project management maturity concept is described as the development of systems and processes that are repetitive in nature and provide a high probability that each project will be a success. The project management maturity is the sophisticated level of an organization which indicates the current organization's project management performance, processes, and practices (Ibbs and Kwak, 2000).

Furthermore, project management maturity is the progressive development of an enterprise wide project management approach, methodology, strategy, and decision making process (International Journal of Business Administration, 2006). Likewise, Kerzner defines project management maturity as the development of systems and processes that are repetitive in nature and provide a high probability that each project will be a success.

What is common in most of the above definitions is the idea of consistent and repeated practice, measurement and improvement or advancement. "Maturity in project management is a never ending journey, with a never-ending cycle of benchmarking and continuous improvement (Kerzner, 2009). In other words, PM Maturity is a kind of development tool for PM processes.

For any organization to deliver successful projects it is critical to understand the organizational project management maturity (OPMM) as "the level of an organization's ability to deliver the desired strategic outcomes in a predictable, controllable, and reliable manner" (PMBOK Guide, 2013). "As an organization gains in (project management) process maturity, it institutionalizes its project management process via policies, standards, and organizational structures.

The more mature an organization's practices are, the more likely the organization meets its project goals successfully" (Crawford, PMMM, 2015). 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.

Project Management Maturity is therefore the progressive development of a project management strategy, methodology and decision making processes. The maturity level has become an indicator to organization's performance and efficiency where the higher the maturity levels of an organization, the better its performance in all observed areas (Pennypacker, 2006).

Accordingly, Organizations attempt and desire to have higher level of maturity; however, the process to achieve any desired level of maturity needs the implementation of effective and suitable standard methodology and processes "such that there exists a high likelihood of repeated successes." (Pennypacker and Grant, 2006). On the other hand, Andersen and

Jessen (2003) mentioned that there is no fully matured organization in the real world that has achieved the highest level of developments and no one will.

2.5. Project Management Maturity Assessment

Researchers and practitioners looked for continuous efforts to develop and improve organizations' capability in Project Management. For them, it is crucial to find out how good they are at managing projects. To that end, the project management maturity assessment concept was developed. An assessment provides a means by which one can benchmark the organization's project management capabilities.

Maturity assessment generally can be conducted either by the organization's internal staff with assistance by a licensed assessor or could be done by an external assessment vendor (Saiedia & Kuzara, 1995), (Crawford, 2015).

Organizations start the assessment with a baseline assessment of their current situation. The baseline assessment enables an organization to identify areas that need immediate actions and areas that will have an impact and provide greatest return on investment (Crawford, 2015). This helps the organization prioritize its improvement actions and plan for continuous improvement.

PM maturity assessments are typically divided into two key assessment processes: audit and self-assessment. Audits collect and compare data against a reference standard, evaluating the degree to which the criteria have been fulfilled, whereas self-assessments are designed to evaluate the strengths, weaknesses, and opportunities for improvement against a number of dimensions. Audits are primarily designed to support an external driver of compliance, whereas self-assessments are typically more internally focused on improvement" (Mullay, 2014).

The sources of data for an assessment are project managers, project team members, project sponsors, support functional managers, customers, vendors, and project management office staff. The assessment process involves collecting data through survey instruments such as questionnaires, interviews, and review of project-specific documents in order to develop quantified and summarized indicators for each project management facet.

The results of a maturity assessment usually provide organizational perspectives, incentives to focus on causes of problems, and the consequences of inadequate or nonexistent procedures. Therefore, the recommendations generated as part of an assessment process would highlight improvement of the organizational areas in the context of project management knowledge areas and with attention to the organizational infrastructure for project management.

Further, a comprehensive assessment should identify and prioritize the steps an organization needs to take to improve its project management capability. In turn, the project management procedures that are modified in response to the assessment will

hopefully effect improvements in project performance, employee morale, and organizational cost effectiveness (Parviz F Red, 2002).

The benefits of a structured assessment of project management maturity lie in setting direction, prioritizing actions, and beginning cultural change rather than in understanding the current level at which an organization is performing. It is important that the assessment be repeatable, provide consistent measurements and results, and promote some degree of benchmarking with other organizations. The structure provides the basis for any assessment to be utilized as a "checkup" tool to measure progress and identify the next logical steps forward.

Assessment establishes standards and the methods for initiating a project. Measure of project management maturity enables organizations to identify on how to improve project performance (Brookes et al., 2014). However, in measuring the success of the projects in terms of efficiency and effectiveness, organizations demonstrate a considerably different interpretation, maturity assessment concept is one of the expressions (Mitra & Tan 2012). Hillson (2003) suggested that to deliver project with effectiveness and increased performance, it is important that organizations continuously evaluate their projects results for finding areas of improvement to increase project management maturity. Once these areas are identified then improvements are implemented to achieve excellence.
Parviz F Red (2002) expressed project management maturity assessment is the foundation for continuous improvement in project management practices. Backlund, Chronéer, and Sundqvist (2015) shown that successful implementation of improvement of a project requires identification of strengths and weakness in project management capability. By proceeding these imperative steps, an organization can assess its maturity in terms of project management performance. This is done by measuring where organization stands for its project management and where it wants to go (Grant and Pennypacker, 2006).

Project management maturity assessment enables organization to further improve its project management structure (Albrecht and Spang, 2014), (APM, 2012) and Spang, 2014). Generally, as stated by PMI, (2013) maturity assessment is the degree to which an organization practices project management measured by the ability of an organization to successfully initiate, plan, execute, monitor and control individual projects.

A major study of project management maturity at a global level was conducted by Price Water House Coopers in 2004 in which two hundred responses were gathered from a balanced group of companies from thirty different countries across the globe. The finding showed that there was a positive correlation between project management maturity and project management performance.

According to the study a higher project management maturity level would most likely deliver superior project management performance in terms of overall project delivery and business benefits. Finally, project management capabilities are improved to higher levels of maturity (Jamaluddin, Chin and Lee, 2010).

A typical approach for measuring project management maturity begins with measurement and assessment of existing project management practices. PMI-OPM3 (2013) proposed two type approaches in conducting maturity assessment.
The first is Binary Scoring technique; which involves use of binary numbers for performing assessment. Digit 1 is given to an outcome if it exists to full extent in the organization otherwise it is awarded digit 0 if full existence is not found. Apart from being simple scoring method, it also has drawback that it does not take into account practices with partial existence (PMI-OPM3, 2013).

The second approach is a Variable Measure technique; which measures existence of best practice using questions like how much and how often a best practice exists. Variable measurement method also takes into account those practices which have partial existence (PMI-OPM3, 2013). In this technique, the established ranking scale of a maturity model provide plateaus for the purposes of continuous and progressive improvement of project management capabilities.

The plateau level indicators of the model highlight key elements of a specific component of project management in the organization in order to identify key practices that need improvement to elevate the organization's ranking in that specific component of project management, an added advantage of evaluating organizational capabilities using a standardized scale through a maturity model is that one can calculate indicators for industry wide level of maturity.

In support to the variable measure technique proposed by PMI, Crawford (2015) developed a self-assessment survey Questionnaire (Appendix E) with a five scale maturity level that can be used to determine the maturity level of an organization.

According to Crawford (2015), achievement of a given maturity level by an organization is cumulative – that is, for each succeeding PMMM level, the assumption is that all criteria for the preceding levels for that component are being (or have been) fulfilled. For example, to assess an organization at Level 3 in one of the knowledge area, the organization must have in place all of the processes described in Levels 1, 2, and 3 of that knowledge area. After completing the assessment, determine the maturity level in each knowledge area. To do that, review the assessments of the knowledge area components, and select the lowest level of assessment: that is the maturity level in the specific area.

To assess the overall Organizational Maturity Level, follow a similar method. Review the maturity assessment result of each of the knowledge areas. Select the lowest level of assessment: that is the Organizational Maturity Level (Crawford, 2015).

2.5.1. Project Management Maturity Model

Based on the importance of project management maturity in the development of project management within the organizational context, it is vital to introduce a project management maturity model in order to improve project management performance.

Maturity Models are conceptual models (measurement tools) comprised of five levels considered as foundation for achieving excellence; and developed to assess the project management maturity (PMI OPM3, 2013). PMM models can also be defined as frameworks used to bring a change into an organization with the purpose of shifting it from being less organized, less standardized, and less documented into one achieving higher standards in delivering products and services. Oftentimes, such models are used as standard to guide improvement efforts of an organization (Cleland and Ireland, 2006).

The majority of the PMM models use five levels of maturity assessment with Level 1 meaning lower level of maturity (initial) and Level 5 as the highest level of maturity (continuous improvement). The levels also help an organization prioritize its improvement efforts (Cooke-Davies & Arzymanow, 2003).

Higher maturity levels signify more effective project management procedures, higher quality deliverables, lower project costs, higher project team morale, a desirable balance between cost–schedule–quality, and ultimately improved profits for the organization.

Further, roles and responsibilities are clearly defined, and customer satisfaction is expected, as the norm. The more mature organization is the one that can manage processes. By contrast, lower maturity levels are normally consistent with organizational environments that encourage fixing problems in the field instead of doing it right the first time.

Primarily, a project management maturity model describes the key elements of a fully effective project management system. These elements are then used for the purposes of benchmarking and evaluation of the current practice. Considering the presence or absence of these elements, one can arrive at a ranking of levels one to five for the maturity of the project management processes of an organization (Cleland and Ireland, 2006). This is achieved through assessment of the organization's PM processes & practices to find out strengths, weaknesses and gaps (Crawford, 2015).

The general opinion is that organizations with higher maturity levels are expected to be successful in terms of project effectiveness and efficiency and also have a competitive advantage in the marketplace (Cooke-Davies & Arzymanow, 2003). Generally, maturity model is a valuable tool which the researcher used for a project management maturity assessment.

2.5.1.1. **Applications and Use of Maturity Models in project management**

Benefits of using a project management maturity model include the ability to assess an organization's current project management capabilities and the ability to identify organizational strengths and weaknesses in project management.

Further, the observations made with the use of a maturity model will provide the motivation to establish uniform project management practices within the organization to provide capabilities for benefiting from one project's experience into the next project, and to formulate continuous improvement methodologies for project management procedures

(Crawford, 2015).
The benefits of adopting and using evaluation models extend into the details of project performance by fostering improved project performance in the areas of cost, schedule, scope, and quality. The results of using assessment models further establish a baseline for improvement objectives if the organization chooses to become project oriented with predictable project success rates (Grant and Pennypacker, 2006).

According to Mullaly (2014), the framework provided by maturity model enables organizations to assess and improve its PM processes. Rad et al. (2006) argues that project management maturity model provides a path and framework which enables firms to achieve excellence in project management.

Project management maturity models (PMMM) provide best practices and housing map to improve project management practices. Brookes et al. (2014) also argued that PMMM, if utilized successfully, provides framework on how to improve performance for projects repeatedly and systematically.

According to Archibald and Prado (2014) the PMM model is a mechanism to numerically quantify the ability of an organization to manage projects successfully. Also, they assist an organization's overall strategy system which allows an organization measuring the degree to which it is executing PM against the standard practice.

Crawford (2015) argued that maturity model can be used to determine the existence of realistic and effective project management policies, procedures and practices. Further, the methodologies associated with a maturity model can be used to assess the effectiveness of the prevailing project management system, which in turn will signal how often and how regularly the project personnel follow the established procedures.

It is an important point that the focus of use of a maturity model is not to provide a quick fix for projects in trouble. The focus of an assessment is to provide the foundation for improvements and guidance for advancement.
A PMMM is therefore a tool for enhancing the ways in which a project can be measured for maturity (Pasian, Sankaran & Boydell 2012). It offers a logical path for a strategic plan of progressive project management. Accordingly, organizations need to have a clear understanding of the concept of maturity and maturity models.

New project management methodologies were developed by PMI after extensive research so as to have mechanisms that were effective and consistently applied to assess organizational capabilities and would reflect existing maturity levels of project management system. These developments brought about the emergence of project management maturity models that emphasized excellence and a means of achieving increased project management performance.

Crawford (2015) reasoned that the advent of development in project management maturity models can be directly attributed to the desire to standardize methods and processes with a view to establishing consistency of best practice with industries by project management practitioners and associations.

Maturity models are not meant to provide a quick fix for projects in trouble. Rather, they are primarily used internally by organizations to guide their effort of improving project management capability (Supic, 2005). Kerzner (2011) confirmed PM maturity model enhances the capacity of the organization to implement its strategic planning on individual and group projects and improve project management efficiency.

Korbel and Benedict (2008) further support Kerzner's confirmation in that Project Management Maturity models. (PMMMs) provide a systematic means to perform benchmarking and hence are adding considerable value to contemporary organizations. Successful use and the resulting benefit from the use of such models have been reported by many researchers in the field. For example, (Sarshar, et al., 2000) reported an average of 35% improvement on productivity.

Generally, as well summarized by Crawford (2015) and others "Maturity models are used in setting direction, prioritizing actions, and beginning cultural change rather than mare understanding (or determination of) the current level at which an organization is performing. maturity models provide baseline for measuring improvement, documents the need for change, provide common language, shared vision, fosters a culture of excellence, and sets the stage for organizational change, provide frame work for prioritizing improvement action".

2.5.1.2. **Summary of Project Management Maturity Models**

Previous studies showed that there are many types of maturity models that are developed according to different functions and applications of project management maturity processes. According to Kohlegger et al (2009), there are over 70 different maturity models that have different characteristics; therefore, it is significant to have clear understanding of each model before adopting or revising it (Kohlegger et al., 2009, cited by Karim, S.B.A. et al., 2014). Different project management maturity models (PMMMs) are due to different sectors, scope, levels, self-assessed, and accreditation for each model applied by different organizations with different business activities (Montero G., 2013). This means that not all PMMMs are the same and not applicable for all companies, organizations, and firms.

Maturity models have currently expanded in choice and continue to do so in the contemporary marketplace. Just as PMI in 2003 introduced OPM3, the Association for Project Management (APM) similarly introduced PRINCE2 (Projects IN Controlled Environment), along with the P3M3 model in 2004 (OGC 2006).

Khoshgoftar and Osman, (2009) describes that maturity model differs with each other in terms of their characteristics, factors and structure to achieve desired purpose. Different research studies were discussed in support of argument that project management maturity has direct impact on project efficiency (Grant and Pennypacker, 2006).
A wide range of project management maturity models are available but only five maturity models have been discussed in this thesis work. Any model selected to measure project management maturity must point out a logical path for progressive development. In

effect, a good model for the measurement of project management maturity creates a strategic plan for moving project management forward in an organization (Crawford, PMMM, 2015).

2.5.1.3. Criteria for comparison Selection of maturity models

In order to reap the full benefit of concept of maturity, the models to be used for assessment should be able to help capture both dimensions of maturity and provide framework for improvement in both maturity dimensions both the process and practice. (Yimam, 2011). Grant and Pennypacker (2006) used following criteria to select project management maturity model for their survey:

1. alignment of project maturity model with organization's project management methodology,
2. Scope covered by project maturity model,
3. Number of publications about specific project maturity model,
4. Independency from industry/organization's type.
5. Ease and comfort ability to use and
6. Years of existence.

Man (2007) also summarized criteria for selection of maturity model as: a) Structure, b) Applicability and c) Usage. In addition to the above criteria, Way Point, (2008), in selecting a maturity assessment model, one must know that he will also be selecting a firm to do the initial assessment. Way Point proposes factors to consider in choosing an assessment model:

Scope – The assessment model should include all areas that are needed to be measured. The areas should be segregated so that anyone can pick and choose the areas to assess.

Granularity – The model should provide enough detail so that one can use the model to perform follow up or progress checks without third party assistance. The model should also have sufficient granularity that its use will enable the identification of root causes and specific actions for improvement.

Currency – The model should reflect the latest standards and proven tools and techniques.

Tailoring – The model should be capable of tailoring an assessment to a particular organization.

Impartiality – The model should not be biased toward any particular tool or solution set. Some firms use a maturity assessment as a lead in to sell software and their checklists are skewed to those products.

Client Orientation – The model should protect an organization's desire for privacy. Some models retain data and use the demographics or use the results to establish benchmarking data for marketing purposes. The model and its resulting report should be owned to use within the organization as the organization desire following the assessment. Some firms do not offer the checklists, only providing an assessment report. The result is that you are dependent upon the initial assessment for future progressive assessments and improvements.

Industry Generic – The model should not be industry specific in standards or in terminology.

Furthermore, 27 additional criteria developed by Khoshgoftar and Osman (2009) used to make comparison of the PMMMs. Based on these criteria, Nenni et al. (2014) shortlisted the following prominent project maturity models developed by different institutions and authors. These five shortlisted project management maturity models are explained for better understanding and then comparison of these five was made.

1. Organizational Project Management Maturity Model (OPM3)
2. Project Management Maturity Model presented by PM solutions
3. Capability Maturity Model Integration (CMMI)
4. Kerzner Project Management Maturity Model (K-PMMM)
5. Project, Program, Portfolio Management Maturity Model (P3M3)

Table 2-2: Comparison of PMMM

Criterion	OPM3	CMM	K-PMMM	P3M3	MINCE
Publisher	PMI	SEI	ILL	OGC	Van Haren
Scope	PM	Software	PM	PM	PM
Maturity level	1-5	1-5	1-5	1-5	1-5
Discrete and Continuous	Continuouss	Both	Discrete	Discrete	Discrete
Details	Extremely high	High	High	High	Medium
Date of Issue	2013 (3rd Edition)	1922	2006		2007
Refer to Standard	PMBOK	-	PMBOK	MSP	-
Definition of Maturity					
Organization Strategic Project Management process	Yes	Yes	Yes	Yes	Yes
Program Management process	Yes	Yes	No	Yes	No
Portfolio Management Process	Yes	No	NO	Yes	No
Coverage assessment					
Assessment difficulty	Low	High	Low	High	Unknown
Assessment Cost	Low	High	Low	High	Unknown

Quantitative Results	Yes	Unknown	Yes	No	Unknown
Tangible of results	Yes	Yes	Yes	Unknown	Unknown
Identifying weakness and strengths	Yes	Yes	Yes	Unknown	Unknown
Continuous Assessment	Yes	Yes	Yes	Unknown	Unknown
Training Difficulty	Low	High	Medium	Unknown	Unknown
Commitment for Continuous improvement	Yes	Yes	Yes	Yes	Yes
Suggestion of Alternative for improvement	Yes	Yes	Yes	Yes	Unknown
Priority of improvement	Medium	Medium	Medium	Low	Unknown
Support by Publisher	High	High	High	High	High
New Edition	Yes	Yes	Yes	Yes	Unknown
Easy for Execution	Yes	Yes	Yes	Yes	Unknown
Simple and Understandable	Yes	Medium	Yes	Medium	Medium

(Source: adopted from Farrokh and Mansur, 2013 by Muhammad Mateen, 2015)

➢ Organizational Project Management Maturity Model (OPMMM)

Organizational Project Management Maturity Model (OPM3) was first defined and published by PMI (Project Management Institute) in 1998. Which is an acceptable organization for its developing a worldwide standard. Since 1998, OPM3 has evolved over time and also it provides with list of predefined best practices.

This thesis report refers to third edition of OPM3 as presented by PMI in 2013. OPM3 – third edition explains all the guidelines which are used for improving organizational project management maturity (PMI- OPM3, 2013). OPM3 enables organization to narrow down the gap between its strategic objectives and projects (PMI-OPM3, 2013). It has characteristic of being multi-dimensional in full context.

It provides framework to measure project, program and portfolio management with wide spread of best practice standards (Khoshgoftar and Osman, 2009). OPM3 also enables organization to prioritize and plan improvements for outcome of improved project maturity levels (APM, 2007). OPM3 does not follow stage model representation for improvement purposes. Rather, best practice standards are measured and assessed using Standardize, Measure, Control and Continuously Improve levels for improvement purpose (PMI-OPM3, 2013).

OPM3 provides tools for self-assessment and external assessment of project management maturity which identifies strength and weakness and suggest alternatives to improve. It also provides path to prioritize improvements. The multidimensional nature of OPM3 provides possibility to assess based on either of project, program and portfolio management domain or combination of these according to needs of organization (Farrokh and Mansur, 2013).

OPM3 provides organization with list of best practice that can be used for achieving excellence in Organizational Project Management (Nenni et al., 2014). Organizational project management provides a framework that integrates project, program and portfolio management of organization for all the best practices. The integration defined by organizational project management includes (PMI-OPM3, 2013):

I. Knowledge (of the portfolio, program, and project processes)

II. Organizational strategy (mission, vision, objectives, and goals)

III. People (having competent resources), and

IV. Processes (the application of the stages of process improvement)

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

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

Variable Measure – measures existence of best practice using questions like how much and how often a best practice exists. Variable measurement method also takes into account those practices which have partial existence (Table 3) (PMI-OPM3, 2013).

Table 2-3: Variable measure scoring method in maturity self-assessment

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

Source PMI-OPM3, 2013.

OPM3 Maturity Levels

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

Description of maturity levels based on the variable measure for the best practices on the

OPM3 is explained below:

Level 1: None – no such practice exists

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

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

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

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

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

Design Model iii) Improvement Model.

I. Comparative Model

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

OPM3 framework steps and determine steps to implement for improvement purposed. Finally, OPM3 framework cycle is repeated according to needs (PMI-OPM3, 2013). The model developed for this research adapts this characteristic of the OPMMM.

II. Design Model

Organizations that are either in process of forming project management practices or newly formed implement design model. Design Model allows designing and implementing

organizational project management approach using Best Practice Standard. In this model, organizations enter Manage Improvement step after acquire knowledge step (PMI-OPM3, 2013).

III. Improvement Model

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

- PM Solutions' Project management maturity model

Project Management Maturity Model (PMMM) is a product of PM Solutions (Figure 2). This model has contributed to widespread success in assisting organizations in improving their project management processes. The model has been used also to baseline project management practices industry-wide, becoming the industry standard in measuring project management maturity. PM Solutions' Project Management Maturity Model provides an organization with a conceptual framework within which specific project management processes can be optimized to efficiently improve the capability of the organization.

Similar to the PM2 model; this model is developed by mirroring PMBOK's knowledge areas with that of CMM's five level maturity stage. It utilizes the PMBOK Guide's ten knowledge areas and is patterned after the Capability Maturity Models of the Software Engineering Institute (SEI). Which are in turn broken down in to components (Crawford, 2015). Model's developers have given a detailed description of the characteristics of the knowledge area at each maturity level (Crawford, 2015).

PM Solutions' approach to minimizing the time for advancing an organization's project management maturity is to first perform an exceptionally detailed gap analysis between the organization's current practices and its desired level of maturity. Then, working with the executive leadership of the organization, PM Solutions charts a housing map of improvement initiatives and detailed implementation and change management plans for improvement activities.

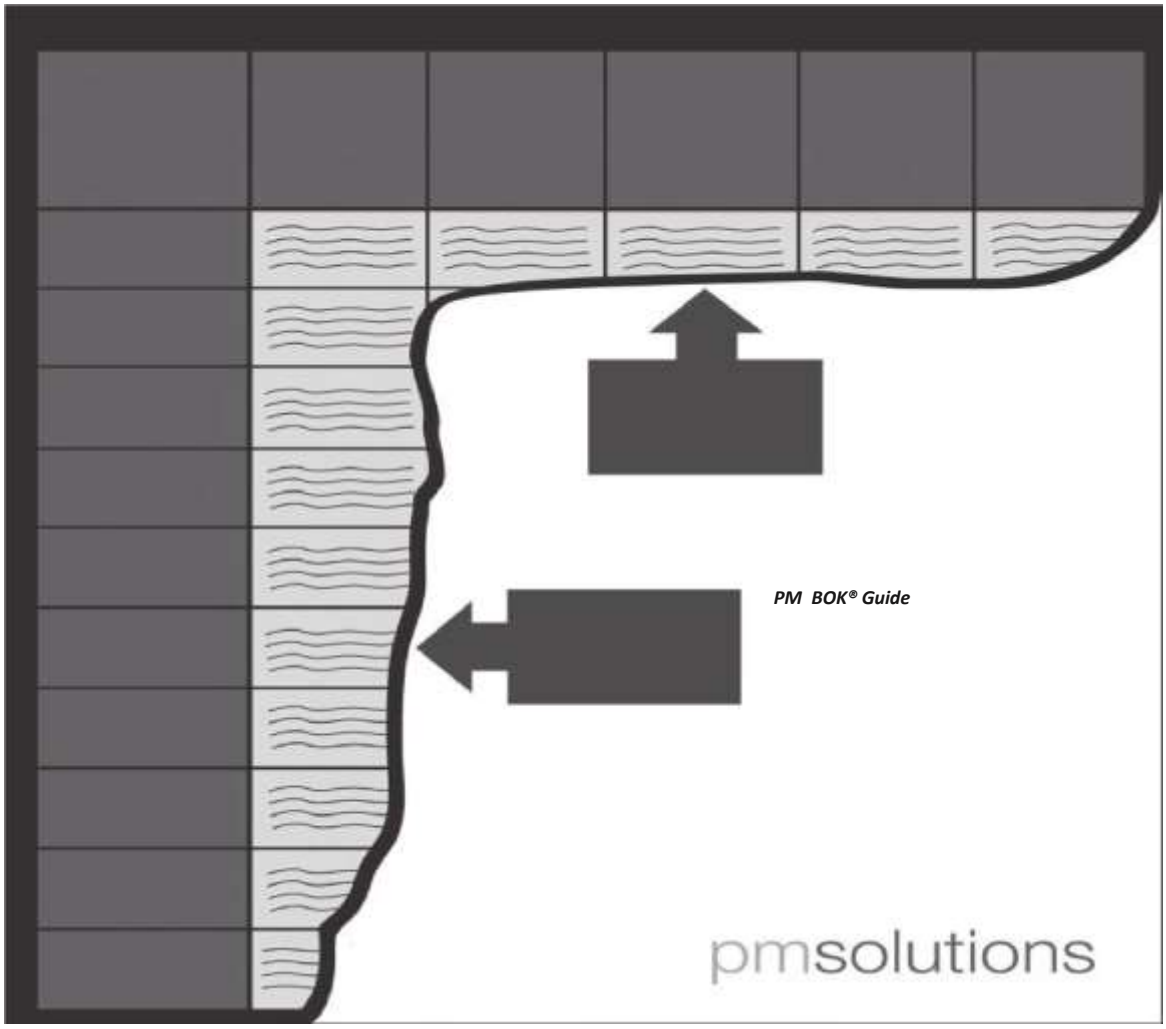

Figure 2-2: PM Solution's PMMM
(Source: Crawford, 2015)

- Capability Maturity Model Integration (CMMI)

The first ever version 1.0 of Capability Maturity Model (CMM) was first presented by Software Engineering Institute (SEI) division of Carnegie Mellon University in 1991. This model targeted at software organizations. CMM does not explain steps on how to improve rather it helps in determining and analyzing current level of process maturity which identifies the issue to overcome for achieving maturity.

CMM framework provides two different approaches for improving project management processes. These approaches are termed as "model representation" which comprises of continuous model representation and staged model representation (Constantinescu and Iacob, 2007). The Key Practice areas of the CMMs include topics familiar to those who read the PMBOK Guide: project planning, execution, monitoring, and control. Our PMMM further decomposes those topics into the component processes associated with each knowledge area as described in the PMBOK Guide.

Continuous Representation – focuses on organization's processes. It provides framework to evaluate and improve processes. It allows room for improvement related to individual process. The improvement progress is measured against capability levels (Constantinescu and Iacob, 2007). The model developed for this research adapts the continuous representation approach in the assessment of the process maturity dimension with modification on the maturity level descriptions.

Staged Representation – provides overall view of organization. It measures maturity at organizations level compared to continuous representation which measures maturity at process level. It is easily understandable and less detailed compared to continuous representation.

The framework of staged representation provides standardized value of organization's maturity (Constantinescu and Iacob, 2007). Similar to process capability levels, staged representation is measured as organization's maturity levels. The stage model of CMMI follows that a higher level can only be achieved if requirements for lower levels are fulfilled (Constantinescu and Iacob, 2007).

This model framework is adopted and considered for a model developed in this research for the assessment of the overall maturity level of the knowledge areas and organizations overall maturity level with modifications in the level description.

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

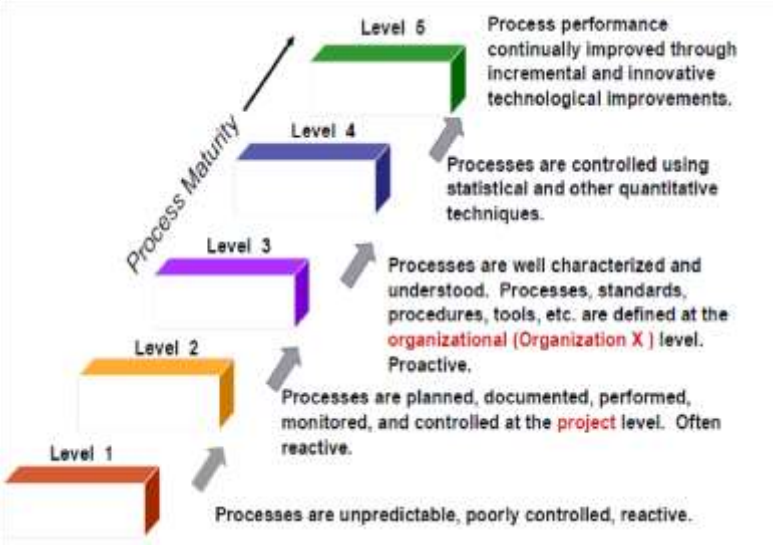

Figure 2-3: Maturity Levels for CMMI staged Representation
Source: (Yimam, 2011)

Kerzner put-forth his Project Management Maturity model in 2002 based on PMBOK knowledge areas. K-PMMM is used to assess Project Management Maturity of organization using PMBOK guide and provides five levels of maturity (Kerzner, 2009).

K-PMMM measures maturity of project management processes only. K-PMMM is based on knowledge areas of PMBOK. K-PMMM does not measure maturity for program and portfolio management. It also follows orthodox of stage representation for maturity levels.

K-PMMM Kerzner derived his maturity levels from CMMI stage-model maturity levels (Kerzner, 2009). These levels are measured in stage as show in figure below:

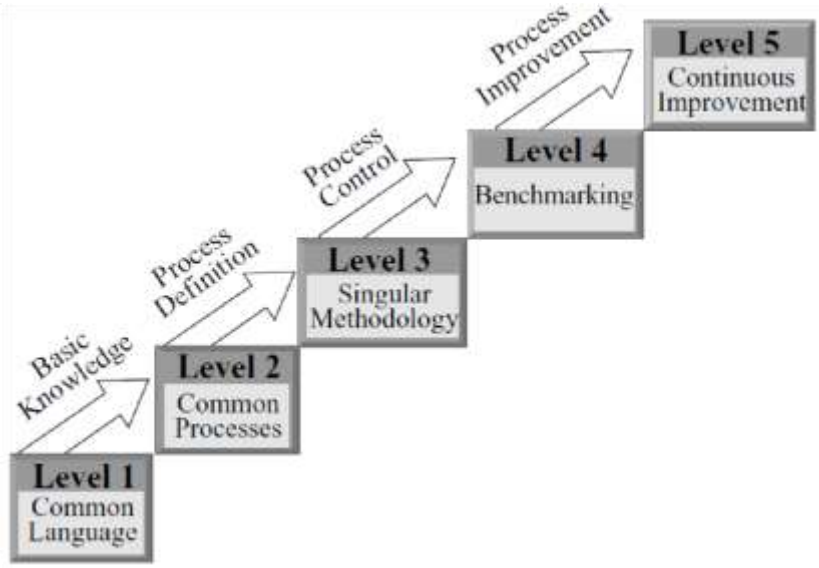

Figure 2-4: CMMI stage-model maturity levels
Source: (Yimam, 2011)

- Project, Portfolio, Program Management Maturity Model

P3M3 enables organization to evaluate its existing capabilities and identify specific areas for improvement. It enables organization to perform maturity assessment of project, program and portfolio management across seven different domains OGC (2011).

It measures maturity of projects using five maturity levels. These maturity levels are derived from CMMI stage-model and follow stage representation (APM, 2012). P3M3 refers to MSP (Managing Successful Programs) standards. P3M3 publisher is OGC. P3M3 covers project, program and portfolio management. It follows staged representation approach for maturity assessment. Although provides list of best practice, it has been reported that high level of difficulty in the use.

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1. Introduction

Research is a systematic investigation to increase the sum of knowledge (Fellows, R. & Liu, A, 2003). Marshal C. & Rossman R. (2006) define research as a systematic inquiry to provide a better understanding of a phenomenon and/or change a social circumstance. In order to study a phenomenon, researchers are expected to employ suitable methodologies defining how the research shall be conducted.

3.2. Type of the research

Since this study was concerned with an attempt to systematically and in-depth investigation of an event or a set of related events with the specific aim of describing and exploring a phenomenon; it was designed to go through the case study research strategies in support of achieving the research goals. According to Yin (2003), Case study research is an approach capable of examining simple or complex phenomenon, with units of analysis varying from single individuals to large corporations and business; it entails using a variety of lines of action in its data-gathering segments, and can meaningfully make use of and contribute to the application of theory.

This research is descriptive research as it tries to describe the current status of PM practice in the construction industry of Ethiopia. On the other hand, the research is of an exploratory nature and is inductive, where the nature of what it investigates is firmly engrained in human perception, something that is more interpretive.

Yin (2003) also states that a survey strategy is suitable when the form of research questions a fact finding and focusing on contemporary events. Among different data collection methods, this study used paper survey so as to make reviews of published materials in developing a new generic theoretical maturity model. On the other hand, questionnaire survey was conducted in this research in soliciting opinions of project management processes level of implementation in organization from the PM practitioners. Therefore, the case study approach was deemed the most appropriate method to be used in this research for the following reasons:

- The case study method is largely used for exploration (Yin, 2003), which allowed flexibility in investigating communication and information processes in construction projects management in great depth.

- Case studies would allow enough information to be systematically gathered about the organizations to provide insight into its project management processes (Berg, 2006), which would be a necessary feature of the research.

- Voss, C. & Tsikriktsis, F. (2002) add that the case study method lends itself to be exploratory investigations where the variables are still unknown and the phenomenon not understood which was the case in this research.

- The case study method is not just suitable for answering how and why questions but are also suitable for development of new theory and ideas (Voss, C. & Tsikriktsis, F., 2002). The exploratory nature of the research in investigating the level of implementation of the overall PMS of AAHDC would end up with the development of new theoretical maturity assessment model and forward ideas on areas of improvement.

- Voss, C. & Tsikriktsis, F. (2002) state that the case study method allows for a relatively full understanding of the nature and complexity of the complete phenomenon. This was an essential feature for this research as it required an understanding of the complex nature of the whole PMS of the case study organization (AAHDC).

- In the case study approach several methods may be used to produce an overall view of the organization (Fellows, R. & Liu, A, 2003)

3.3. Description of the case study organization

Addis Ababa Housings Development corporation (AAHDC) is a legally autonomous project-based organization whose principal business is to oversee the planning and execution of projects; established on January 26, 2005; working under the Addis Ababa Housing Development and Administration Bureau (AAHDAB), responsible for housing sector policy, planning and formulating long and short term plans and programs for housing construction, design, maintenance of trunk and major link housings on the federal housing network, as well as for the administration of contracts.

As sited by Solomon, (2015) and Hobday (2000), a project-based organization is an organization in which the project is primary unit for production, innovation, and competition. Project-based organizations organize 'their structures, strategies, and capabilities around the needs of projects, which often cut across conventional industrial and firm boundaries' (Hobday, 2000).

Since its establishment, the Corporation has gone through a series of structural changes; most recently in July 2018 by the Council of Addis Ababa through regulation number 64/2018. This regulation confirmed the split of operational and regulatory functions of AAHDC as two independent entities. AAHDC mandate, however, remains unchanged; it is still responsible for managing the nation's federal housings construction projects. Most of the AAHDC systems, norms and cultures are geared towards management by projects therefor in AAHDC, housing projects are basic units of focus. The Government of Ethiopia allocates a considerable amount of Budget towards the housings construction program, and external financiers also assist AAHDC with important credit and grant facilities. AAHDC is responsible for overall planning, coordination, implementation and

management of the federal housing construction sector program, and is the primary implementing agency for all donor financed housing infrastructure projects in the country. Hence, the main objectives of AAHDC, are to develop and administer housings, create conducive conditions for the coordinated development of housing network, and ensure the quality of standards in housing construction. Generally, AAHDC is responsible for managing, maintaining and developing the national housing development in the cites to support the economic development, growth and poverty reduction.

3.4. Methodological issues in project management research

Research methodology plays a key role in generation of knowledge on projects and their management (Smyth and Morris, 2007). According to Punch (2005), research methodologies housing classified into two distinct approaches as scientific empirical tradition and the naturalistic phenomenological modes. These two approaches have come to be synonymous with quantitative and qualitative research methods, respectively (Bryman, 2008).

Project management applicability is contingent upon context, and while the importance of context is acknowledged, epistemologically context is overlooked in the selection of research methodology. The project management literature and bodies of knowledge are epistemologically associated with positivism, seeking general explanations and practical solutions disregarding context (Smyth and Morris, 2007).

Bryman, (2008) also claims that most research works fall within the range, and thereby, do not fit neatly within categories since more often than not researchers 'borrow useful constructs from a variety of perspectives'. This in turn gives way to a 'mixed-methods' research.

The shortcomings of the 'hard' quantitative (positivist) analysis may not be appropriate when studying 'subjective' issues difficult to quantify and collect (anti-positivist), which account for the 'soft' personal data. However, a mixture of quantitative and qualitative research may be used within certain limits (Walliman, 2005). Bryman, (2003) suggestes that the mixed method could be influential in espousing multi-level research within construction management research, to embrace both ontological and epistemological viewpoints.

Therefore, this research also found the mixed method approach suitable for use in the study. The exploratory nature of the research favored a highly subjective approach in developing a new generic theoretical maturity model; and due to the nature of the phenomenon under study, it did lend itself to the use of quantitative method which deserved the need for numerical measurements; Therefore, this research also uses methodological triangulation where more than one method of data collection and/or analysis is employed, include a mix of quantitative and qualitative sources.

3.5. Sampling Methods & Sample Size Determination

3.5.1. Sampling Methods

The target population was AAHDC staff members and because of the nature of the research title and its objectives, it demands professionals' opinions on the area; for this fact, a purposive sampling technique was applied in determining the sampling frame for the study. Accordingly, the sample frame is determined based on direct functional relationships of different directorates found in the organizational structure of AAHDC to the subject of the study.

In light of this facts, out of the total directorates found on the organizational structure of AAHDC; the planning & ICT DDG and the Engineering Operations DDG were selected as a representative sample frame for this study.

This study used the random sampling method in disseminating the survey questionnaire by the **snowball method**. This research also involves a non-probability sampling/purposive sampling method in which the convenience sampling used in selecting the sampling frame out of the whole population under the organizational structure of the case study organization.

3.5.2. Sample Size Determination

Rules-of-thumb represent quick heuristics for setting sample sizes. It is believed to be borne out of statistical principles (e.g. a sample size of 30 is about the minimum needed for rendering normal sampling distributions of means independently of whether the sample itself is normal; Aron, Coups, & Aron, 2013). Or it is expected to be linked to particular tests,

Often enough, it is simply handed down as such rules-of-thumb (Van Voorhis & Morgan, 2007). This rule is independent of any particular research context. According to the rule explained above, the rule of thumb recommends the minimum sample size to be 30; therefore, it is better to remember that one needs only a sample size as big as 30 to guarantee normality if started with the worst-case population distribution.

Based on the assertion of the rule of thumb, regardless of the size of total population, the type of the research and the research context, one is free to determine a sample size above thirty. This research also relied on the simple rules of thumb in determining the sample size for this study; accordingly, in a study where $n>30$, the sample is assumed to be large samples and the distribution of these sample statistic is a normal distribution.

In light of these facts, out of the directorates found in the organizational structure of AAHDC this research determined the sample size to be 50 as a convenient sample size so as to be adequate for a survey questionnaire to be disseminated in the population.

Furthermore, for PM maturity assessment purpose, this sample size can be assumed to be a representative in taking relatively large sample size in comparison with a major study of project management maturity at a global level conducted by Price Water House Coopers

in 2004 in which two hundred responses gathered from thirty different countries across the globe.

3.6. Data types & Collection Tools

Both primary and secondary data collection methods were used in the research. The project management practitioners in AAHDC are the target population involved as primary sources for quantitative data collection; whereas different documents from report, internet and research findings reviewed as a secondary source for the study.

Pretest/pilot test was conducted on questionnaires for their clarity by first distributing a sample of 10 questionnaires for AAHDC staff member who were not part of the sample by the researcher. Feedbacks were gathered and comments accepted prior of mass distribution. This helped in ascertaining the reliability and validity of the instrument.

3.6.1. Primary Data Collection

For the fact that responses from the population enable generalizations to be formed from the comparative results, for this study data, were collected through the use of a survey questionnaire consisting of closed-ended questions for the fact that Close-ended questions facilitate the statistical analysis.

A questionnaire having two sections with all closed ended questions were designed as a tool for primary data collection (Appendix A). The first section of the questionnaire is concerned with the collection of general information of the respondent to classify respondent's demographic characteristics. The real purpose of having these general questions was to get the participant in the mode of answering Project Management related questions and help in justifying the reliability of the data as well as its associated results and conclusions. The second section of the questionnaire was developed by the premise of variable measure technique used in assessing and determining the maturity level of AAHDC; proposed by PMI. It was an adaptation of the self-assessment questionnaire for determining level of maturity developed by PM Solution with modifications on the project management knowledge areas raised from ten to fourteen and having a total of sixty-two processes under the fourteen knowledge areas.

3.6.2. Secondary Data Collection

The secondary data used in this research were acquired by surveying existing literature regarding project management and assessment of project management maturity from various publications, both published and unpublished materials such as books, conference papers, thesis, media, journal, conference papers, articles, and the internet so as to make a comprehensive literature review and help in developing the new assessment model.

3.7. Method of Data Analysis

The overall goal, to assess the level of maturity of AAHDC PMS, has been classified in to three objectives as shown in the chapter one. The outcome of the survey statistical analysis results is presented and used as basis to answer research questions. Analysis of data was done in order to answer the four research questions of this study. **The collected raw data sorted, classified and coded then tabulated before analysis.** The SPSS (version 20) computer software was used to aid the analysis as it is more users friendly and most appropriate for analysis of Management related attitudinal responses. The method of data analysis employed in this work followed descriptive statistics; which include frequencies, means, and mean scores (MSs), were computed to analyze the data obtained from respondents citing their experience in the construction industry. The results were analyzed and presented on frequency distribution tables, pie charts and bar charts. Here the interest was to focus on frequency of occurrence across attributes of measures. The steps used to calculate the overall score on the Project Management Assessment System is based the mean score values of the processes.

3.8. Validity and Reliability

Studies in general should be conducted in a valid and logical manner. Authors such as Bryman and Bell (2003) have advocated the use reliability and validity measurements to qualitative research. However, from the perspective of some researchers, these measures are viewed as applicable to quantitative research and not to qualitative research. The logic is that reliability and measurement validity are essentially concerned with adequacy of measures. Internal validity is concerned with the soundness of findings which specify a causal connection, which is a concern mainly in quantitative research.

The issue of generalizability is addressed by external validity (Yin, 2003). External validity is concerned with sample representativeness, which may be applicable to qualitative research, but is more concerned with sampling procedures that generate a representative sample, a concern that is more applicable to quantitative research (Bryman and Bell, 2003). Reliability requires demonstrating that procedures used in the research may be repeated to achieve the same result (Fellows and Liu, 2003).

The nature of the research and the methodology followed favored this study fulfill the requirements of validity and reliability. Furthermore, because of the facts that the measurement materials used in this research study, both the newly developed maturity model and the survey questionnaire with their contents, were basically developed with direct customization of predesigned and globally accepted standards, the outputs of the survey data and its measured attributes can be guaranteed for validity and reliability of the whole research work; provided that both the newly developed maturity model and the standard survey questionnaire with their contents were directly applied.

3.9. PMM Assessment Framework

In order to conduct maturity assessment and determine AAHDC current PM maturity level instead of direct self-assessment for PM maturity level, variable measure technique with five-point Likert scale was used in evaluating the level of implementation of PM processes; assuming the mean value of each of the level of implementation of processes correspond to the level of Maturity of the process.

According to Crawford (2015), achievement of a given maturity level by an organization is cumulative – that is, for each succeeding PMMM level, the assumption is that all criteria for the preceding levels for that component are being (or have been) fulfilled. For example, to assess an organization at Level 3 in one of the knowledge area, the organization must have in place all of the processes described in Levels 1, 2, and 3 of that knowledge area.

After completing the assessment, determine the maturity level in each knowledge area. To do that, review the assessments of the knowledge area components, and select the lowest level of assessment: that is the maturity level in the specific area.

To assess the overall Organizational Maturity Level, follow a similar method. Review the maturity assessment result of each of the knowledge areas. Select the lowest level of assessment: that is the Organizational Maturity Level (Crawford, 2015).

3.9.1. Assumptions for Determination of PM Practice Maturity

The overall construction PM practice maturity level is determined by taking the lowest mean value of the level of implementation of components under each knowledge area. After identifying the mean values of the 14 knowledge areas, in determining the overall maturity of an individual practice, the mean value of the level of level of implementation of all the processes under a knowledge area must fulfill and attain the requirements of the presiding level. (Appendix-B:)

1. Mean score value between one and two: Practice Maturity Level 1
2. Mean score value between two and three: Practice Maturity Level 2
3. Mean score value between three and four: Practice Maturity Level 3
4. Mean score value between four and five: Practice Maturity Level 4
5. Mean score value attains exactly five: Practice Maturity Level 5

3.9.2. Assumptions for Determination of PM Process Maturity

The overall construction PM process group maturity level is determined by taking the lowest mean value of the level of implementation of the components under each process group. Maturity score determined for the 5 process groups. In determining the overall maturity of an individual process group, the mean value of the level of level of implementation of all the processes under each process group must fulfill and attain the requirements of the presiding level and the model.

1. Mean score value between one and two: Process Maturity Level 1
2. Mean score value between two and three: Process Maturity Level 2
3. Mean score value between three and four: Process Maturity Level 3
4. Mean score value between four and five: Process Maturity Level 4
5. Mean score value attains exactly five: Process Maturity Level 5

CHAPTER FOUR

4. RESULTS AND DISCUSSION

Because of the research involved **a mixed method approach**, inclusion of both qualitative and quantitative methods, this chapter presents the contents in two parts; first the qualitative part where the newly developed generic maturity model introduced; and next, the quantitative in part two; which represents the empirical findings and results of the survey data (based on responses collected by the survey instrument) and articulate the statistical analysis of the data.

4.1. Qualitative Study Part

4.2. Comparison and Selection of a Prime Maturity Model

In this research, the prominent maturity models shortlisted by Nenni et al. (2014) and discussed in Chapter Two are further compared each other according to the criteria proposed by different authors so as to make a selection on the most appropriate model to be customized and help in developing the intended assessment model.

Any model selected to measure project management maturity must point out a logical path for progressive development. In effect, a good model for the measurement of project management maturity creates a strategic plan for moving project management forward in an organization (Crawford, PMMM, 2015).

All the other maturity models were useful, however they all needed to be shaped to be utilized for construction sectors maturity assessment in its context. For the case that their specific applicability in concerned areas, different practices and processes, different cultures and organizational structures, differences in their production processes and the product itself, etc. This research considers the importance of these maturity models and their maturity leveling systems, but because of the previously mentioned reasons, this study modified and developed the previous maturity levels for project management maturity assessment by focusing on construction sectors taking the case of AAHDC as a representative for applying and having structured management system in the Ethiopian construction industry shouldering the responsibility of managing the housing construction projects.

According to accepted and working criteria set by different authors, all the models have common characteristics fulfilling most of the criteria; However, the PM Solution's PMMM, in comparison with the other models, it is recently updated version, even it is latest than the most recognized and known model the "OPM3".

Furthermore, two of the model's characteristics make it ideal for use in the current study; first, it's assessment is based on the PMI's knowledge areas of the PMBOK Guide; second, it is well known and accepted all over the world. Its concepts can then be more

applicable to conduct the assessment processes and desired improvements for the research case-study organization.

The model is also efficient in the sense that it can predict a project's outcome. It is consistent, reliable, and goes hand in hand with organizational success (Crawford, 2015). The model also offers a framework with which successful projects can be realized within the context of the organization. The model depends on the capability of the organization in acquiring and applying the necessary management skills.

Therefore, having the aforementioned specific features in comparison of all the five maturity models as shown on Table 4-1, this research selected PM solution's PMMM as a best model framework which is appropriate and it was selected for a reasonable modifications and further assumptions on it so as to adapt in developing a new generic maturity model for use of maturity assessment in this research work. In light of this facts, a new maturity model called "Construction Project Management Maturity Model" was developed and designated as "Con-PM3".

Table 4-1: Comparison of PMMM

Criteria	Maturity Model				
	OPM3	**PMMM**	**CMMI**	**K-PMMM**	**P3P3**
Developer	PMI	PM Solutions	SEI	Kerzner	APM Group
Publisher	PMI		SEI	ILL	OGC
Year	2013	2015	1922	2006	2004
Scope	PM	PM	Software	PM	PM
Maturity Levels	**4**	**5**	**5**	**5**	**5**
Details	Extremely high	Extremely High	High	High	High
Refer to Standard	PMBOK	PMBOK	PMBOK	PMBOK	MSP
Area of Application	PPPM	PM	PM	PM	PPPM
Classification	System Based	System based	System based	System based	System based
Target organization	Project driven	Project driven	Project driven	Project driven	Project driven
Organization strategic project management Processes	Yes	Yes	Yes	Yes	Yes
Program management process	yes	No	Yes	No	Yes
Assessment Difficulty	Low	Low	High	Low	High
Assessment cost	Low	Low	High	Low	High

quantitative result	Yes	Yes	Unknown	Yes	No
Tangible of the result	Yes	Yes	Yes	Yes	Unknown
Identifying strength and weaknesses	Yes	Yes	Yes	Yes	Unknown
Training Difficulty	Low	Low	High	Medium	Unknown
Commitment for continuous improvement	Yes	Yes	Yes	Yes	Yes
Suggestion of Alternative for Improvement	Yes	Yes	Yes	Yes	Yes
New Edition	Yes	Yes	Yes	Yes	Yes
Easy for Execution	Yes	Yes	Yes	Yes	Yes
Simple and understandable	Yes	Yes	Medium	Yes	Medium
Definition of Maturity	Yes	Yes	Yes	Yes	Yes

(Source: Adapted & modified from Muhammad Mateen, 2015)

4.3. Description of New Maturity Model

Based on the above criteria, a comparative five leveled Con-PM3 have been developed by adapting relevant concepts considered in all the shortlisted models. Con-PM3 used for assessing project management maturity for federal housing construction sector in Ethiopia.

The model is an adaptation and customization of the previous maturity models such as (OPM3, 2013), PM Solutions' PMMM, (CMMI, 2003), (K-PMMM). The lions share of the model adaptation is of the PM Solutions' PMMM with contribution of concepts from the rest of the models that are believed to be relevant in the proposed model. The model uses PMBOK as a primary reference for assessment and instructing areas of PM and closely aligned with it.

The new maturity model was redrawn based on the recent - the construction extension to a guide to the PMI's PMBoK by using the fourteen knowledge areas (PMI, 2013) and five maturity level descriptions of PM solutions' project management maturity model were adapted and synchronized to it.

4.3.1. Nature of the New Maturity Model "Con-PM3"

Below Figure 4-1, is the pictorial representation of the newly developed generic maturity assessment model "Con-PM3"; as its name indicates, it is designed for use in the assessment of construction project management system. In addition to the ten knowledge areas of the PMI's Guide, the model developed in this study, Con-PM3, exceptionally considered the additional four knowledge areas proposed by the PMI as construction

extension to a guide to the PMBoK that are specific for the construction management project management; which none of the maturity models developed yet did not encompass.

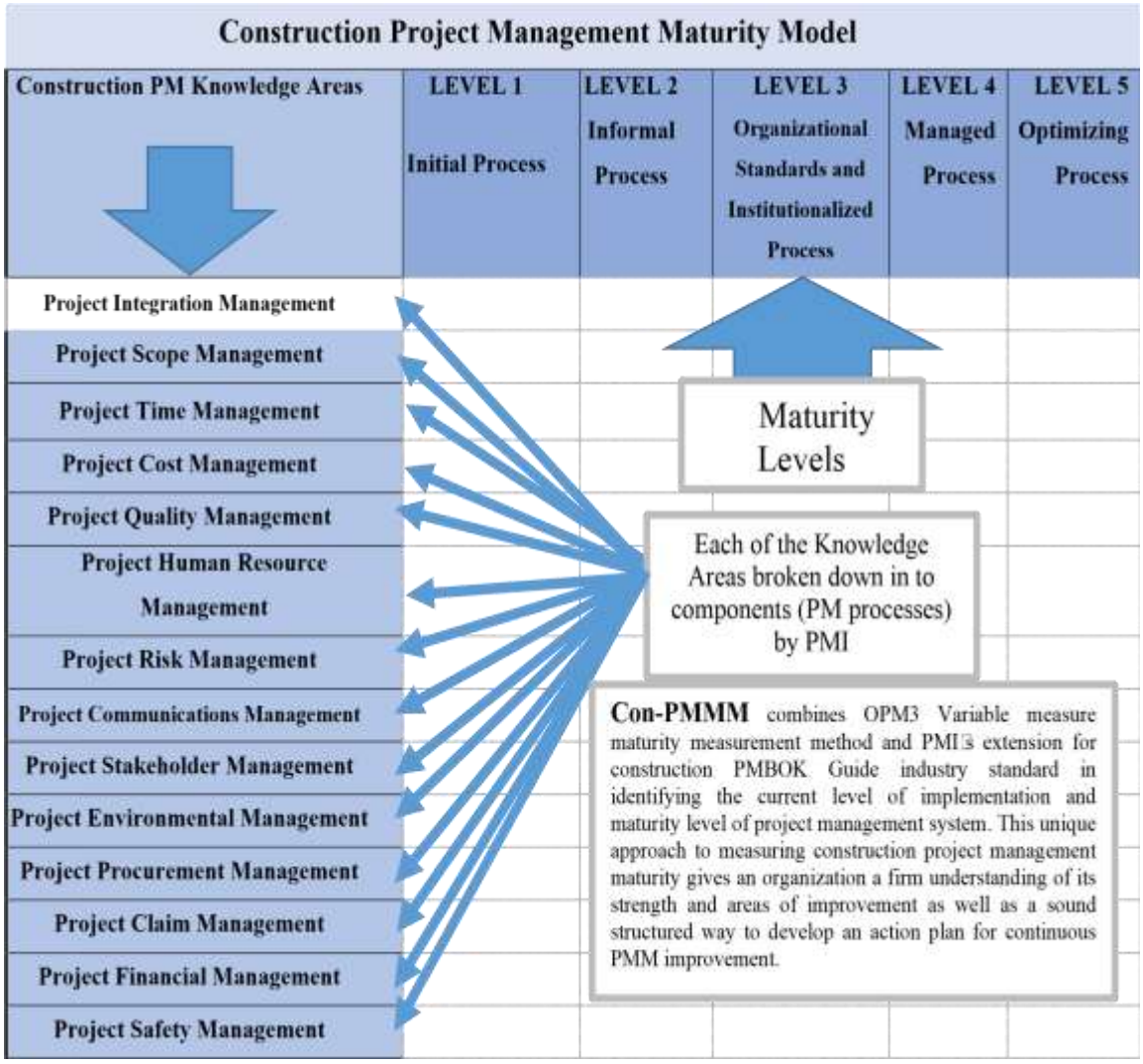

Figure 4-1: Construction Project Management Maturity Model
(Adapted from PM Solution's PMMM; Modified & Redrawn by the Author)

Therefore, Con-PM3 Model is generic for the construction industry but not necessarily specific for construction industry. The model appears to be primarily designed to help determination of the overall level of maturity of construction project management by establishing relationship between maturity of each key components and the score of each process (i.e. its weight) as determined by perceived contribution to success of construction project. The model employs statistical methods to determine the score (weight) of each key processes. Once the score is determined and fixed then for a given company the level of maturity of each of the 14 knowledge areas and process groups, maturity level of an organization could be determined.

The model uses the idea of variable measuring self-assessment technique used in the OPM3 proposed by PMI's which is specifically adapted and modified for use in this study (Table 4-2); was prepared for the questionnaire to measure AAHDC PMS maturity.

Therefore, the model uses a variable measure self-assessment scale in evaluating the level of implementation of the project management processes. Hence, based on their level of implementation, an organizations' overall level of maturity could be determined.

Table 4-2: Modified Variable measure scoring method for maturity self-assessment

Score	Perceived Level of implementation	Description
1	Very Poor	Standard Process not Exist In the Organization
2	Poor	Standard Process Exists but not performed
3	Fair	Partially Performed Process
4	Good	Fully Performed but not Consistently implemented Process
5	Very Good	Fully Performed and Consistently implemented Process

(Source: Adapted from PMI, 2013)

4.3.2. Features of the New Maturity Model "Con-PM3"

The Con-PM3 has remarkable features of:

- Inclusions of all the PM knowledge areas needed to be measured,
- It provides enough detail so that an assessor can use the model to perform follow up or progress checks without third party assistance.
- It has also sufficient granularity that its use enables identification of root cases and specific actions for improvement.
- Its currency is also guaranteed in that it reflects uses latest standards and proven tools and techniques of the PMI guide.
- The model is capable of altering an assessment to a particular organization.
- Mainly the model is client oriented, Because, the assessment method is not very cumbersome and can easily be used to determine organizations' current level of maturity, as well as the required level of maturity.

It can therefore be concluded that the maturity model developed in this research addresses most of the needs of AAHDC PMS. It also protects organization's desire for privacy. Some models retain data and use the demographics or use the results to establish benchmarking data for marketing purposes. The model and its resulting report is owned to

use within the organization as the organization desire following the assessment. Some firms do not offer the checklists, only providing an assessment report.

4.4. "Con-PM3" Model's Maturity Assessment Dimensions

The model developed and proposed for measuring Project Management Maturity in this study has two dimensions. These are "Process Group Maturity" dimension, "Practice or Knowledge Area Maturity" dimension.

Crawford justified that because the processes are very large within each of the PMBOK Guide's knowledge areas, it was necessary to identify the level of implementation of all the component processes under each knowledge area and based on the finding of the level of implementation of the processes, one can assess and determine the maturity level of each of the PM processes as well as the knowledge areas maturity level.

Further, Crawford (2015) confirmed in his study that this is where the real measurement of maturity takes place. The processes were scaled by their level of implementation by PM practitioners in the organization as very poor practice, poor practice, fair practice, good practice and very good practice based on their perceived level of implementation in AAHDC.
The model follows a staged model representation; in determining the overall maturity of an organizational PMS, in either of the maturity assessment results, the mean value of the level of implementation of all the processes under each knowledge area must fulfill and attain the requirements of the presiding level and the model. (Appendix-B:)

4.4.1. "Con-PM3" Model's "Practice" Maturity Dimension

The PM practice maturity dimension of the proposed model follows a two stage assessment: first, evaluating the level of implementation of individual process under each knowledge areas; second, finding mean value of the level of implementation of each process under the practices. Based on the mean values of their level of implementation of individual process under the PM knowledge areas, the overall construction PM practice maturity level is determined by taking the lowest mean value of the level of implementation of the processes under each knowledge area.

4.4.2. "Con-PM3" Model's "Process Group" Maturity Dimension

The PM process group maturity dimension of the proposed model follows a two stage assessment: first, evaluating the level of implementation of individual process under the process group; second, finding mean value of the level of implementation of each process.

Based on the mean values of their level of implementation of individual process under the PM process group, the model classifies the maturity level of the PM practices/processes group under five levels of Process group maturity dimension. The overall construction

PM Process group maturity level is determined by taking the lowest mean value of the level of implementation of the processes under each Process group.

4.5. Maturity Levels of the "Con-PM3" model

Like most of the PM maturity models, the proposed Maturity model for process groups maturity dimension was developed mainly (with some modifications) by adapting the concepts and frame works of maturity definition of OPM3, K-PMMM, PM solutions and CMMI's continuous maturity model representation

Hence, the definitions, the concepts and terms used in this model share parts in OPM3, KPMMM, PM solutions and CMMI's unless it is explicitly redefined.

The proposed Con-PM3 has five maturity levels for the PM process maturity dimension.

These levels are: Initial Processes Level, Informally Performed Processes Level, Organizational Standards and Institutionalized Processes Level, Managed Processes level, and Processes Optimization Level. The levels of the proposed Project Management Maturity Model are as follows

The five levels, similar to those in the PM Solutions PMMM, are described below. Each of the levels represents a discrete organizational capability based on the summary-level characteristics, as shown in Appendix D.

4.5.1. Level 1: Initial process

"There is recognition on project management processes but there are not established practices and standards, and individual project managers are not held to specific accountability by any process standards. Documentation is loose and ad hoc and metrics are informally collected on an ad hoc basis. Management understands the definition of a project, that there are accepted processes and is aware of the need for project management" (Grant and Pennypacker, 2006)

4.5.2. Level 2: Informal process and standards

"Many project management processes exist in the organization, but they are not considered organizational standards. Documentation exists on these basic processes and management supports the implementation of project management, but there is neither consistent understanding, involvement, nor organizational mandate to comply for all projects. Functional management is involved in the project management of larger, more visible projects and these are typically executed in a systematic fashion.
There are basic metrics to track project cost, schedule, and technical performance, although data may be collected/correlated manually. Information available for managing the project is often a mix between summary level data and detailed level data" (Grant and Pennypacker, 2006).

4.5.3. Level 3: standards and institutionalized process

"All project management processes are in place and established as organizational standards. Nearly all projects use this process with minimal exception – management has institutionalized the processes and standards with formal documentation existing on all process and standards.

Project management processes are typically automated and management is regularly involved in input and decision making. Each project is evaluated and managed in light of other projects" (Grant and Pennypacker, 2006).

4.5.4. Level 4: Managed process

"Project is managed by considering the past performed and future expectation. Management uses efficiency and effectiveness metrics to make decisions and understands the impacts on other projects and to evaluate all projects, changes and issues from cost estimates, baseline estimates, and earned value.

Project information, project management processes and standards are integrated with other corporate systems and processes. Processes and standards are documented. Management clearly understands its role in project management process and execute it well, managing at right level. Management styles and project management requirements for different sizes/complexities of projects are clearly differentiated" (Grant and Pennypacker, 2006).

4.5.5. Level 5: Optimizing process

"Processes are in place and actively used to improve project management activities. Lessons learned are regularly examined and used to improve project management processes, standards, and documentation. Management and organization are not only focused on effectively managing projects but also on continuous improvement. The metrics collected during execution are used to understand performance of projects and for making organizational management decision for the future" (Grant and Pennypacker, 2006). Quantitative Study Part

4.6. Demographic Characteristics of the Respondents

In order to fulfill the purpose of the quantitative part of the study, analysis of the survey data was oriented towards determining the perceived degree of implementation of AAHDC project management processes attributed to the project management Knowledge areas. In this section, first, Demographical data are interpreted; second, the evaluation results of AAHDC PM processes & practices level of implementation presented and discussed; Third, the assessment results of AAHDC current PM processes & practices maturity level results determined and discussed.

Analysis began with a demographic profile of the 50 respondent based on the answers to the questions in section one of the questionnaire, this section consists of general

demographic questions such as sex, age, occupational status, field of specialization, level of academic achievement, years of experience as a project manager and years of experience in the organization. Furthermore, the questionnaire item scores were analyzed for any missing or erroneous values or data, and no such values or missing data were found. *SPSS* was used to conduct the demographic analysis and the results were presented and discussed.

4.6.1. Response Rate

From the data collected, out of the 50 questionnaires administered, 50 were filled and returned, which represents 100% response rate. This response rate is considered to be very good. The recorded high response rate can be attributed to the data collection procedures, where the researcher pre-notified the potential of the intended survey, utilized a self-administered questionnaire where the respondents completed and these were picked shortly after and made follow up calls to clarify queries as well as prompt the respondents to fill the questionnaires. Based on the result of the questionnaire survey, the following sections summarize the profile of the professionals involved in the study.

4.6.2. Academic Achievement and Occupational Status of the Respondents

In this research work, the occupational status of the respondents under the survey was classified as Higher Level manager, Middle Level manager, lead engineer, senior engineer; engineer and junior engineer.

According to Part one of the survey questionnaire, the respondents were directly asked to classify their occupational status in the organization. Based on that, out of 50 respondents, only one respondent classified himself as a higher manager, while 28 respondents classified themselves as a middle level manager where as the other 21 respondents labeled themselves below the middle managerial level as lead engineer, senior engineer, engineer and junior engineer; in light of this fact, in this research the classifications of the respondents below the lead engineer were considered as a Lower Managerial level.

The demographic analysis result of the educational level of the respondents revealed that 58 % of the respondents or 29 persons were at master’s degree level and the rest 42 % of the respondents or 21 persons were at first degree level (Table 4-3). Out of this, while majority of the master’s degree level respondents, around 42 % working as middle level managers where as 28 % of first degree level respondents were at lower level manager.

The result also showed that, among the respondents having master’s degree, only 2% (one person) is found at higher level management level. This justified the data was more reliable in that the respondents involved were more professionals in their field of study. And since the majority of the respondents with higher level of education were found at middle level managerial position, this makes the assessment more knowledge based.

Table 4-3: Academic achievement of the respondents

Education Level	Occupation status of the respondent			
	Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	Total (N=50)
First Degree	0(0.0%)	7(14.0%)	14(28.0%)	21(42.0%)
MSc	1(2.0%)	21(42.0%)	7(14.0%)	29(58.0%)

Source: Own Survey Data analysis result (2017)

4.6.3. Field of Specialization

As it is shown on the Table 4-4 below, 60 % of the respondents were civil engineers and 30

% of the respondents were construction technology & management professionals where as 6 % of respondents were highway engineers only 1 % of respondents was Geo-technical engineer and 1 % of the respondents specified as other field of specialization found at lower level of management. As the result clearly indicated almost all of the respondents' field of specialization forces them to directly involve in the management of the construction project and at this field of specialization they are expected to have the full knowledge of project management, the data collected from them is valid and reliable.

Table 4-4: Field of specialization of respondents

Field of Specialization	Occupation status of the respondent			Total
	Higher level Manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	level (N=50)
Civil Engineer	1(2.0%)	13(26.0%)	16(32.0%)	30(60.0%)
CoTM	0(0.0%)	12(24.0%)	3(6.0%)	15(30.0%)
Building Engineer	0(0.0%)	2(4.0%)	1(2.0%)	3(6.0%)
Geo-technical Engineer	0(0.0%)	1(2.0%)	0(0.0%)	1(2.0%)
Other	0(0.0%)	0(0.0%)	1(2.0%)	1(2.0%)

Source: Own Survey Data analysis result (2021)

4.6.4. Number of Years the Experience as Project Manager

The Table 4-5 below represents a general breakdown of the number of years of professional experience with regard to the managerial level assumed by the respondent (Higher level manager, Middle level manager and lower level manager).

With regard to the working experience of the professionals involved in the questionnaire survey, the analysis result on the above table showed that 50 % of the respondents were having six to ten years of managerial experience and out of them 42 % were engaged in the middle managerial level. On the other hand, 34 % of the respondents were with experience from two to five years of managerial experience and 28% of them were found at lower level of management.

While only 3 % of respondents were with managerial experience of below two years all involved in the lower managerial level, where as 10 % of respondents were more than ten years of managerial experience furthermore, among which while 8 % found as middle level management the rest 2 % were higher level manager.

There fore, this study was fortunate to obtain such experienced persons for the study. This gives an indication that quite experienced project management practitioners on the field were surveyed. This combination of figures regarding the participants is of great value for the reliability/representativeness of the information obtained from the questionnaire survey.

Table 4-5: Respondents Experience as Project manager

Number of years the respondent worked as a project	Occupation status of the respondent			
	Higher level manager (N=50)	Middle level manager (N=1)	Lower level manager (N=28)	Total manager (N=21)
Less than 2 years	0(0.0%)	0(0.0%)	3(6.0%)	3(6.0%)
Between 2 and 5 years	0(0.0%)	3(6.0%)	14(28.0%)	17(34.0%)
Between 6 and 10 years	0(0.0%)	21(42.0%)	4(8.0%)	25(50.0%)
More than 10 years	1(2.0%)	4(8.0%)	0(0.0%)	5(10.0%)

Source: Own Survey Data analysis result (2021)

4.6.5. Number of Years the Respondent Worked in AAHDC

As shown on the Table 4-6 below, among participants who involved in the study while minimum years of service year in AAHDC was 2 years the maximum was 16 years of experience in AAHDC. The average year of respondents' experience in the organization was found to be 6 years of experience, which implies that professionals involved in the study have a vast of experience in the area and in their stay in the organization therefore,

they are expected to know all about the current managerial practice of AAHDC, which implies that the information forwarded could be important and reliable as required in the study.

Table 4-6: Respondents Experience in AAHDC

Continues variable	N	Minimum	Maximum	Mean	Std. Deviation
Number of years the Respondent worked in AAHDC	50	2.00	15.00	6.10	3.01

Source: Own Survey Data analysis result (2021)

4.7. AAHDC PM Knowledge Areas Components' Level of Implementation

Part two of the survey questionnaire is intended to evaluate the level of implementation of standard PM processes under each project management knowledge areas as well as the project management maturity level of AAHDC PMS.

The five-point ordinal scale ranged as: 5 point scale - for processes fully and consistently performed and considered as a Very Good level of implementation, 4 point scale - for processes fully performed but not consistently implemented are considered as a Good level of implementation, 3 point scale- for partially performed processes and considered as a Fair level of implementation, 2 point scale - for the existed standard practice but not performed and considered as a Poor level of implementation, 1 point scale - for No Standard Practices and considered as a Very Poor implementation level.

4.7.1. Project Integration Management Knowledge Area

4.7.1.1. Integration Management Processes level of implementation

The Table: 4-7 below presents the frequency percentage of respondents rating of the implementation level of the six standard project integration management processes identified by the PMI. In AAHDC project integration management practice, the monitoring and control work processes are almost not performed.

In addition to this, the integrated change control process also has got little attention in the

AAHDC project management system. As the analysis result on the above table showed, in AAHDC project integration management practice, processes such as direct and manage project work, developing project management plan, and developing project charter are found to be in a "good" level of implementation with a response rate of 56%, 54% and 52% respectively. This means the processes are fully performed but not consistently implemented.

Whereas, performing integrated change control and closing work processes are in "fair" level of implementation having a response rate of 54% and 30% respectively. As the result showed, these processes are partially performed in AAHDC project integration management practice. On the other hand, 52% of the respondents thought the monitoring and control project work process in AAHDC PMS "poor" level of implementation; that showed the process is almost not performed in the organization.

Table 4-7: Project Integration Management processes level implementation

Integration Management Processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Develop project charter	Very poor process	0(0%)	3(10.7%)	0(0%)	3(6%)
	Poor process	0(0%)	5(17.9%)	1(4.8%)	6(12%)
	Fair process	1(100%)	4(14.3%)	8(38.1%)	13(26%)
	Good process	0(0%)	15(53.6%)	11(52.4%)	26(52%)
	Very good process	0(0%)	1(3.6%)	1(4.8%)	2(4%)
Develop project management plan	Poor process	0(0%)	3(10.7%)	0(0%)	3(6%)
	Fair process	0(0%)	10(35.7%)	5(23.8%)	15(30%)
	Good process	1(100%)	14(50%)	13(61.9%)	28(56%)
	Very good process	0(0%)	1(3.6%)	3(14.3%)	4(8%)
Direct and manage project work	Fair process	0(0%)	11(39.9%)	4(19%)	15(30%)
	Good process	1(100%)	14(50%)	12(57.1%)	27(54%)
	Very good process	0(0%)	3(10.7%)	5(23.8%)	8(16%)
Monitor and control project work	Poor process	0(0%)	13(46.4%)	13(61.9%)	26(52%)
	Fair process	0(0%)	4(14.3%)	1(4.8%)	5(10%)
	Good process	1(100%)	11(39.3%)	7(33.3%)	19(38%)
Perform integrated change control	Very poor process	1(100%)	3(10.7%)	1(4.8%)	5(10%)
	Poor process	0(0%)	10(35.7%)	1(4.8%)	11(22%)
	Fair process	0(0%)	13(46.4%)	14(66.7%)	27(54%)
	Good process	0(0%)	2(7.1%)	5(23.8%)	7(14%)
Close project or phase	Poor process	0(0%)	6(21.4%)	5(23.8%)	11(22%)
	Fair process	0(0%)	9(32.1%)	6(28.6%)	15(30%)
	Good process	0(0%)	8(28.6%)	5(23.8%)	13(26%)
	Very good process	1(100%)	5(17.9%)	5(23.8%)	11(22%)

Source: Own Survey Data analysis result (2021)

4.7.1.2. Integration Management Practice implementation level

Figure 4-2: below shows further analysis result for determination of the level of implementation of AAHDC overall integration management practice by taking an average of the multiple respondents' ratings given for all the six processes under the practice.

It appears that an average of only 40% of multiple respondents' rate showed the practice in "good" level of implementation; while 30 % of the responses thought that the practice is fairly implemented 19% of the respondents replied it "poor" level of implementation the rest 3% replied "Very Poor" level of implementation.

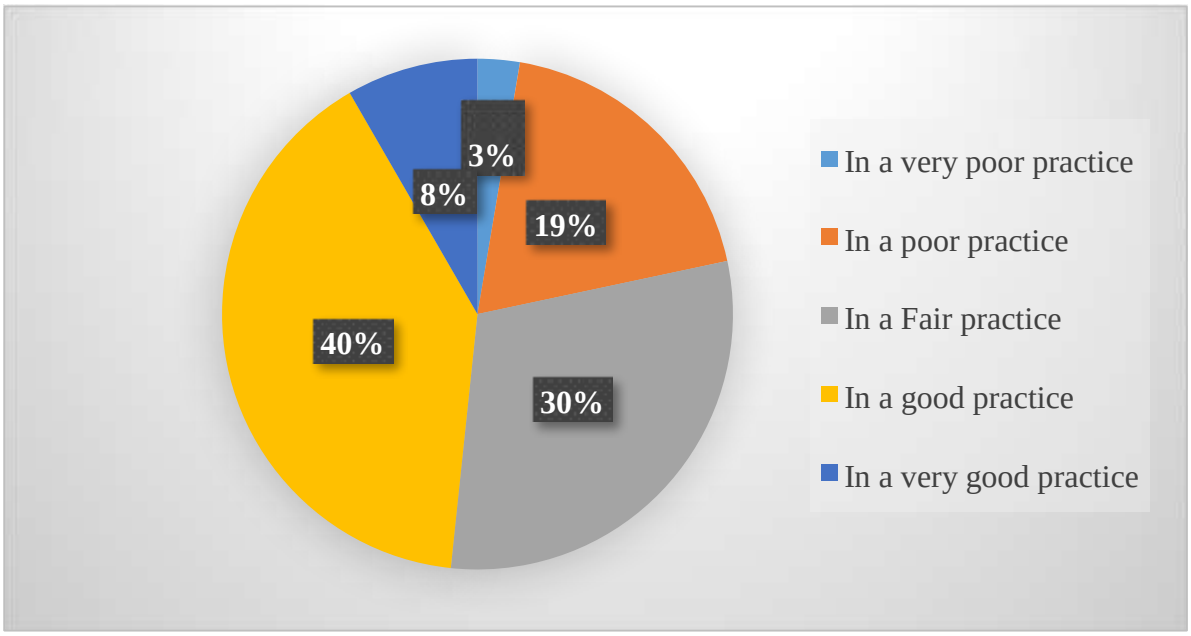

Figure 4-2: Integration Management Practice's level of implementation
Source: Own Survey Data analysis result (2021)

4.7.2. Project Scope Management Knowledge Area

4.7.2.1. Scope Management Processes' level of implementation

Table 4-8: below presents the frequency percentage of respondents rating of the implementation level of the six standard project scope management processes identified by the PMI. As the analysis result on the Table 10: showed, in the AAHDC PSMP, processes such as collecting requirement, planning scope management, creating WBS, defining scope and validating scope processes are found to be in a good level of implementation having a response rate of 60 %, 54 %, 54 %, 50 % and 46 % respectively.

This means the processes are fully performed but not consistently implemented. Whereas, 32% of respondent marked the Controlling Scope practice as "fair" and "poor" level and found to be "partially performed processes". On the other hand, 52% of the respondents said the monitoring and control project work process in AAHDC PSMS is at "poor" level of implementation therefore, the process is supposed as almost not performed.

Table 4-8: Scope Management processes' Level of Implementation

Scope Management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Plan scope management	Very poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
	Poor process	1(100%)	4(14.3%)	2(9.5%)	7(14%)
	Fair process	0(0%)	6(21.4%)	3(14.3%)	9(18%)
	Good process	0(0%)	14(50%)	13(61.9%)	27(54%)
	Very good process	0(0%)	2(7.1%)	3(14.3%)	5(10%)
Collect requirements	Poor process	1(100%)	6(21.4%)	2(9.5%)	9(18%)
	Fair process	0(0%)	8(28.6%)	1(4.8%)	9(18%)
	Good process	0(0%)	13(46.4%)	17(81%)	30(60%)
	Very good process	0(0%)	1(3.6%)	1(4.8%)	2(4%)
Define scope	Poor process	0(0)	4(14.3%)	1(4.8%)	5(10%)
	Fair process	1(100%)	7(25%)	2(9.5%)	10(20%)
	Good process	0(0%)	13(46.4%)	12(57.1%)	25(50%)
	Very good process	0(0%)	4(14.3%)	6(28.6%)	10(20%)
Create WBS	Poor process	0(0%)	1(3.6%)	2(9.5%)	3(6%)
	Fair process	0(0%)	12(42.9%)	6(28.6%)	18(36%)
	Good process	1(100%)	15(53.6%)	11(52.4%)	27(54%)
	Very good process	0(0%)	0(0%)	2(9.5%)	2(4%)
Validate scope	Poor process	0(0%)	3(10.7%)	1(4.8%)	4(8%)
	Fair process	1(100%)	13(46.4%)	7(33.3%)	21(42%)
	Good process	0(0%)	12(42.9%)	11(52.4%)	23(46%)
	Very good process	0(0%)	0(0%)	2(9.5%)	2(4%)
Control scope	Very poor process	0(0%)	4(14.3%)	0(0%)	4(8%)
	Poor process	1(100%)	9(32.1%)	6(28.6%)	16(32%)
	Fair process	0(0%)	9(32.1%)	7(33.3%)	16(32%)
	Good process	0(0%)	6(21.4%)	6(28.6%)	12(24%)
	Very good process	0(0%)	0(0%)	2(9.5%)	2(4%)

Source: Own Survey Data analysis result (2021)

4.7.2.2. Scope Management Practice implementation level

As sown on the figure 4-3 below, Further analysis for determination of the level of implementation of AAHDC PSMP revealed, the multiple respondents rating over all the six processes under the project scope management practice, taking the avAAHDCge of all the six processes under the practice, while 48% of multiple respondents' rate showed the practice in "good" level of implementation as "fully performed but not consistently implemented",

28% of the response rate showed the practice is in "fair" level of implementation, where as 14 % of it is "poor", 8 % is "very good" and only 2% of the respondents said it is in a very poor level of implementation.

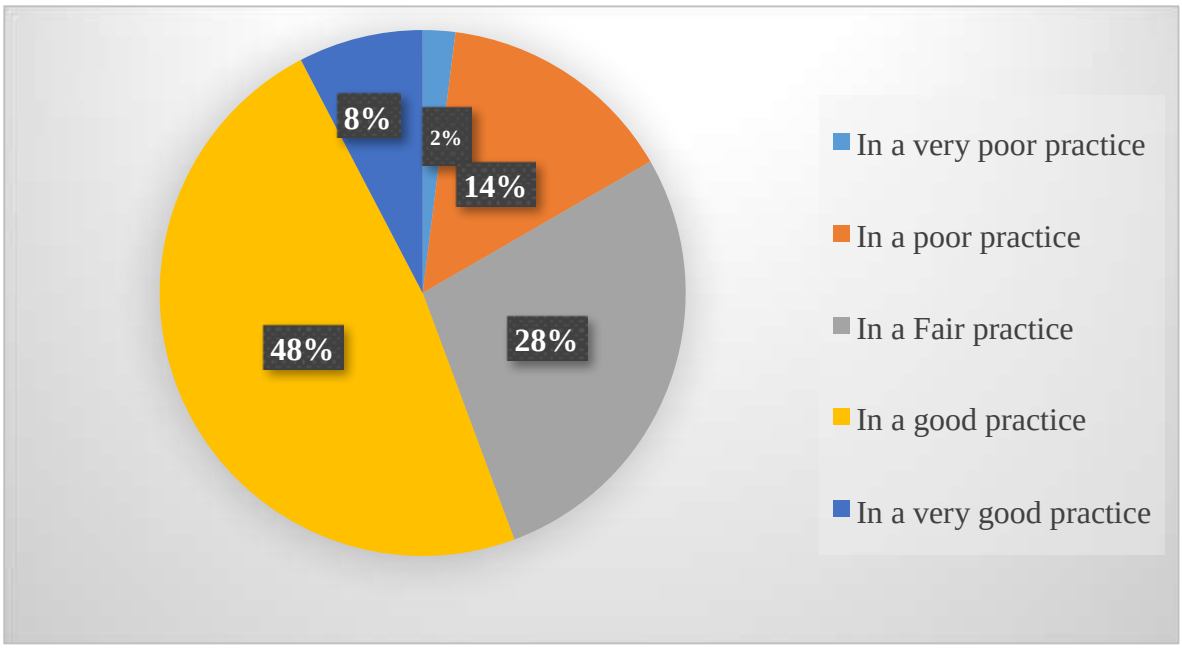

Figure 4-3: Scope Management Practice's level of implementation
Source: Own Survey Data analysis result (2017)

4.7.3. Project Time Management Knowledge Area

4.7.3.1. Time Management Processes' level of implementation

Table 4-9: below presents the frequency percentage of respondents rating of the implementation level of the seven standard project Time management processes identified by the PMI. Among the seven processes of project time management processes, As the analysis result on the above table showed, five processes such as the defining activities, plan schedule management, estimate activity duration, estimate activity resource and developing schedule are found to be in a "good" level of implementation in AAHDC PTMP so that they are classified as "fully but not consistently performed processes" with a response rate of 70%, 60%, 60%, 40% and 34% respectively.

Where as out of the rest two processes, the sequencing activities process is in a "fair" level of implementation as "partially performed processes" with 40% response rate; whereas 52% of respondent marked the control schedule process in a "poor" level of implementation and found to be as almost not performed process.

Table 4-9: Time Management processes' Level of Implementation

Time Management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Plan schedule management	Poor process	0(0%)	6(21.4%)	0(0%)	6(12%)
	Fair process	1(100%)	1(3.6%)	3(14.3%)	5(10%)
	Good process	0(0%)	18(64.3%)	12(57.1%)	30(60%)
	Very good process	0(0%)	3(10.7%)	6(28.6%)	9(18%)
Define activities	Poor process	0(0%)	1(3.6%)	2(9.5%)	3(6%)
	Fair process	0(0%)	2(7.1%)	2(9.5%)	4(8%)
	Good process	1(100%)	20(71.4%)	14(66.7%)	35(70%)
	Very good process	0(0%)	5(17.9%)	3(14.3%)	8(16%)
	Very poor process	0(0%)	1(3.6%)	0(0%)	1(2%)
Sequence activities	Poor process	0(0%)	1(3.6%)	2(9.5%)	3(6%)
	Fair process	0(0%)	11(39.3%)	9(42.9%)	20(40%)
	Good process	1(100%)	11(39.3%)	7(33.3%)	19(38%)
	Very good process	0(0%)	4(14.3%)	3(14.3%)	7(14%)
	Very poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
Estimate activity resources	Poor process	0(0%)	3(10.7%)	0(0%)	3(6%)
	Fair process	0(0%)	11(39.3%)	7(33.3%)	18(36%)
	Good process	1(100%)	8(28.6%)	11(52.4%)	20(40%)
	Very good process	0(0%)	4(14.3%)	3(14.3%)	7(14%)
	Very poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
Estimate activity durations	Poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
	Fair process	1(100%)	6(21.4%)	3(14.3%)	10(20%)
	Good process	0(0%)	15(53.6%)	15(71.4%)	30(60%)
	Very good process	0(0%)	3(10.7%)	3(14.3%)	6(12%)
	Very poor process	0(0%)	3(10.7%)	0(0%)	3(6%)
Develop schedule	Poor process	0(0%)	4(14.3%)	4(19%)	8(16%)
	Fair process	1(100%)	7(25%)	8(38.1%)	16(32%)
	Good process	0(0%)	11(39.3%)	6(28.6%)	17(34%)
	Very good process	0(0%)	3(10.7%)	3(14.3%)	6(12%)
	Very poor process	0(0%)	0(0%)	1(4.8%)	1(2%)
Control schedule	Poor process	1(100)	16(57.1%)	9(42.9%)	26(52%)
	Fair process	0(0)	8(28.6%)	6(28.6%)	14(28%)
	Good process	0(0)	4(14.3%)	3(14.3%)	7(14%)
	Very good process	0(0%)	0(0%)	2(9.5%)	2(4%)

Source: Own Survey Data analysis result (2021)

4.7.3.2. Time Management Practice implementation level

Figure 4-4: below Shows Further analysis for determination of the level of implementation of AAHDC PTMP revealed, based on the multiple respondents rating over all the seven processes under the project time management practice, taking the averaage of all the seven processes under the practice, while 45% of multiple respondents' rate showed the practice in "good" level of implementation as "fully performed but not consistently implemented", 25% of the response rate showed the practice in "fair", whereas 14 % of it is "poor", 13 % is found to be in a "very good" and the rest 3% said it is in a "very poor" level of implementation. This could be anticipated with a considerable project time delays in the current construction project delivery in AAHDC.

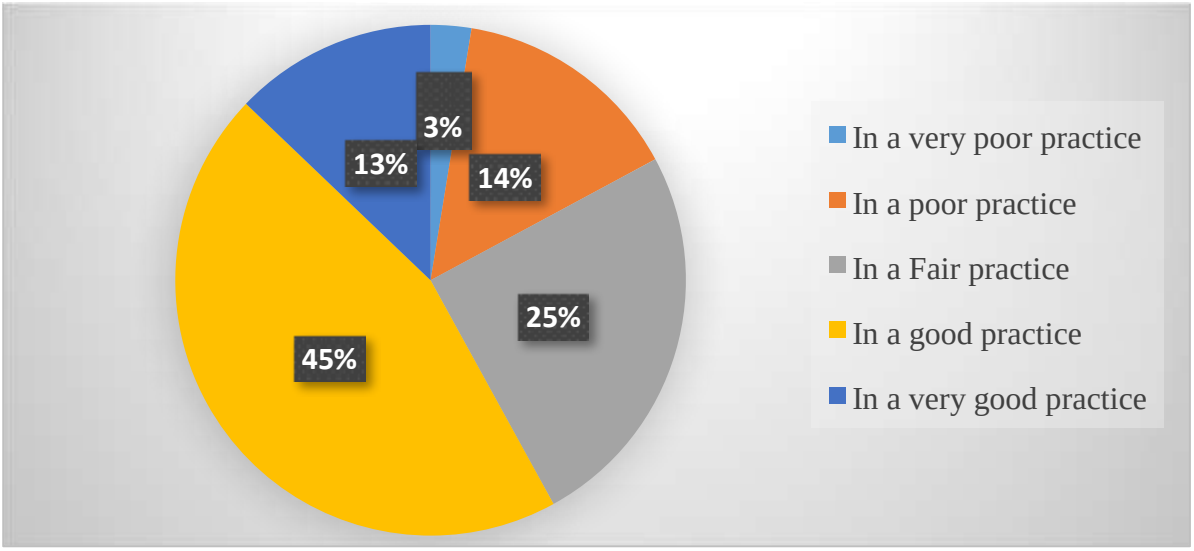

Figure 4-4: Time Management Practice's implementation level
Source: Own Survey Data analysis result (2021)

4.7.4. Project Cost Management Knowledge Area

4.7.4.1. Cost Management Processes' level of implementation

As Table 4-10: below presents the frequency percentage of respondents rating of the implementation level of the four standard project cost management processes identified by the PMI.

Among the four processes of project cost management processes, As the analysis result on the above table showed AAHDC PCMP, three processes such as the determining budget, cost estimation and cost management planning were found to be in a "good" level of

implementation so that they are classified as "fully but not consistently performed" processes with respondents of 56 %, 52 % and 50 % rate respectively where as 60 % of the respondents labeled the cost controlling process in a "poor" level of implementation as almost not performed process. There are no defined standards to use earned value management for project cost control. This might be a strong indication why construction projects are facing a remarkable amount of cost over run.

Table 4-10: Cost management Processes' level of Implementation

Cost Management Processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Plan cost management	Poor process	0(0%)	4(14.3%)	1(4.8%)	5(10%)
	Fair process	1(100%)	6(21.4%)	5(23.8%)	12(24%)
	Good process	0(0%)	15(53.6%)	10(47.6%)	25(50%)
	Very good process	0(0%)	3(10.7%)	5(23.8%)	8(16%)
Estimate costs	Poor process	0(0%)	3(10.7%)	1(4.8%)	4(8%)
	Fair process	1(100%)	7(25%)	5(23.8%)	13(26%)
	Good process	0(0%)	17(60.7%)	9(42.9%)	26(52%)
	Very good process	0(0%)	1(3.6%)	6(28.6%)	7(14%)
Determine budget	Poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
	Fair process	0(0%)	4(14.3%)	7(33.3%)	11(22%)
	Good process	1(100%)	18(64.3%)	9(42.9%)	28(56%)
	Very good process	0(0%)	4(14.3%)	5(23.8%)	9(18%)
Control costs	Very poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
	Poor process	1(100%)	17(60.7%)	12(57.1%)	30(60%)
	Fair process	0(0%)	4(14.3%)	1(4,8%)	5(10%)
	Good process	0(0%)	4(14.3%)	3(14.3%)	7(14%)
	Very good process	0(0%)	1(3.6%)	5(23.8%)	6(12%)

Source: Own Survey Data analysis result (2017)

4.7.4.2. Cost Management Practice implementation level

Figure 4-5: below Shows Further analysis for determination of the level of implementation of AAHDC PCMP. Based on the multiple respondents rating over all the four processes under the project cost management practice, taking the average of all the four processes under the practice, the result revealed; while the large amount of multiple respondents' (43%) rate showed the practice in "good" level of implementation as "fully performed but not consistently implemented"; whereas only 1% of the multiple response rate showed it is in a very "poor" level of implementation. Despite all the facts AAHDC PCMP can be classified as a good level, fully performed but not consistently implemented practice.

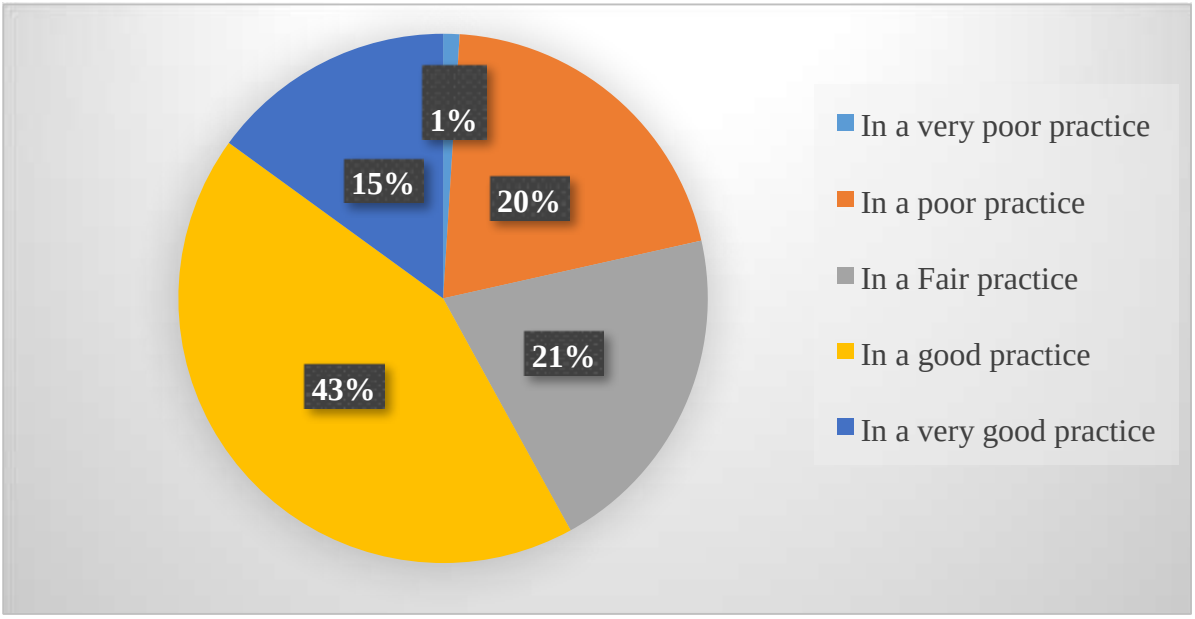

Figure 4-5: Cost Management Practice implementation level
Source: Own Survey Data analysis result (2017)

4.7.5. Project Quality Management Knowledge Area

4.7.5.1. Quality Management Processes' level of implementation

Table 4-11: below presents the frequency percentage of respondents rating of the level of implementation of the three standard project quality management processes identified by the PMI. Among the three processes of project quality management processes, As the analysis result on the above table shows only one process, the planning quality management process, is found in a "good" level of implementation in AAHDC PQMP so that it is classified as fully but not consistently performed process with a response rate of 62%. Whereas 42% of the respondents labeled the quality controlling process in a "poor" level of implementation as almost not performed process besides, 40% of the respondents replied that quality assurance to be in a "fair" level of implementation, as it is partially performed in AAHDC PQMP.

Table 4-11: Quality Management processes' level of Implementation

Quality Management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Plan quality management	Poor process	0(0%)	2(7.1%)	1(4.8%)	3(6%)
	Fair process	1(100%)	7(25%)	5(23.8%)	13(26%)
	Good process	0(0%)	17(60.7%)	14(66.7%)	31(62%)
	Very good process	0(0%)	2(7.1%)	1(4.8%)	3(6%)
Perform quality assurance	Poor process	0(0%)	8(28.6%)	2(9.5%)	10(20%)
	Fair process	1(100%)	10(35.7)	9(42.9)	20(40%)
	Good process	0(0%)	10(35.7)	7(33.3)	17(34%)
	Very good process	0(0%)	0(0%)	3(14.3)	3(6%)
Control quality	Poor process	0(0%)	12(42.9%)	9(42.9%)	21(42%)
	Fair process	1(100%)	11(39.3%)	5(23.8%)	17(34%)
	Good process	0(0%)	5(17.9%)	4(19%)	9(18%)
	Very good process	0(0%)	0(0%)	3(14.3%)	3(6%)

Source: Own Survey Data analysis result (2021)

4.7.5.2. Quality Management Practice implementation level

As shown in Figure 4-6: below Shows Further analysis result for the determination of the level of implementation of AAHDC PQMP. Based on the multiple respondents rating over all the three processes under the practice taking the average the result revealed; while the large amount of multiple respondents' (38%) rate showed the practice in "good" level of implementation as "fully performed but not consistently implemented"; whereas only 6% of the multiple response rate showed it is in a very "Good" level of implementation. Despite all the facts, AAHDC PQMP can be classified as a good level, fully performed but not consistently implemented practice.

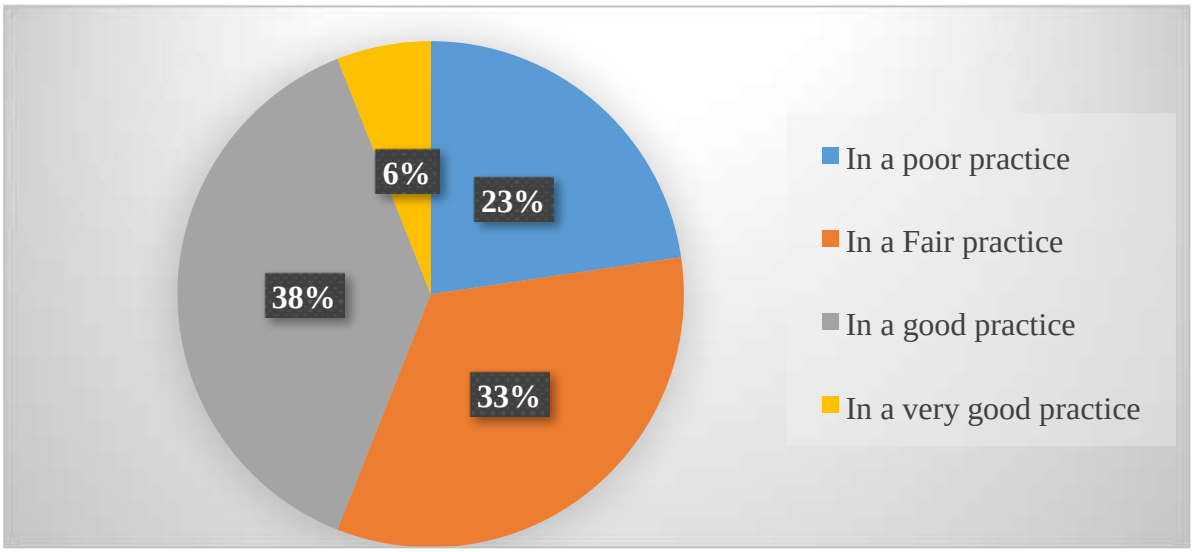

Figure 4-6: Quality Management Practice implementation level

Source: Own Survey Data analysis result (2021)

4.7.6. Project Human Resource Management Knowledge Area

4.7.6.1. Human Resource Management Processes' level of implementation

As Table 4-12: below presents the frequency percentage of respondents rating of the implementation level of the four standard project human resource management processes identified by the PMI.

Among the four processes of project Human Resource management practice, 50% and 46% of respondents replied that developing project team process and acquiring project team are in "good" level of implementation as "fully but not consistently performed process".

Where as processes such as project team management and human resource management planning are found to be in a "fair" level implementation as partially performed processes having respondents ratting of 46% and 40% respectively.

Table 4-12: Human Resource Management processes' level of implementation

Human resource management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Plan human resource Management	Very poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
	Poor process	0(0%)	2(7.1%)	3(14.3%)	5(10%)
	Fair process	0(0%)	12(42.9%)	8(38.1%)	20(40%)
	Good process	1(100%)	10(35.7%)	7(33.3%)	18(36%)
	Very good process	0(0%)	2(7.1%)	3(14.3%)	5(10%)
Acquire project team	Very poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
	Poor process	0(0%)	1(3.6%)	0(0%)	1(2%)
	Fair process	0(0%)	12(42.9%)	8(38.1%)	20(40%)
	Good process	1(100%)	12(42.9%)	10(47.6%)	23(46%)
	Very good process	0(0%)	1(3.6%)	3(14.3%)	4(8%)
Develop project team	Very poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
	Fair process	0(0%)	13(46.4%)	6(28.6)	19(38%)
	Good process	1(100%)	12(42.9%)	12(57.1%)	25(50%)
	Very good process	0(0%)	1(3.6%)	3(14.3%)	4(8%)
Manage project team	Very poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
	Poor process	0(0%)	1(3.6%)	0(0%)	1(2%)
	Fair process	0(0%)	16(57.1%)	7(33.3%)	23(46%)
	Good process	1(100%)	5(17.9%)	10(47.6%)	16(32%)
	Very good process	0(0%)	4(14.3%)	4(19%)	8(16%)

Source: Own Survey Data analysis result (2021)

4.7.6.2. Human Resource Management Practice implementation level

As shown in Figure 4-7 below; Further analysis result for the determination of the level of implementation of AAHDC PHRMP. Based on the respondents rating over all the four processes under the project human resource management practice, taking the average score found under the processes, it appears that an average of 41.0% of the response rate pointed the project human resource management practice both as “good” and “fair” level of implementation. Where as the rest positioned the practice in “very good”, “very poor” and “poor” level of implementation with a response rate of 11%, 4% and 3% respectively

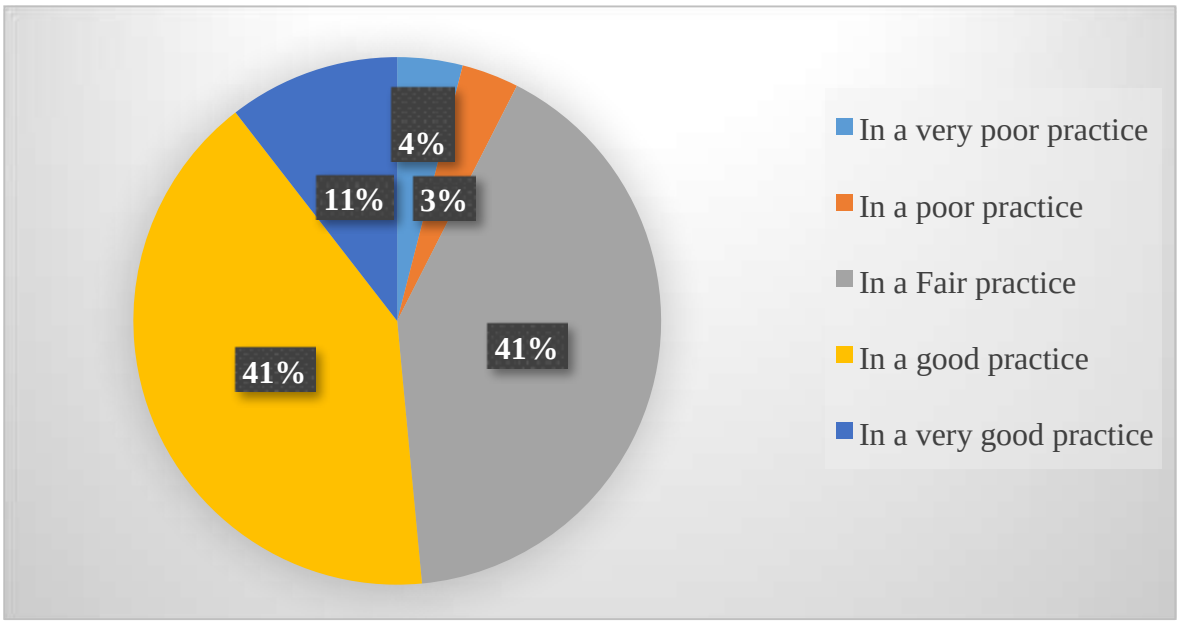

Figure 4-7: Human Resource Management Practice implementation level
Source: Own Survey Data analysis result (2021)

4.7.7. Project Communication Management Knowledge Area

4.7.7.1. Communications Management Processes' level of implementation

Table 4-13: below presents the frequency percentage of respondents rating of the level implementation of the three AAHDC Project Com Management Processes identified by the PMI.

As the table shows, all the three processes of project communication management practice such as managing communication, planning communication management and controlling communication processes, are found to be in a "fair" level of implementation as partially performed processes having a response rate of 52%, 48% and 44% respectively.

Table 4-13: Communication Management processes' level of implementation

Communication management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Plan communications management	Poor process	0(0%)	6(21.4%)	0(0%)	6(12%)
	Fair process	0(0%)	13(46.4%)	11(52.4%)	24(48%)
	Good process	1(100%)	6(21.4%)	5(23.8%)	12(24%)
	Very good process	0(0%)	3(10.7%)	5(23.8%)	8(16%)
Manage communications	Poor process	0(0%)	8(28.6%)	0(0%)	8(16%)
	Fair process	0(0%)	15(53.6%)	11(52.4%)	26(52%)
	Good process	1(100%)	4(14.3%)	7(33.3%)	12(24%)
	Very good process	0(0%)	1(3.6%)	3(14.3%)	4(8%)
Control communications	Poor process	0(0%)	14(50%)	1(4.8%)	15(30%)
	Fair process	0(0%)	10(35.7%)	12(57.1%)	22(44%)
	Good process	1(100%)	2(7.1%)	5(23.8%)	8(16%)
	Very good process	0(0%)	2(7.1%)	3(14.3%)	5(10%)

Source: Own Survey Data analysis result (2021)

4.7.7.2. Communications Management Practice implementation level

Figure 4-8: below shows analysis result based on the respondents rating over all the three processes under the project communication management practice. Taking the average score found under the processes, it appeared that an average of 48.0% of the response rate pointed the project communication management practice was found to be in fair level of implementation.

Therefore, the actual project communication management practice level is found in a "fair" level of implementation as "partially performed process".

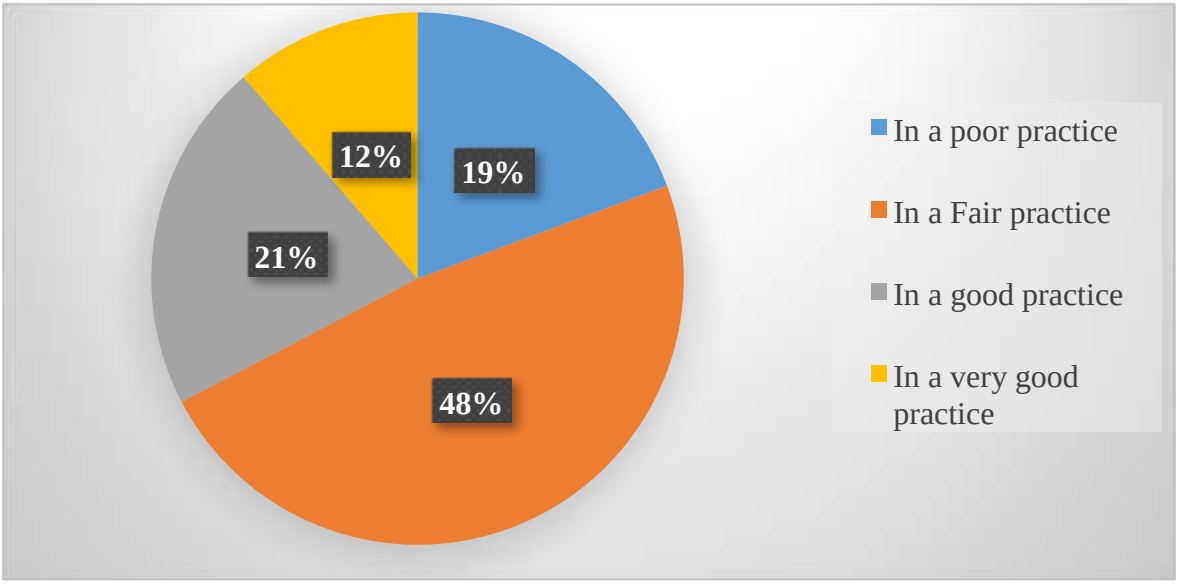

Figure 4-8: Communications Management Practice implementation level
Source: Own Survey Data analysis result (2021)

4.7.8. Project Risk Management Knowledge area

4.7.8.1. Risk Management Processes' level of implementation

As Table 4-14 below presents the frequency percentage of respondents rating of the implementation level of the six standard project risk management processes identified by the PMI. As the table shows, out of the six processes of project risk management practice, five processes are found to be in a "fair" level of implementation as "partially performed processes" having a response rate of 50%, 44%, 44% 34% and 34% accounting for risk response planning, controlling risk, planning risk management, identifying risk and performing qualitative risk analysis processes respectively. Whereas the performing quantitative risk analysis process is found to be in "poor" level of implementation as "not performed process" having a response rate of 46%.

Table 4-14: Risk Management Processes' level of implementation

Risk Management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Plan risk management	Very poor process	0(0%)	5(17.9%)	0(0%)	5(10%)
	Poor process	0(0%)	5(17.9%)	4(19%)	9(18%)
	Fair process	1(100%)	10(35.7%)	11(52.4%)	22(44%)
	Good process	0(0%)	7(25%)	6(28.6%)	13(26%)
	Very good process	0(0%)	1(3.6%)	0(0%)	1(2%)
Identify risks	Very poor process	0(0%)	5(17.9%)	0(0%)	5(10%)
	Poor process	1(100%)	9(32.1%)	5(23.8%)	15(30%)
	Fair process	0(0%)	9(32.1%)	8(38.1%)	17(34%)
	Good process	0(0%)	3(10.7%)	8(38.1%)	11(22%)
	Very good process	0(0%)	2(7.1%)	0(0%)	2(4%)
Perform qualitative risk analysis	Very poor process	0(0%)	6(21.4%)	1(4.8%)	7(14%)
	Poor process	1(100%)	13(46.4%)	3(14.3%)	17(34%)
	Fair process	0(0%)	7(25%)	10(47.6%)	17(34%)
	Good process	0(0%)	2(7.1%)	7(33.3%)	9(18%)
Perform quantitative risk analysis	Very poor process	0(0%)	7(25%)	1(4.8%)	8(16%)
	Poor process	1(100%)	14(50%)	8(38.1%)	23(46%)
	Fair process	0(0%)	7(25%)	6(28.6%)	13(26%)
	Good process	0(0%)	0(0%)	6(28.6%)	6(12%)
Plan risk responses	Very poor process	0(0%)	7(25%)	1(4.8%)	8(16%)
	Poor process	1(100%)	6(21.4%)	3(14.3%)	10(20%)
	Fair process	0(0%)	14(50%)	11(52.4%)	25(50%)
	Good process	0(0%)	1(3.6%)	4(19%)	5(10%)
	Very good process	0(0%)	0(0%)	2(9.5%)	2(4%)
Control risks	Very poor process	0(0%)	3(10.7%)	1(4.8%)	4(8%)
	Poor process	1(100%)	9(32.1%)	4(19%)	14(28%)
	Fair process	0(0%)	12(42.9%)	10(47.6%)	22(44%)
	Good process	0(0%)	4(14.3%)	6(28.6%)	10(20%)

Source: Own Survey Data analysis result (2021)

4.7.8.2. Risk Management Practice implementation level

Based on the respondents rating over all the six processes under the project risk management practice, taking the average score found under the processes, as the result shown on the

Figure 4-9: below, it appears that an average of 39% of the response rate pointed AAHDC PRMP is at "fair" level of implementation. Whereas 29%, 18%, 12% and 2% of the respondents' answer showed the level of implementation of the practice as in poor, good, very poor and very good respectively.

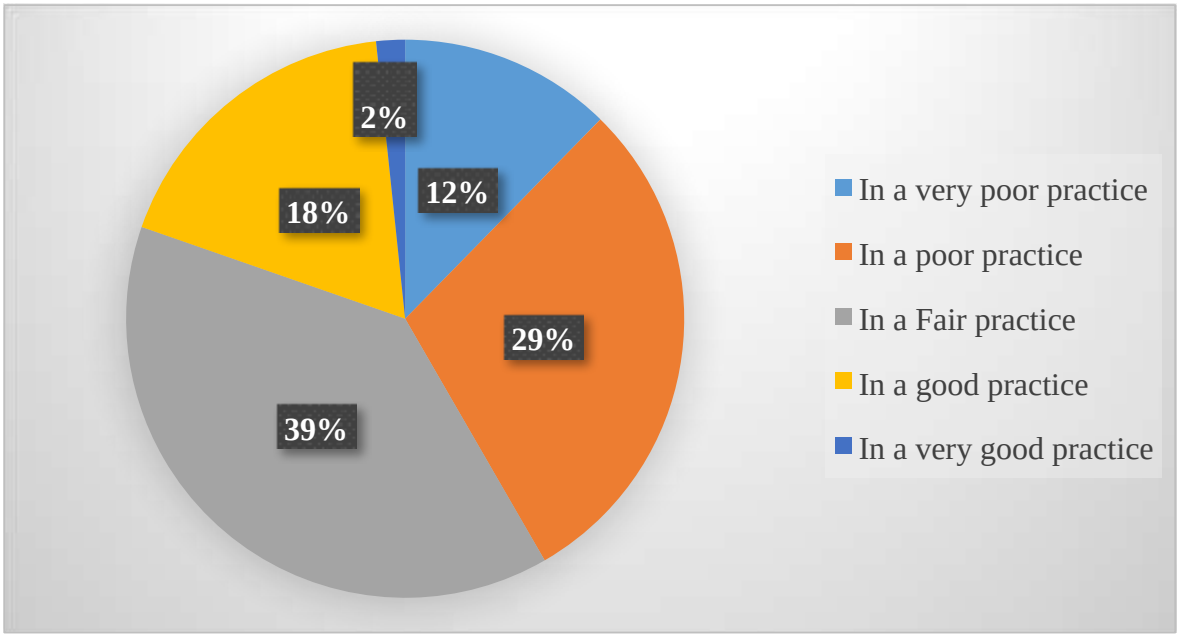

Figure 4-9: Risk Management Practice implementation level

Source: Own Survey Data analysis result (2021)

4.7.9. Project Procurement Management Knowledge area

4.7.9.1. Procurement Management Processes level of implementation

As shown below Table 4-15; presents the frequency percentage of respondents rating of the implementation level of the six standard project procurement management processes identified by the PMI.

As sown on the table, Among the six processes under project procurement management processes, 58%, 48%, 40% and 40% of respondents marked the conducting procurement, procurement management planning processes, control procurement and contract closeout processes respectively in a "good" level of implementation; While closing procurement lay at "fair" level of implementation having a response rate of 44%, whereas contract administration is found to be at "poor" level of implementation as not performed process having respondents rating of 44 %.

Table 4-15: Procurement Management processes' level of implementation

Procurement management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Plan procurement management	Very poor process	0(0%)	2(7.1%)	1(4.8%)	3(6%)
	Fair process	0(0%)	4(14.3%)	6(28.6%)	10(20%)
	Good process	1(100%)	15(53.6%)	8(38.1%)	24(48%)
	Very good process	0(0%)	7(25%)	6(28.6%)	13(26%)
Conduct procurements	Very poor process	0(0%)	2(7.1%)	1(4.8%)	3(6%)
	Fair process	0(0%)	4(14.3%)	4(19%)	8(16%)
	Good process	1(100%)	17(60.7%)	11(52.4%)	29(58%)
	Very good process	0(0%)	5(17.9%)	5(23.8%)	10(20%)
Control procurements	Very poor process	0(0%)	2(7.1%)	1(4.8%)	3(6%)
	Fair process	0(0%)	9(32.1%)	9(42.9%)	18(36%)
	Good process	1(100%)	12(42.9%)	7(33.3%)	20(40%)
	Very good process	0(0%)	5(17.9%)	4(19%)	9(18)
Close procurements	Very poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
	Fair process	0(0%)	13(46.4%)	9(42.9%)	22(44%)
	Good process	1(100%)	8(28.6%)	6(28.6%)	15(30%)
	Very good process	0(0%)	5(17.9%)	6(28.6%)	11(22%)
Contract administration	Very poor process	0(0%)	17(60.7%)	5(23.8%)	22(44%)
	Fair process	1(100%)	2(7.1%)	8(38.1%)	11(22%)
	Good process	0(0%)	4(14.3%)	2(9.5%)	6(12%)
	Very good process	0(0%)	5(17.9%)	6(28.6%)	11(22%)
Contract closeout	Very poor process	0(0%)	3(10.7%)	5(23.8%)	8(16%)
	Fair process	0(0%)	9(32.1%)	1(4.8%)	10(20%)
	Good process	1(100%)	9(32.1%)	10(47.6%)	20(40%)
	Very good process	0(0%)	7(25.7%)	5(23.8%)	12(24%)

Source: Own Survey Data analysis result (2021)

4.7.9.2. Procurement Management Practice implementation level

The Figure 4-10: below shows the analysis result based on the respondents rating over all the six processes under the project procurement management practice, taking the average score found under the practices, it appears that an average of 36% of the response rate pointed the project procurement management practice in "good" level of implementation. Where as the rest 28%, 21%, 13% and 2% of the respondents' response showed the level of implementation of the practice as in fair, very good, poor and very poor practice respectively.

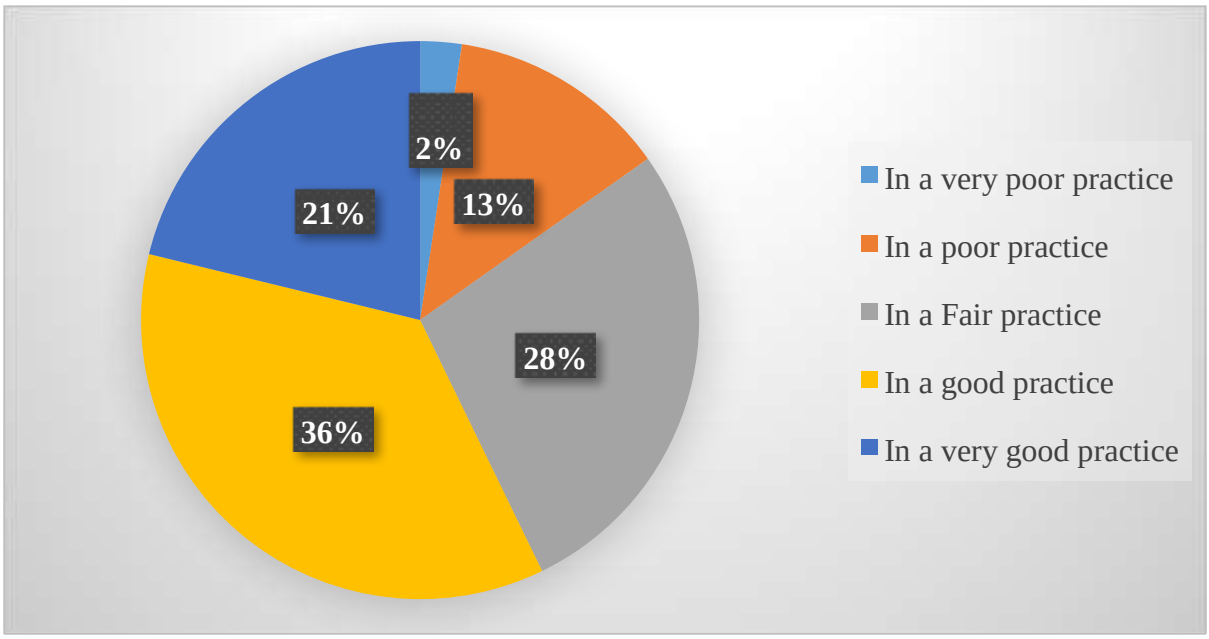

Figure 4-10: Procurement Management Practice implementation level
Source: Own Survey Data analysis result (2021)

4.7.10. Project Stakeholders Management Knowledge area

4.7.10.1. Stakeholders Management Processes' level of implementation

As shown below Table 4-16; presents the frequency percentage of respondents rating of the implementation level of the four standard project stakeholder's management processes identified by the PMI. Among the four processes of project Stakeholders management practice, only the identifying stakeholders process is found to be in good level of implementation having a response rate of 50% the rest three processes; managing stakeholders' engagement, planning stakeholder management and controlling stakeholder engagement processes are found to be in a "fair" level of implementation with respondents ratting of 56%, 52% and 44% respectively.

Table 4-16: Stakeholders Management processes' level of implementation

Stakeholders Management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Identify stakeholders	Poor process	0(0%)	2(7.1%)	0(0%)	2(4%)
	Fair process	1(100%)	7(25%)	7(33.3%)	15(30%)
	Good process	0(0%)	15(53.6%)	10(47.6%)	25(50%)
	Very good process	0(0%)	4(14.3%)	4(19%)	8(16%)
Plan stakeholder management	Poor process	0(0%)	0(0%)	3(14.3%)	3(6%)
	Fair process	0(0%)	20(71.4%)	6(28.6%)	26(52%)
	Good process	1(100%)	8(28.6%)	10(47.6%)	19(38%)
	Very good process	0(0%)	0(0%)	2(9.5%)	2(4%)
Manage stakeholder engagement	Poor process	0(0%)	1(3.6%)	3(14.3%)	4(8%)
	Fair process	1(100%)	20(71.4%)	7(33.3%)	28(56%)
	Good process	0(0%)	7(25%)	9(42.9%)	16(32%)
	Very good process	0(0%)	0(0%)	2(9.5%)	2(4%)
Control stakeholder engagement	Poor process	0(0%)	7(25%)	3(14.3%)	10(20%)
	Fair process	1(100%)	13(46.4%)	8(38.1%)	22(44%)
	Good process	0(0%)	8(28.6%)	7(33.3%)	15(30%)
	Very good process	0(0%)	0(0%)	3(14.3%)	3(6%)

Source: Own Survey Data analysis result (2021)

4.7.10.2. Stakeholders Management Practice implementation level

Based on the respondents rating over all the four practices under the project stakeholder management practice, as shown on the Figure 4-11: below, taking the average score found under the processes, it appears that an average of 45% of the response rate pointed the project stakeholder management practice in to "fair" level of implementation as partially performed practice. On the other hand, 38%, 9% and 8% of the respondents' response rate showed the level of implementation as in good, poor and very good practice respectively.

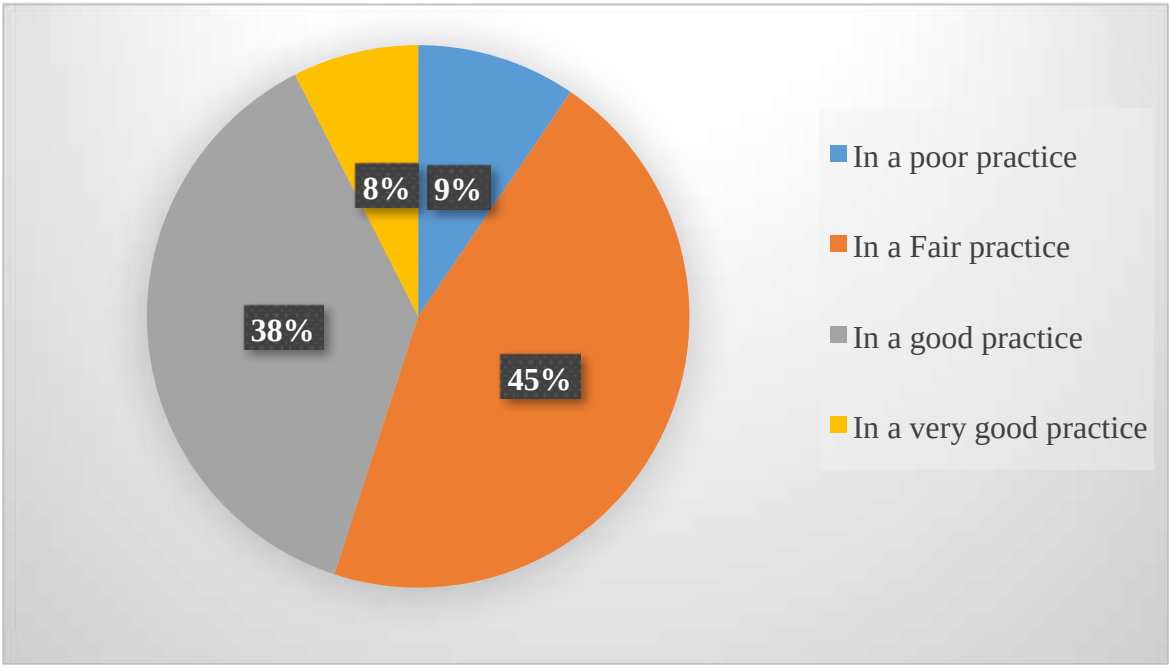

Figure 4-11: Stakeholders Management Practice implementation level
Source: Own Survey Data analysis result (2021)

4.7.11. Project Financial Management Knowledge area

4.7.11.1. Financial Management Processes' level of implementation

Table 4-17: below presents the frequency percentage of respondents rating of the level of implementation of the three standard project financial management processes identified by the PMI. As shown on the table, all the three processes of project financial management practice, are found to be in a "good" level of implementation as fully performed but not consistent processes having a response rate of 60%, 44% and 42% accounting for planning financial management, financial controlling and administering and recording practices respectively.

Table 4-17: Financial Management processes' level of implementation

Financial Management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Financial planning	Poor process	0(0%)	1(3.6%)	1(4.8%)	2(4%)
	Fair process	0(0%)	4(14.3%)	1(4.8%)	5(10%)
	Good process	1(100%)	17(60.7%)	12(57.1%)	30(60%)
	Very good process	0(0%)	6(21.4%)	7(33.3%)	13(26%)
Financial control	Poor process	0(0%)	8(28.6%)	3(14.3%)	11(22%)
	Fair process	0(0%)	8(28.6%)	3(14.3%)	11(22%)
	Good process	1(100%)	9(32.1%)	12(57.1%)	22(44%)
	Very good process	0(0%)	3(10.7%)	3(14.3%)	6(12%)
Administration and records	Poor process	0(0%)	4(14.3%)	4(19%)	8(16%)
	Fair process	0(0%)	10(35.7%)	1(4.8%)	11(22%)
	Good process	1(100%)	10(35.7%)	10(47.6%)	21(42%)
	Very good process	0(0%)	4(14.3%)	6(28.6%)	10(20%)

Source: Own Survey Data analysis result (2021)

4.7.11.2. Financial Management Practice implementation level

As shown on the figure 4-12: below, based on the respondents rating over all the four processes under the project financial management practice, taking the average score found under the processes, it appears that an average of 49% of the response rate pointed the project financial management practice in to "good" level of implementation. Whereas the rest 19%, 18%, and 14% of the respondents' response showed the level of implementation of the practice as in very good, fair, and poor practice respectively.

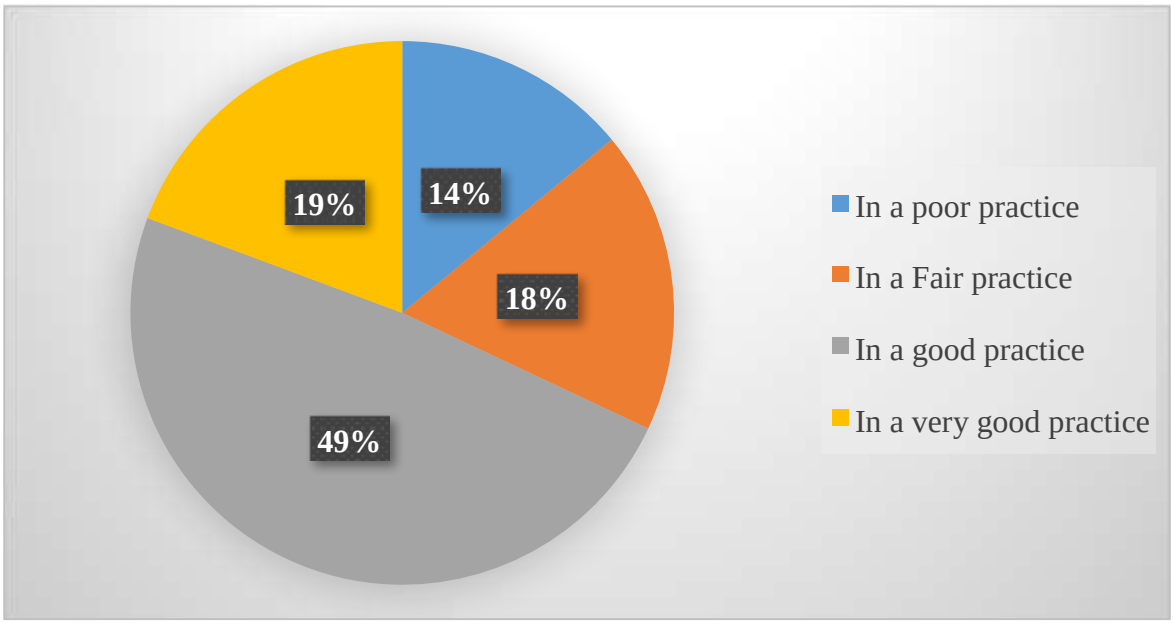

Figure 4-12: Financial Management Practice implementation level

Source: Own Survey Data analysis result (2021)

4.7.12. Project Environmental Management Knowledge area

4.7.12.1. Environmental Management processes' level of implementation

Table 4-18: below presents the frequency percentage of respondents rating of the implementation level of the three standard project environmental management processes identified by the PMI. As the table above shows, all the three processes of project environmental management practice are found to be in a "fair" level of implementation as "partially performed process" having a response rate of 52%, 48% and 40% accounting for environmental control, environmental assurance and planning environmental management respectively.

Table 4-18: Environmental Management processes' level of implementation

Environmental Management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Environmental management planning	Very poor process	0(0%)	1(3.6%)	1(4.8%)	2(4%)
	Poor process	1(100)	4(14.3%)	2(9.5%)	7(14%)
	Fair process	0(0%)	12(42.9%)	8(38.1%)	20(40%)
	Good process	0(0%)	8(28.6%)	3(14.3%)	11(22%)
	Very good process	0(0%)	3(10.7%)	7(33.3%)	10(20%)
Environmental assurance	Very poor process	0(0%)	1(3.6%)	1(4.8%)	2(4%)
	Poor process	1(100%)	5(17.9%)	2(9.5%)	8(16%)
	Fair process	0(0%)	16(57.1%)	8(38.1%)	24(48%)
	Good process	0(0%)	6(21.4%)	8(38.1%)	14(28%)
	Very good process	0(0%)	0(0%)	2(9.5%)	2(4%)
Environmental control	Very poor process	0(0%)	1(3.6%)	1(4.8%)	2(4%)
	Poor process	1(100%)	5(17.9%)	2(9.5%)	8(16%)
	Fair process	0(0%)	18(64.3%)	8(38.1%)	26(52%)
	Good process	0(0%)	3(10.7%)	7(33.3%)	10(20%)
	Very good process	0(0%)	1(3.6%)	3(14.3%)	4(8%)

Source: Own Survey Data analysis result (2021)

4.7.12.2. Environmental Management Practice implementation level

Based on the respondents rating over all the three processes under the project environmental management practice, taking the average score found under the processes, as the figure 4-13 below shows, it appears that an average of 47% of the response rate concluded the project environmental management practice in to a "fair" level of implementation. Whereas the rest 23%, 25%, 11% and 4% of the respondents' response showed the level of implementation of the practice as in good, poor, very good and very poor practice respectively.

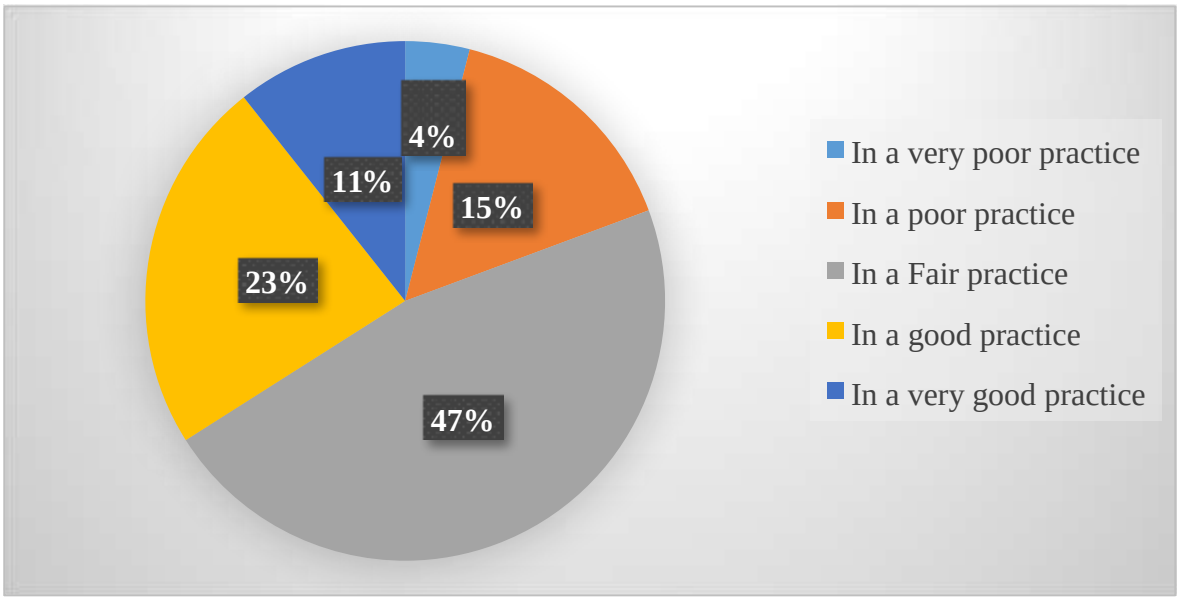

Figure 4-13: Environmental Management Practice implementation level
Source: Own Survey Data analysis result (2021)

4.7.13. Project Claim Management Knowledge area

4.7.13.1. Claim Management Processes level of implementation

Table 4-19: below presents the frequency percentage of respondents rating of the implementation level of the five standard project claim management processes identified by the PMI. Among the five processes of project claim management practice, three processes such as the claim identification, claim management planning and claim quantification processes are found to be in a "good" level of implementation as "fully but not consistently performed processes" with a response rate of 50%, 48% and 36% respectively. Where as the rest two processes such as claim prevention and claim resolution processes are found to be in a "poor" level of implementation as almost not performed processes.

Table 4-19: Claim Management processes' level of implementation

Claim Management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Claim identification	Poor process	0(0%)	5(17.9%)	2(9.5%)	7(14%)
	Fair process	1(100%)	6(21.4%)	1(4.8%)	8(16%)
	Good process	0(0%)	12(42.9%)	13(61.9%)	25(50%)
	Very good process	0(0%)	5(17.9%)	5(23.8%)	10(20%)
Claim management Planning	Poor process	1(100%)	9(32.1%)	3(14.3%)	13(26%)
	Fair process	0(0%)	9(32.1%)	1(4.8%)	10(20%)
	Good process	0(0%)	10(35.7%)	14(66.7%)	24(48%)
	Very good process	0(0%)	0(0%)	3(14.3%)	3(6%)
Claim quantification	Poor process	1(100%)	12(42.9%)	5(23.8%)	18(36%)
	Fair process	0(0%)	3(10.7%)	0(0%)	3(6%)
	Good process	0(0%)	9(32.1%)	9(42.9%)	18(36%)
	Very good process	0(0%)	4(14.3%)	7(33.3%)	11(22%)
Claim prevention	Very poor process	0(0%)	0(0%)	1(4.8%)	1(2%)
	Poor process	1(100%)	13(46.4%)	4(19%)	18(36%)
	Fair process	0(0%)	9(32.1%)	3(14.3%)	12(24%)
	Good process	0(0%)	6(21.4%)	9(42.9%)	15(30%)
	Very good process	0(0%)	0(0%)	4(19%)	4(8%)
Claim resolution	Poor process	0(0%)	13(46.4%)	3(14.3%)	16(32%)
	Fair process	1(100%)	7(25%)	6(28.6%)	14(28%)
	Good process	0(0%)	4(14.3%)	8(38.1%)	12(24%)
	Very good process	0(0%)	4(14.3%)	4(19%)	8(16%)

Source: Own Survey Data analysis result (2021)

4.7.13.2. Claim Management Practice implementation level

Figure 4-14 below shows the respondents rating over all the five processes under the project claim management practice; taking the average score found under the processes, it appears that an average of 38% of the response rate pointed the project claim management practice in to "good" level of implementation as "fully but not consistently performed practice".

Whereas the rest 29%, 19% and 14% of the respondents' response showed the level of implementation of the practice as in poor, fair, and very good practice respectively.

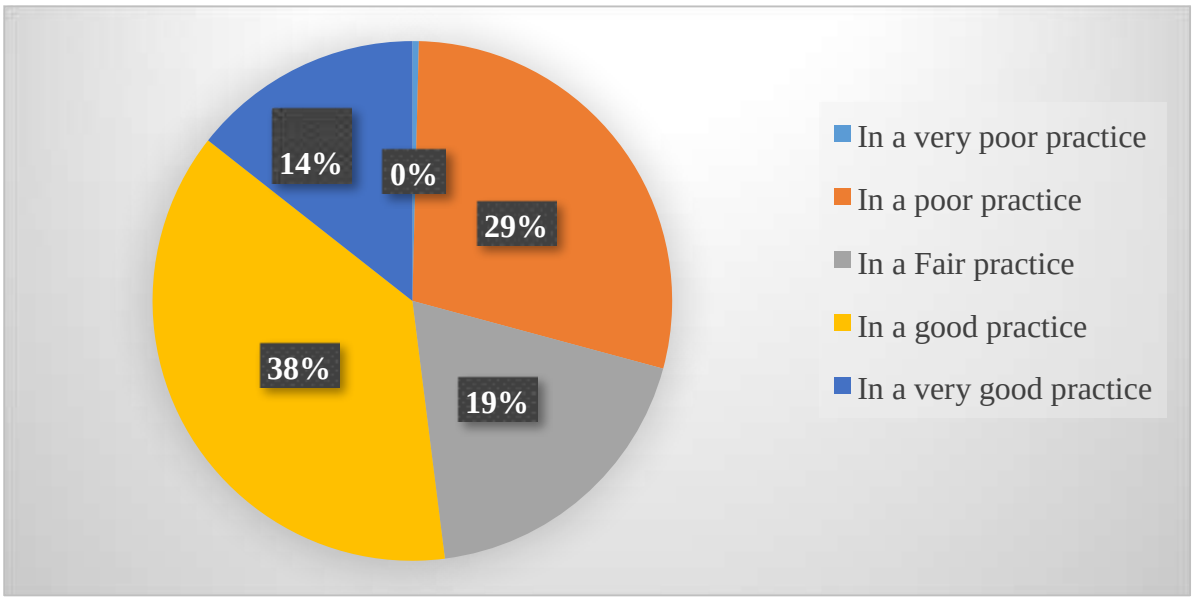

Figure 4-14: Claim Management Practice implementation level
Source: Own Survey Data analysis result (2021)

4.7.14. Project Safety Management Knowledge area

4.7.14.1. Safety Management Processes' level of implementation

Table 4-20: below presents the frequency percentage of respondents rating of the implementation level of the two standard project safety management processes identified by the PMI. As shown on the above table, both the processes of project safety management practice such as safety plan execution and safety management planning processes are found to be in a "fair" level of implementation as partially performed processes having a response rate of 48% and 32% respectively.

Table 4-20: Safety Management processes' level of implementation

Safety Management processes	Perceived Level of Implementation of processes	Occupation status of the respondent			Total (N=50)
		Higher level manager (N=1)	Middle level manager (N=28)	Lower level manager (N=21)	
Safety planning	Very poor process	1(100%)	4(14.3%)	2(9.5%)	7(14%)
	Poor process	0(0%)	6(21.4%)	3(14.3%)	9(18%)
	Fair process	0(0%)	10(35.7%)	6(28.6%)	16(32%)
	Good process	0(0%)	6(21.4%)	8(38.1%)	14(28%)
	Very good process	0(0%)	2(7.1%)	2(9.5%)	4(8%)
Safety plan execution	Very poor process	1(100%)	4(14.3%)	2(9.5%)	7(14%)
	Poor process	0(0%)	6(21.4%)	3(14.3%)	9(18%)
	Fair process	0(0%)	16(57.1%)	8(38.1%)	24(48%)
	Good process	0(0%)	2(7.1%)	7(33.3%)	9(18%)
	Very good process	0(0%)	0(0%)	1(4.8%)	1(2%)

Source: Own Survey Data analysis result (2021)

4.7.14.2. Safety Management Practice implementation level

Based on the respondents rating over all the two processes under the project safety management practice, taking the average score found under the processes, as shown on the Figure 4-15 below, it appears that an average of 40% of the response rate concluded the project safety management practice in a "fair" level of implementation. Whereas the rest 23%, 18%, 14% and 5% of the respondents' response showed the level of implementation of the practice as in good, poor, very poor and very good practice respectively.

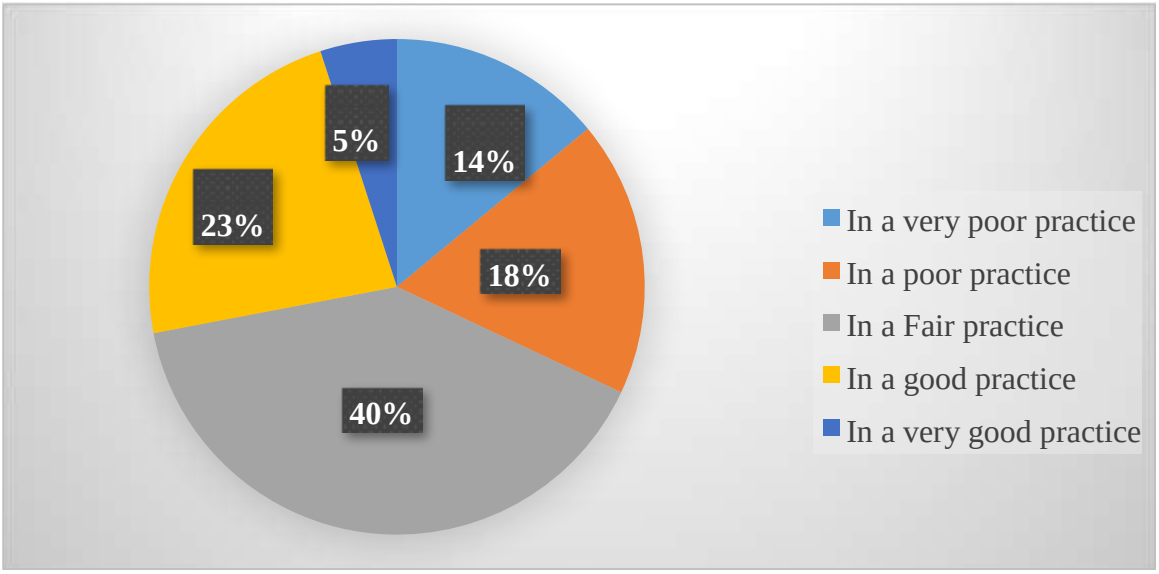

Figure 4-15: Safety Management Practice implementation level
Source: Own Survey Data analysis result (2021)

4.8. AAHDC PM knowledge area maturity level determination

4.8.1. Integration Management Practice Maturity

Figure 4-16: below shows the integration management practice maturity level based on the mean values of the level of implementation of the processes listed under the practice. As shown in the figure, the mean value of the processes is between the range greater than two but less than four (2<MSs<4).

The result clearly showed that out of the six processes under the practice, two processes such as monitoring & controlling project work and performing integrated change control processes still remain at maturity “level 2”; they are still at an informal process level having mean values 2.86 and 2.72 respectively; where as the other four processes maturity is at “level 3” having their mean value of implementation level score above 3 but less than 4; hence the processes are at institutionalized and standardization process level.

There fore, according to the analysis result and the staged representation of the model assumption, the over all maturity of the AAHDC integration management practice is found at maturity “Level 2”, “Informal practice level". This result shows, integration management practices exist in AAHDC and the processes are in place, but they are not considered as organizational standards. From the assessment result based on the Level 2 maturity level description, it can be described that, in AAHDC integration management practice, there is no defined and documented project change control system that incorporates the change control processes for scope, cost, and schedule. The process documentation does not include change control request. The project integrated change control system and processes are not implemented and utilized by the project management team. In addition, Status and performance reports are not produced to address project performance, No performance measurement analyses.

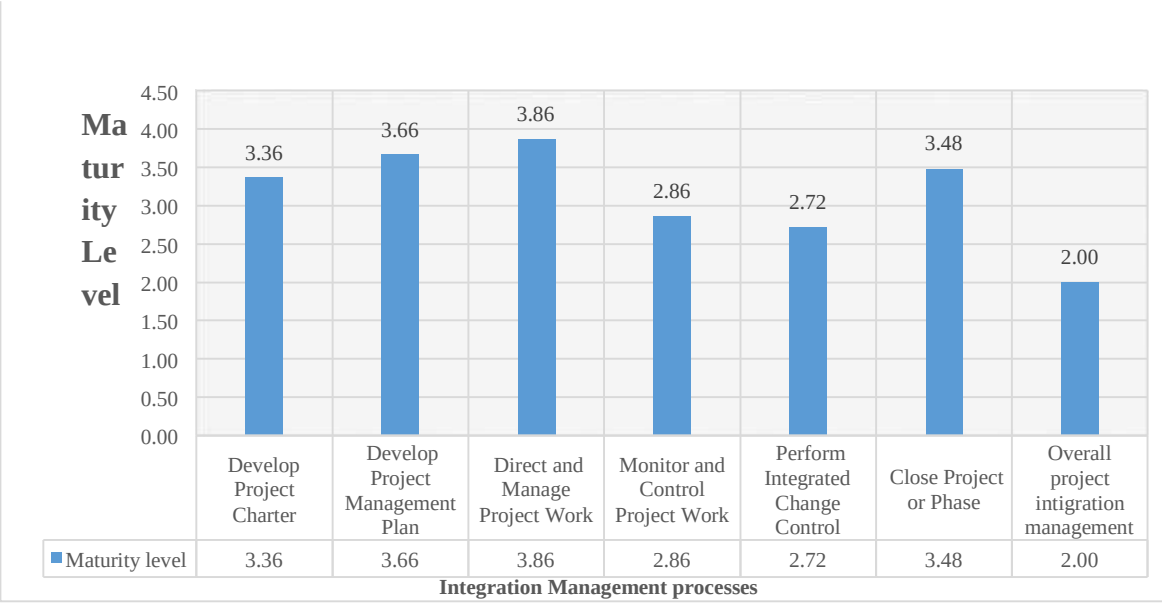

Figure 4-16: Integration Management Practice Maturity level
Source: Own Survey Data analysis result (2021)

4.8.2. Scope management practice maturity

Figure 4-17: below shows the scope management practice maturity level based on the mean values of the level of implementation of the processes listed under the practice. As shown in the figure, the mean value of the processes is between the range greater than two but less than four (2<MSs<4).
The result clearly showed that out of the six processes under this practice, the control scope process maturity was at "Level 2" this is because of its implementation level mean value 2.84; where as the other five processes implementation level mean values score above 3 but less than 4; which makes their maturity at "level 3". Although the majority of the processes under attained "level 3" maturity; the scope controlling process maturity couldn't pass "level 2". Consequently, according to the analysis result and the assessment based on the staged model representation assumption, AAHDC over all maturity of the scope management practice is determined to be at maturity "Level 2"; "Informal practice level"

From the assessment result based on the Level 2 maturity level description, the result clearly shows, scope management practices exist in AAHDC and the processes were in place, but they are not institutionalized and standardized by AAHDC. It can be concluded that, AAHDC scope management Practice, there is no defined and documented project scope control system that incorporates the scope control processes.

The project integrated scope control system and processes are not implemented and utilized by the project team. In addition, Status and performance reports are not produced to address project performance, no scope performance measurement and analyses, Scope baselines are not established, managed, and met.

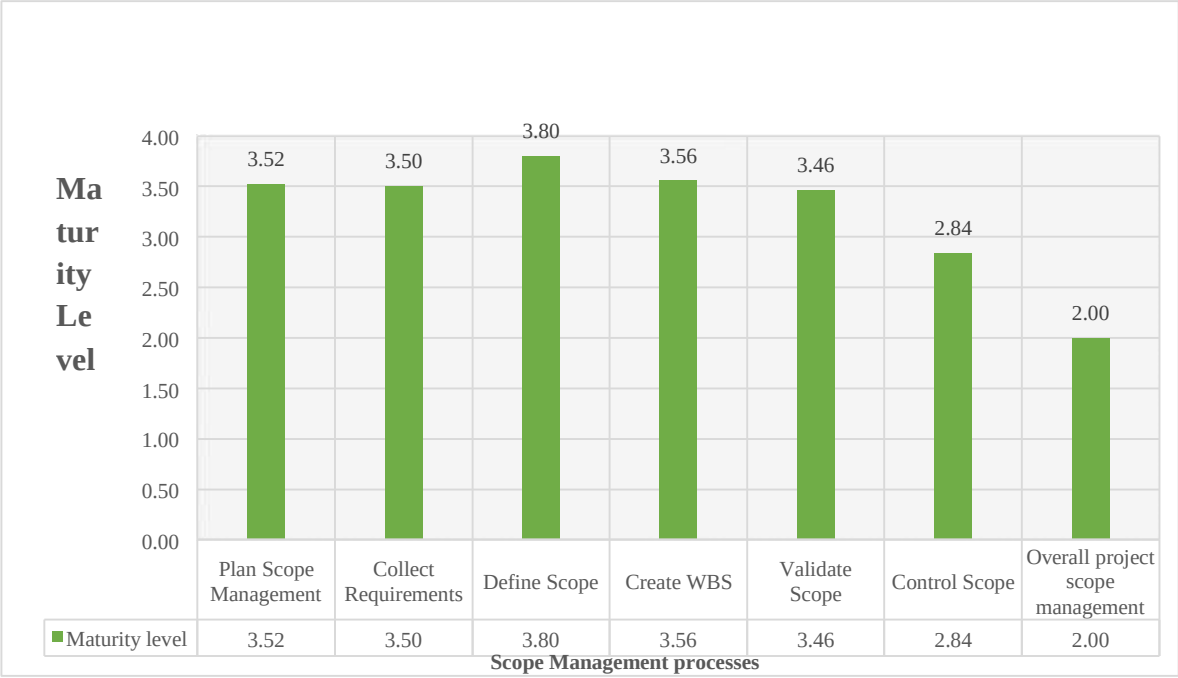

Figure 4-17: Scope Management Practice Maturity level
Source: Own Survey Data analysis result (2021)

4.8.3. Time Management Practice Maturity

As shown in Figure 4-18: below, the time management practice maturity level based on the mean values of the level of implementation of the processes listed under the practice. As shown in the figure, the mean value of the level of implementation of processes is between the range greater than two but less than four (2<MSs<4).

The maturity assessment result showed that out of the seven processes under the time management knowledge area, the control schedule process maturity found at “Level 2” this is because of its implementation level mean value 2.66; where as the other six processes implementation level mean values score above 3 but less than 4 which makes their maturity at “level 3”.

Although the majority of the processes under the practice attained “level 3” maturity; the schedule controlling process maturity couldn’t pass “level 2”. Consequently, according to the analysis result and the assessment; based on the staged model representation assumption, AAHDC over all maturity of the time management practice is found determined to be at maturity “Level 2”; “Informal practice level”.

From the assessment result based on the “Level 2” maturity level description; it can be concluded that, although a standard process is developed and documented for managing and controlling schedules, a schedule change control system is not introduced in AAHDC. Summary and detailed schedule reports are not developed and provided to key stakeholders. Schedule status is not tracked by comparing planned versus actual data and percent complete. Metrics such as schedule baseline, planned status, and actual status are not collected.

The project integrated schedule control system and processes are not implemented and utilized by the project management teams. Schedule status and changes are not identified, evaluated, followed and managed, and stakeholders are not informed. The schedule change control system is not integrated with the organization's control systems, monitoring programs, and risk management process. Cost and schedule reports are not integrated.

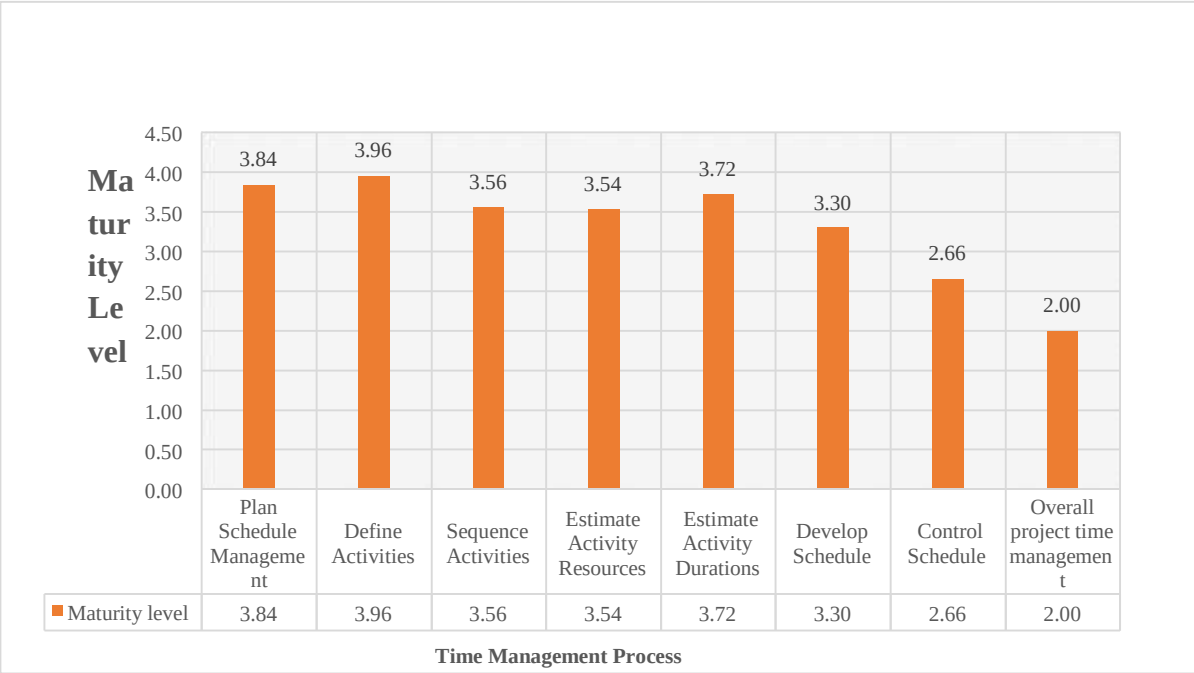

Figure 4-18: Time Management Practice Maturity level

Source: Own Survey Data analysis result (2021)

4.8.4. Cost Management Practice Maturity

As shown in figure 4-19: below, the cost management practice maturity level based on the mean values of the level of implementation of the processes listed under the practice. As shown in the figure; the mean value of the level of implementation of the processes is between the range greater than two but less than four (2<MSs<4).

The maturity assessment result showed that out of the four processes under the cost management knowledge area, the cost control process maturity found at "Level 2" this is because of its implementation level mean value 2.7; where as the other three processes implementation level mean values score above 3 but less than 4 which makes their maturity at "level 3".

Although the majority of the processes under the practice attained "level 3" maturity; the cost controlling process maturity couldn't pass "level 2". Consequently, according to the analysis result and the assessment; based on the staged representation of the model assumption, AAHDC over all maturity of the cost management practice was determined to be at maturity "Level 2"; "Informal practice level".

From the assessment result based on the “Level 2” maturity level description, it can be concluded that, although a standard process is developed and documented for managing and controlling cost, a schedule change control system is not introduced by project management practitioners in AAHDC. Baselines are established in line with the project schedule, but changes happen frequently.

The cost change control processes are not followed and utilized by AAHDC project management team. Cost and schedule reports are not integrated. Performance status reporting is not integrated with cost and schedule control systems. There are no defined standards to use for project cost control. The only procedure in practice at AAHDC is reviewing costs against issued invoices during status review sessions for each project. This might be a strong indication why construction projects are facing a remarkable amount of cost over run.

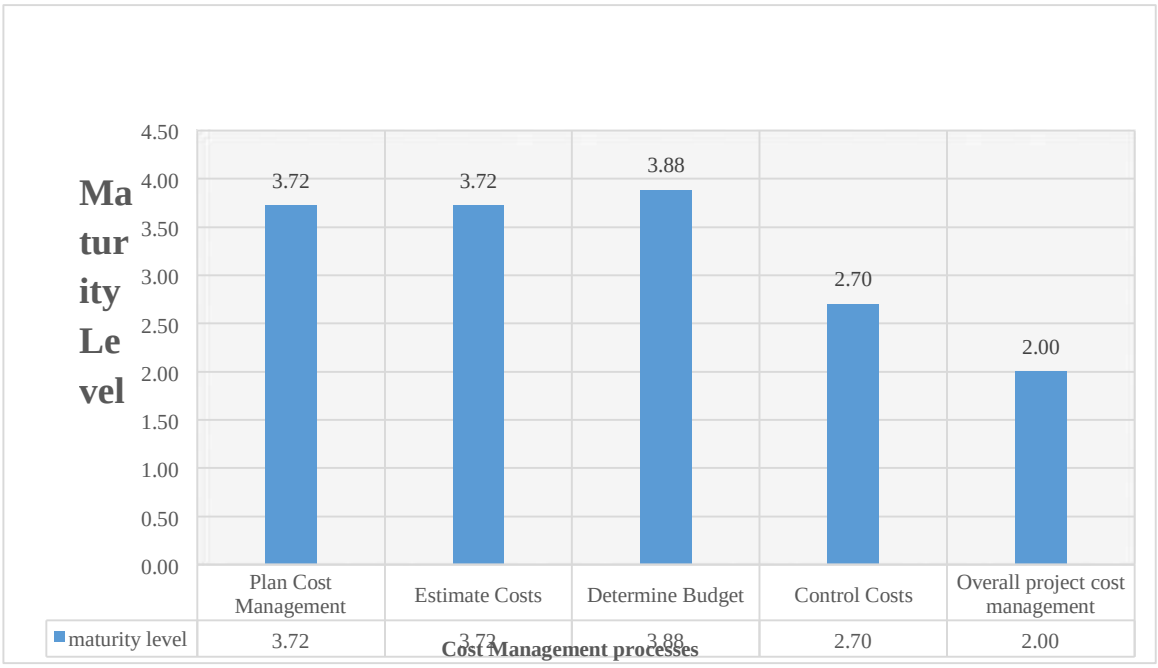

Figure 4-19: Cost Management Practice Maturity level
Source: Own Survey Data analysis result (2017)

4.8.5. Quality Management Practice Maturity

Figure 4-20: below shows the quality management practice maturity level based on the mean values of the level of implementation of the processes listed under the practice. As shown in the figure; the mean value of the processes is between the range greater than two but less than four (2<MSs<4).

The maturity assessment result showed that out of the three processes under the quality management knowledge area, the quality control process maturity found at “Level 2” this is because of its implementation level mean value score of 2.88; where as the other two processes implementation level mean values score above 3 but less than 4 which makes their maturity at “level 3”.

Although the majority of the processes under the practice attained “level 3” maturity; the quality controlling process maturity couldn’t pass “level 2”. Consequently, according to the analysis result and the assessment; based on the staged representation of the model assumption, AAHDC over all maturity of the quality management practice was determined to be at maturity “Level 2”; “Informal practice level”.

This result showed, quality management practices exist in AAHDC and the processes are in place, but they are not considered organizational standards. From the assessment result based on the “Level 2” maturity level description, it can be concluded that, although a standard process is developed and documented for managing and controlling quality; quality controlling process was not institutionalized and standardized in AAHDC project management system. Quality baselines are established in line with the project requirements, but changes happen frequently. The quality control processes are not followed and utilized by AAHDC project management team.

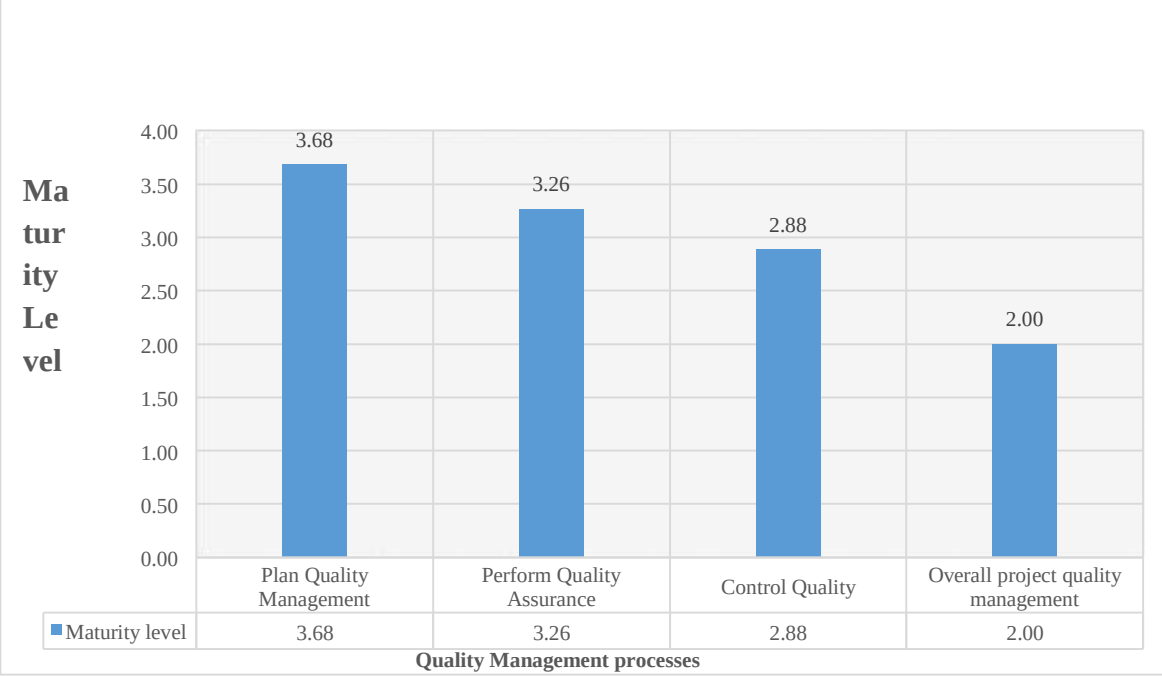

Figure 4-20: Quality Management Practice Maturity level

Source: Own Survey Data analysis result (2021)

4.8.6. Human Resource Management Practice Maturity

Figure 4-21: below shows the human resource management practice maturity level based on the mean values of level of the level of implementation of the processes under the practice. As shown in the figure; the mean value of the processes is between the range greater than two but less than three (3<MSs<4).

The maturity assessment result showed that all of the four processes under the human resource management knowledge area, the implementation level mean values score above 3 but less than 4 which makes their maturity found to be at maturity “level 3”.

Therefore, according to the analysis result and the staged representation of the model assumption, the research finding indicated that over all maturity of the human resource management practice attained maturity Level 3, standardized and institutionalized practice level. This result shows, AAHDC human resource management processes are in place and established as organizational standards management practices.

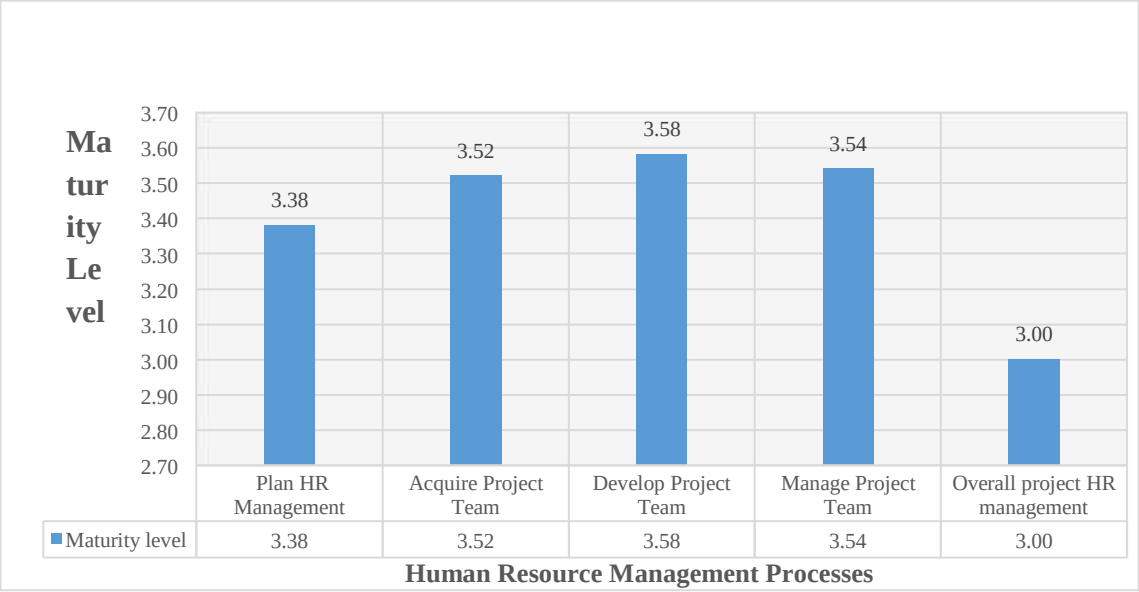

Figure 4-21: Human resource Management Practice Maturity level
Source: Own Survey Data analysis result (2021)

4.8.7. Communications Management Practice Maturity

As shown in Figure 4-22: below, the communication management practice maturity level based on the mean values of the level of implementation of the processes listed under the practice. As shown in the figure; the mean value of the processes is between the range greater than three but less than four (3<MSs<4).

The maturity assessment result showed that all of the four processes under the human resource management knowledge area, the implementation level mean values score above 3 but less than 4 which makes their maturity found to be at maturity “level 3”.

Therefore, according to the analysis result and the staged representation of the model assumption, the research finding indicated that AAHDC over all maturity of the communications management practice attained maturity “Level 3”; “standardized and institutionalized level”. This result shows, in AAHDC PMS, communications management processes are in place and established as organizational standards management practices.

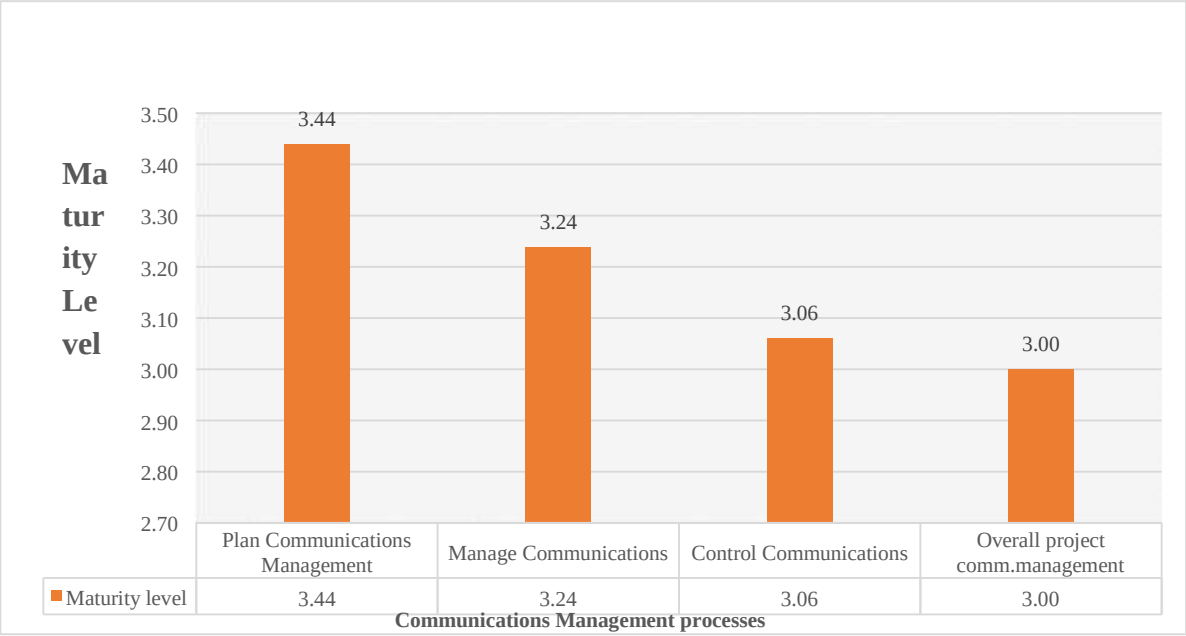

Figure 4-22: Communications Management Practice Maturity level
Source: Own Survey Data analysis result (2021)

4.8.8. Risk Management Practice Maturity

As shown in Figure 4-23 below, the risk management practice maturity level based on the mean values of the level of implementation of the processes listed under the practice. As shown in the figure; the mean value of the level of implementation of processes is between the range greater than two but less than three (2<MSs<3).

The mean values for the level of implementation of the processes, used in the determination of maturity assessment result, showed that all of the six processes under the risk management knowledge area score above 2 but below 3 which makes their maturity level to be found at maturity "level 2".

Therefore, according to the analysis result and the staged representation of the model assumption, the research finding indicated that AAHDC over all maturity of the risk management practice is found to be at maturity "Level 2", "Informal practice level". risk management practices exist in AAHDC PMS and the standardized procedures and processes for project risk management practice are in place, but they are not recognized as organizational standards.

In the actual practice, risk management processes are not used for every project done under AAHDC. Project management teams of AAHDC are resistant for using risk management processes in all projects. It is mutual understanding among project team members that they will be able to handle all the risks for projects without implementing risk management plan.

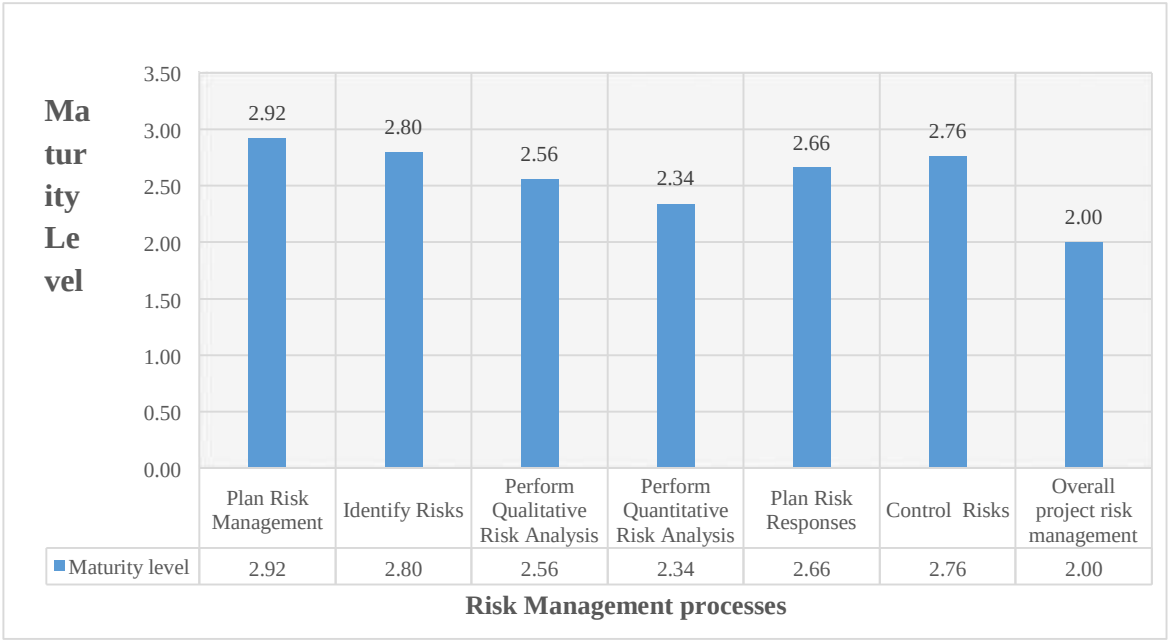

Figure 4-23: Risk Management Practice Maturity level
Source: Own Survey Data analysis result (2021)

4.8.9. Procurement Management Practice Maturity

As shown in Figure 4-24: below, shows the procurement management practice maturity level based on the mean values of the level of implementation of the processes listed under practice. As shown in the figure, the mean value of the processes is between the range greater than three but less than four (3<MSs<4).

The mean values for the level of implementation of the processes, used in the determination of maturity assessment result, showed that all of the six processes under the procurement management knowledge area score above 3 but below 4 which makes their maturity level to be found at maturity "level 3"; "standardized and institutionalized level".

Therefore, according to the analysis result and the staged representation of the model assumption, the research finding indicated that over all maturity of the procurement management practice attained maturity Level 3, standardized and institutionalized level. This result shows, in AAHDC PMS, procurement management processes are in place and established as organizational standards management practices.

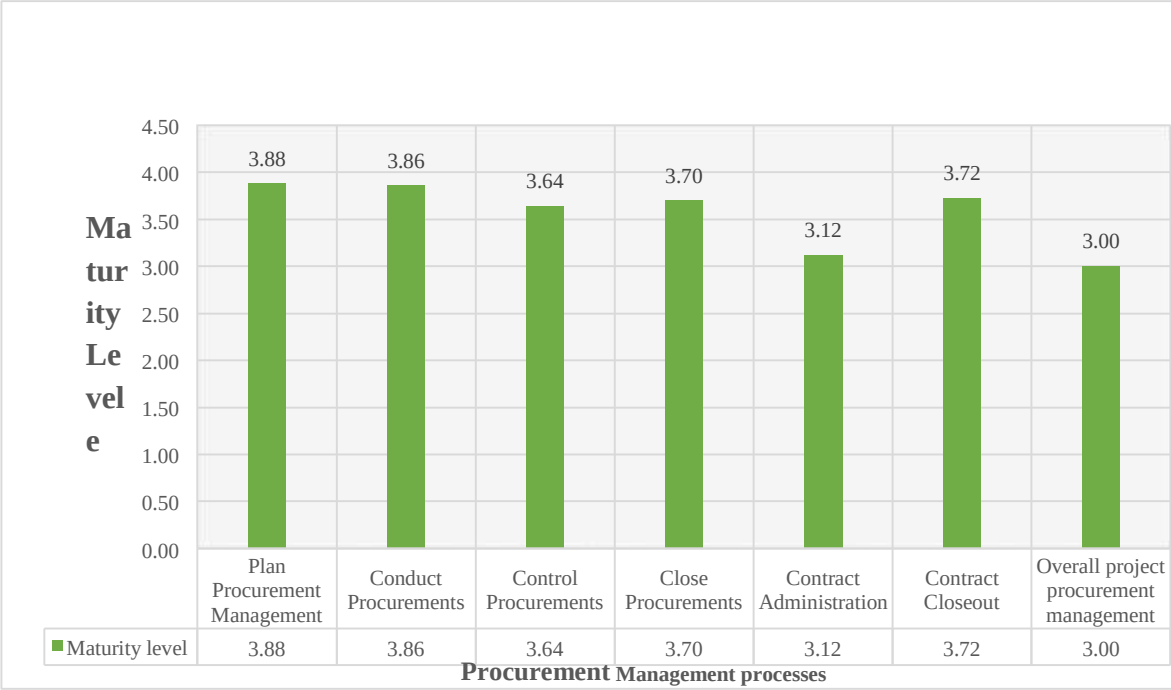

Figure 4-24: Procurement Management Practice Maturity level
Source: Own Survey Data analysis result (2021)

4.8.10. Stakeholders Management Practice Maturity

Figure 4-25: below shows the stakeholders' management practice maturity level based on the mean values of the level of implementation of the processes listed under the practice. As shown in the figure; the mean value of the processes is between the range greater than three but less than four (3<MSs <4).

The mean values for the level of implementation of the processes, used in the determination of maturity assessment result, showed that all of the four processes under the stakeholders' management knowledge area score above 3 but below 4 which makes their maturity level to be found at maturity "level 3"; "standardized and institutionalized level".

Therefore, according to the analysis result and the staged representation of the model assumption, the research finding indicated that AAHDC over all maturity of the stakeholder management practice attained maturity "Level 3", standardized and institutionalized practice level. This result shows, in AAHDC; stakeholder management processes are in place and established as organizational standards management practices.

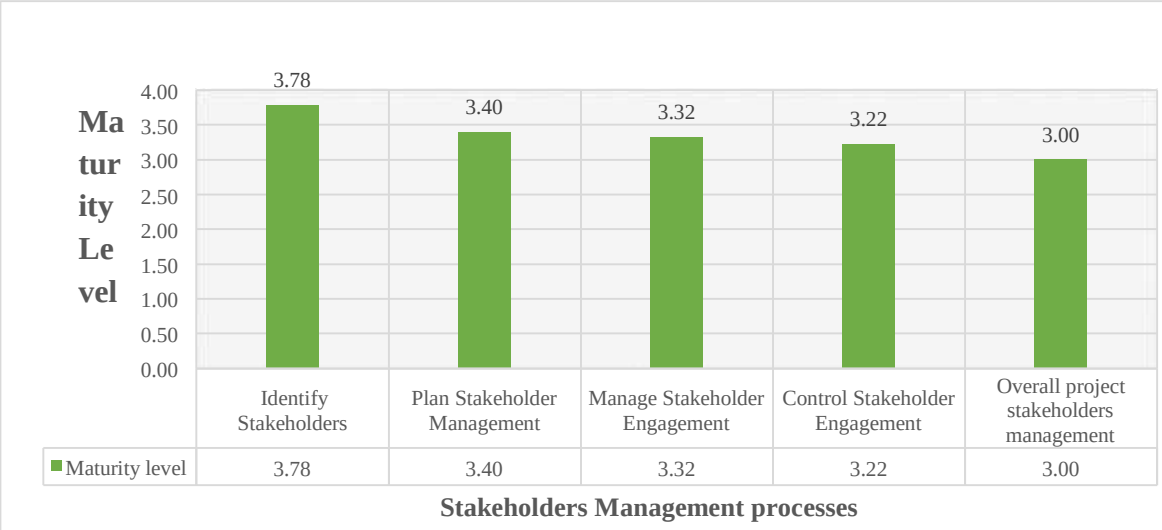

Figure 4-25: Stakeholders Management Practice Maturity level
Source: Own Survey Data analysis result (2021)

4.8.11. Financial Management Practice Maturity

Figure 4-26: below shows the financial management practice maturity level based on the mean values of the level of implementation of the processes listed under the practice. As shown in the figure; the mean value of the processes is between the range greater than three but less than five (3<MSs<5).

The mean values for the level of implementation of the processes, used in the determination of maturity assessment result, among three processes under the financial management knowledge area, only one process, the financial planning process, attained mean score 4.08 which makes it attain maturity "level 4"; where as the rest processes under score above 3 but below 4 which makes their maturity level to be found at maturity "level 3"; "standardized and institutionalized level". Although the financial planning process exceptionally gets a higher maturity "level 4"; "managed process level" in the practice, the rest practices still remained back at maturity "level 3". Consequently, according to the analysis result and the assessment; based on the staged model representation assumption, AAHDC over all maturity of the Financial management practice was determined to be at maturity "Level 3" Therefore, according to the analysis result and the staged representation model assumption, the research finding indicated that over all maturity of the financial management practice attained maturity "Level 3"; "standardized and institutionalized level". This result shows, in AAHDC, financial management processes are in place and established as organizational standards management practices.

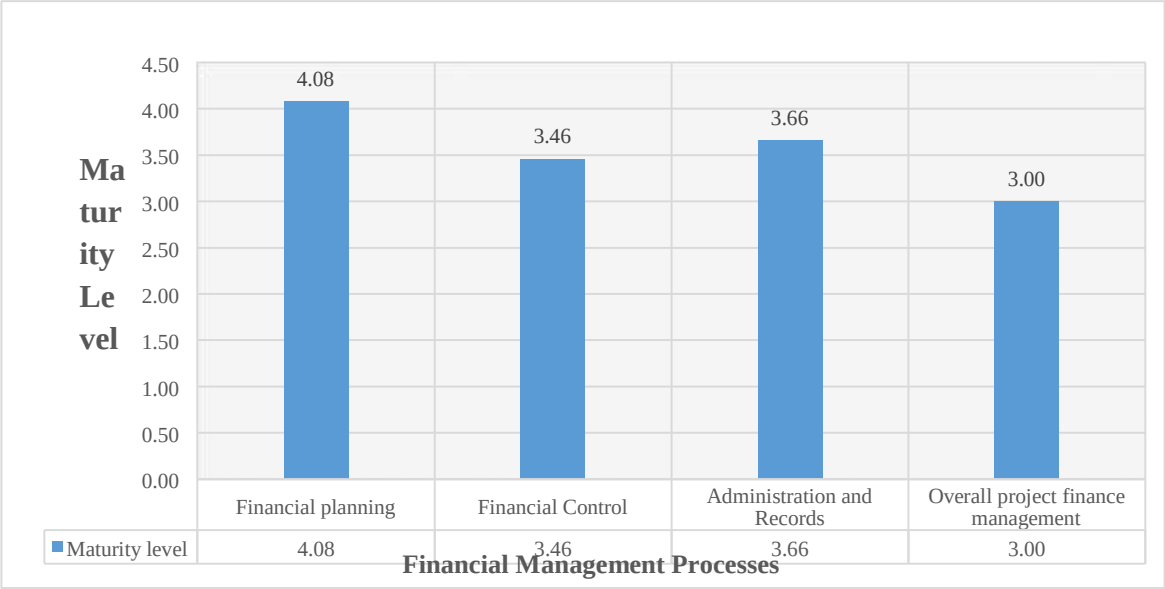

Figure 4-26: Financial Management Practice Maturity level

Source: Own Survey Data analysis result (2021)

4.8.12. Environmental Management Practice Maturity

Figure 4-27: below shows the environmental management practice maturity level based on the mean values of the level of implementation of the processes listed under the practice. As shown in the figure, the mean value of the processes is between the range greater than three but less than four (3<MSs <4).

The mean values for the level of implementation of the processes, used in the determination of maturity assessment result, showed that all of the three processes under the environmental management knowledge area score above 3 but below 4 which makes their maturity level to be found at maturity "level 3"; "standardized and institutionalized level".

Therefore, according to the analysis result and the staged representation of the model assumption, the research finding indicated that AAHDC over all maturity of the environmental management practice attained maturity "Level 3"; "standardized and institutionalized level". This result shows, in AAHDC environmental management processes are in place and established as organizational standards management practices.

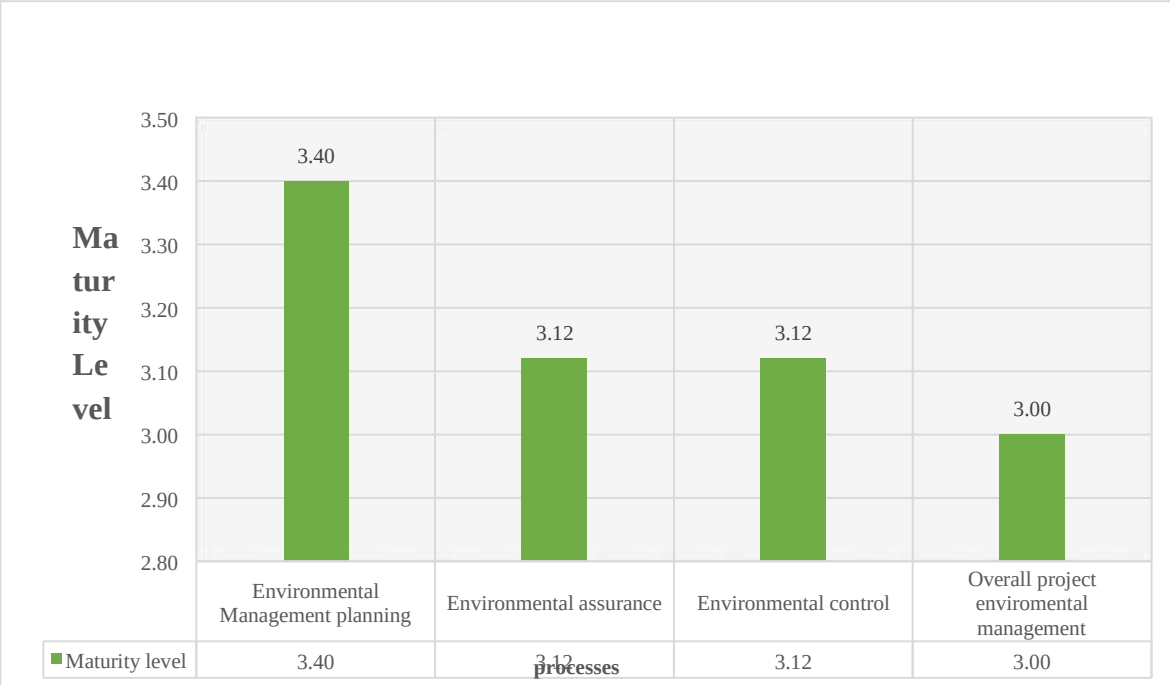

Figure 4-27: Environmental Management Practice Maturity level
Source: Own Survey Data analysis result (2021)

4.8.13. Claim Management Practice Maturity

As shown in Figure 4-28: below, the claim management practice maturity level based on the mean values of the level of implementation of the processes listed under the practice. As shown in the figure, the mean value of the processes is between the range greater than three but less than four (MSs >3<4).

The mean values for the level of implementation of the processes, used in the determination of maturity assessment result, showed that all of the three processes under the claim management knowledge area score above 3 but below 4 which makes their maturity level to be found at maturity "level 3"; "standardized and institutionalized level".
Therefore, according to the analysis result and the staged representation of the model assumption, the research finding indicated that AAHDC over all maturity of the claim management practice attained maturity "Level 3"; "standardized and institutionalized level". This result shows, in AAHDC, claim management processes are in place and established as organizational standards management practices.

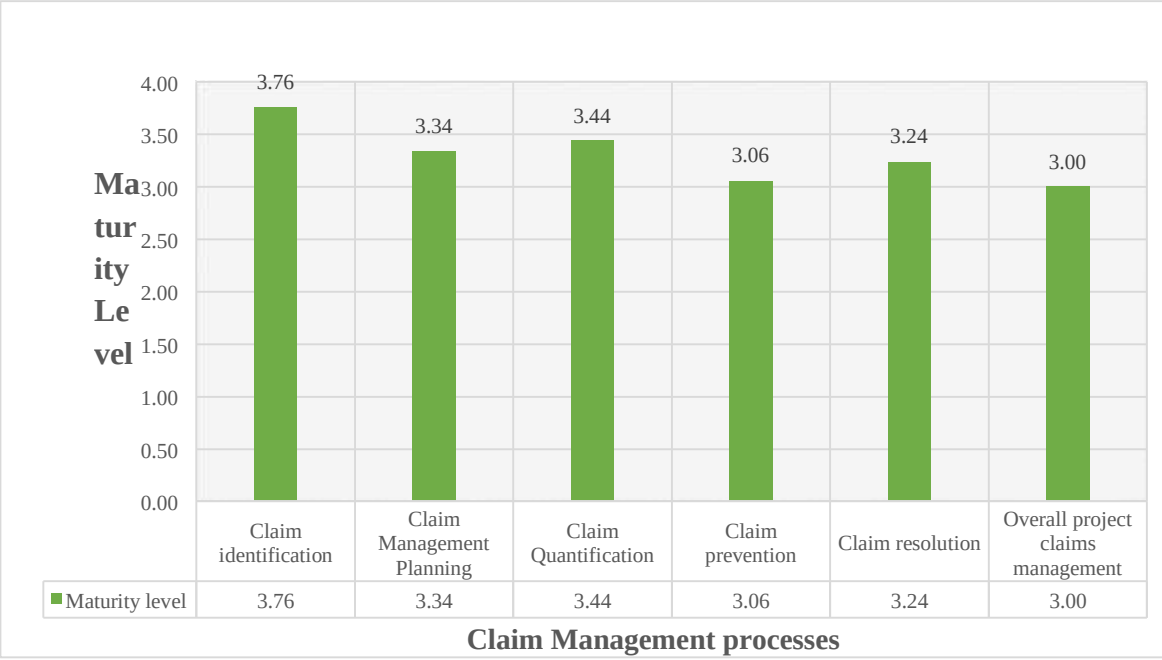

Figure 4-28: Claim Management Practice Maturity level
Source: Own Survey Data analysis result (2021)

4.8.14. Safety Management Practice Maturity

Figure 4-29: shows the safety management practice maturity level based on the mean values of the level of implementation of the processes listed under practice. As shown in the figure, the mean value of the processes is between the range greater than two but less than three (MSs >2<3).

The mean values for the level of implementation of the processes, used in the determination of maturity assessment result, showed both processes under the safety management knowledge area score above 2 but below 3 which makes their maturity level to be found at at maturity "Level 2", "Informal practice level"
Therefore, according to the analysis result and the staged representation model assumption, the research finding indicated that over all maturity of the safety management practice is at maturity Level 2, informal practice level. This result shows, safety management practices exist in AAHDC and the processes are in place, but they are not considered organizational standards.

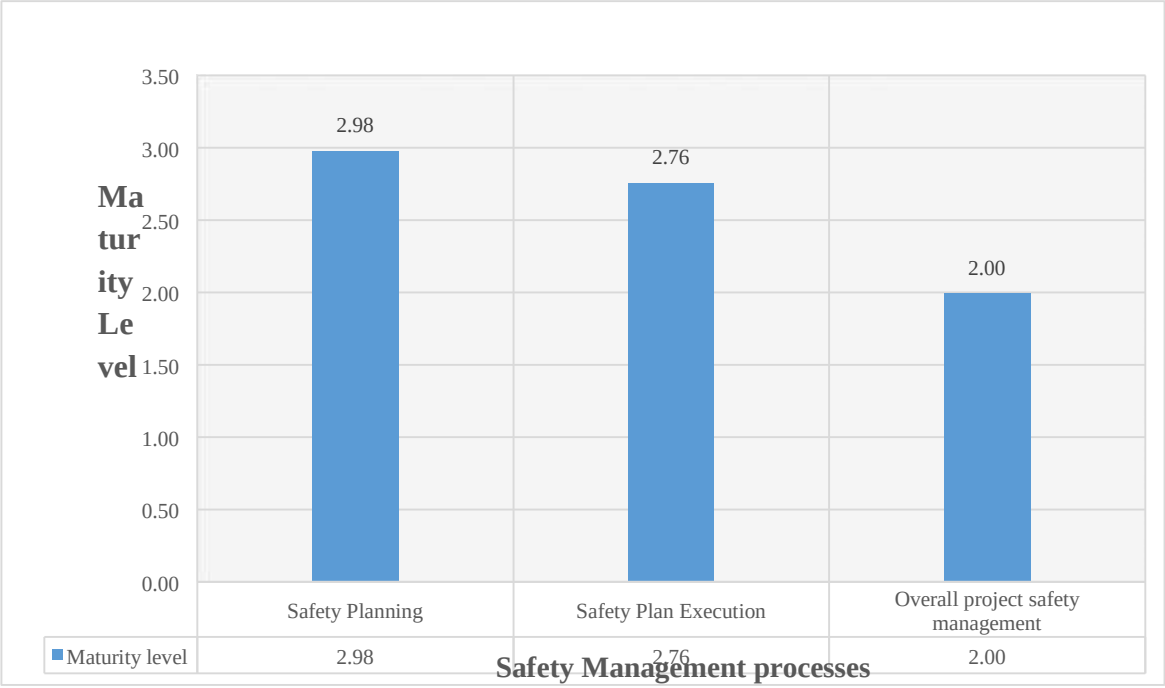

Figure 4-29: Safety Management Practice Maturity level
Source: Own Survey Data analysis result (2021)

4.9. AAHDC Project Management Process Groups Maturity Assessment

As recommended by Crawford (2015), In addition to the knowledge areas maturity, assessment for the process group maturity is helpful in determining the overall project management maturity level of an organization.

Based on Crawford's recommendation, in order to determine the overall project management maturity level of AAHDC PMS, assessment has also been performed for the 5 Process Groups covered of the knowledge areas. The assessment is performed for project management processes based on the mean value of the level of implementation of processes under each process groups.

The assessment on this section also followed a staged model representation assumption. Finally, AAHDC overall project management maturity have been determined by taking the least maturity level out of the five process groups. Subsequent parts provide assessment summary result and discussion of the process groups maturity level and finally the conclusion part summarizes the overall maturity level of AAHDC current project management system.

4.9.1. Initiation Process Group Maturity

According to the analysis result, mean value of the overall initiation process group is 3.57

(figure 4-30), which indicated that AAHDC Initiation process group Maturity is at Level 3, Organizational Standards and Institutionalized Process Level. This means AAHDC project initiation processes are in place and established as organizational standards.

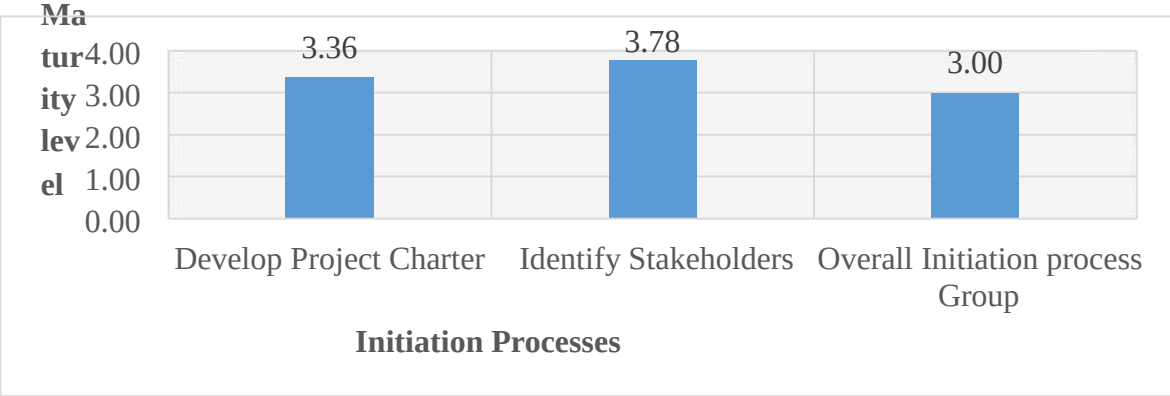

Figure 4-30: Initiation Process Group Maturity level
Source: Own Survey Data analysis result (2021)

4.9.2. Planning and Design Process Group Maturity

According to the analysis result, mean value of the overall planning and design process group is 3.44 (Figure 4-31:), which indicated that AAHDC planning and design process group Maturity is at Level 3, Organizational Standards and Institutionalized Process Level.

This means AAHDC project planning and design processes are in place and established as organizational standards. Even though, the overall maturity level of the process group is fulfilling the organizational standards and the institutionalize process level, the following processes such as risk planning, identifying risk, performing qualitative and quantitative risk analysis, planning risk response and safety planning processes are still at informal level having mean value below 3; that made these processes to be at level 2.

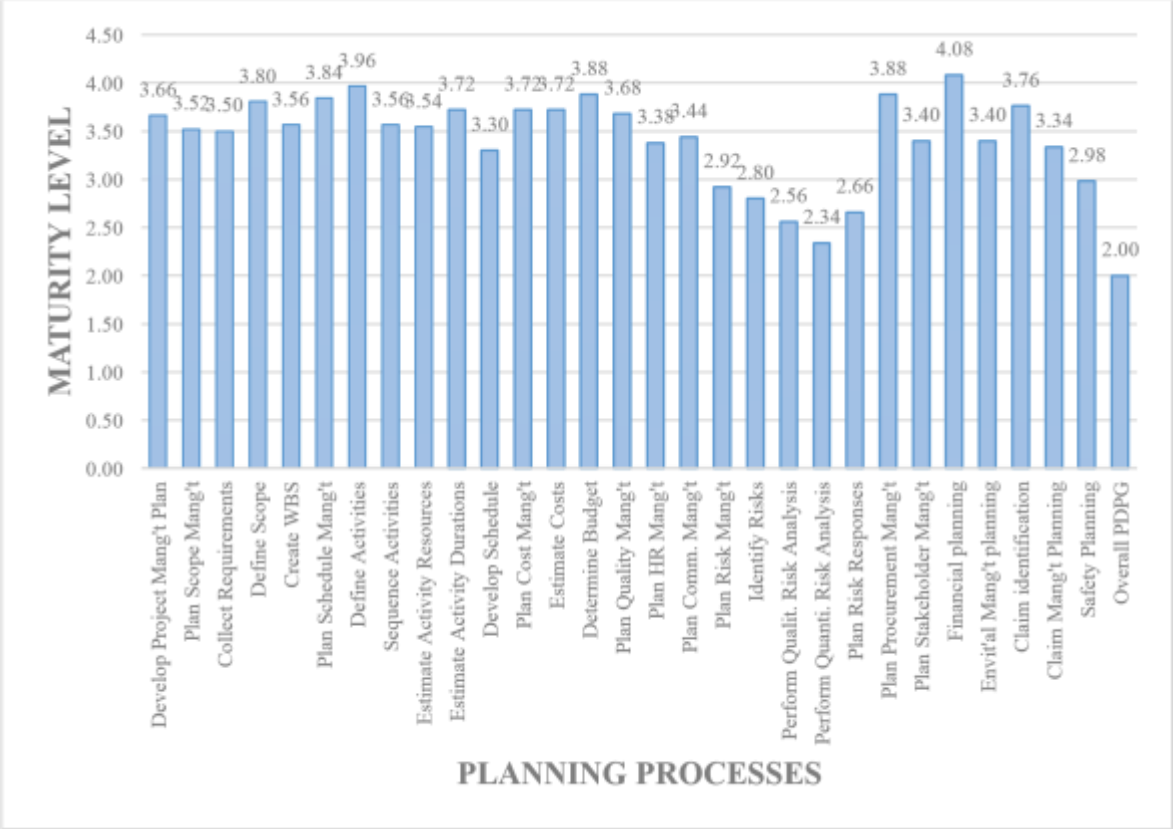

Figure 4-31: Planning & Design Process Group Maturity level
Source: Own Survey Data analysis result (2021)

4.9.3. Execution Process Group Maturity

According to the analysis result, mean value of the overall execution process group is 3.37

(figure 4-32), which indicated that AAHDC execution process group Maturity is at Level 3, Organizational Standards and Institutionalized Process Level.

This means AAHDC project execution processes are in place and established as organizational standards. Even though, the overall maturity level of the process group is fulfilling the organizational standards and the institutionalize process level, among the processes the safety plan execution process lags behind still at informal level.

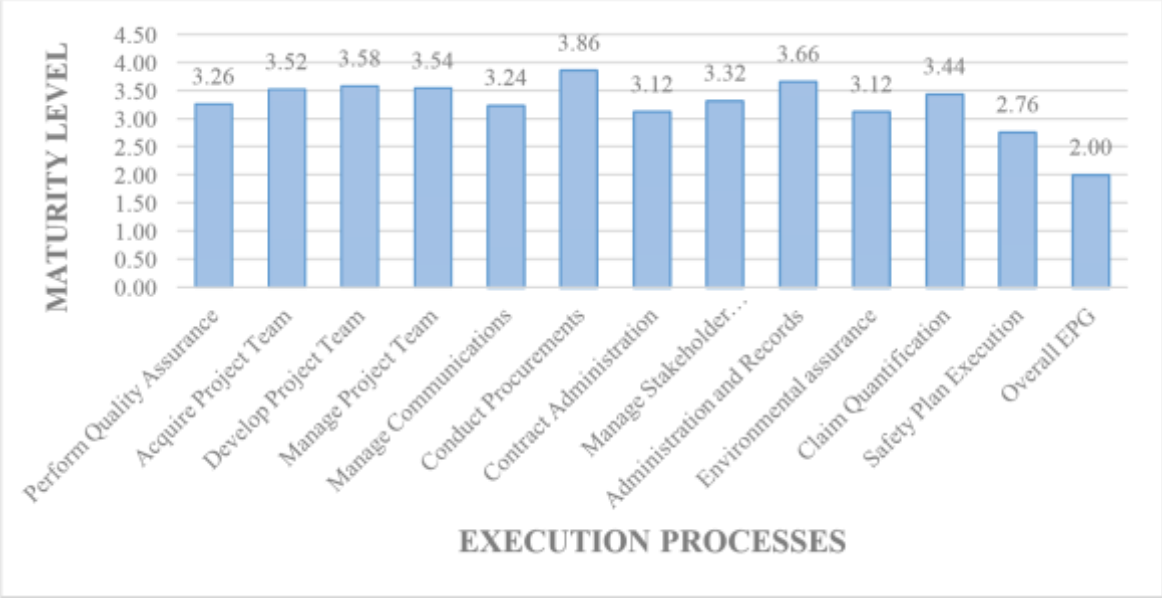

Figure 4-32: Execution Process Group Maturity level
Source: Own Survey Data analysis result (2021)

4.9.4. Monitoring and control Process Group Maturity

According to the analysis result, mean value of the overall monitoring and controlling process group is 3.05 (figure 4-33:), which indicated that AAHDC monitoring and evaluation process group Maturity is at Level 3, Organizational Standards and Institutionalized Process Level; This means AAHDC project monitoring and evaluation processes are in place and established as organizational standards.

Even though, the overall maturity level of the process group is fulfilling the organizational standards and the institutionalize process level, the following processes such as monitoring and controlling project work, performing integrated change control, controlling scope, schedule controlling, cost controlling, quality controlling and controlling risk processes are still at informal level.

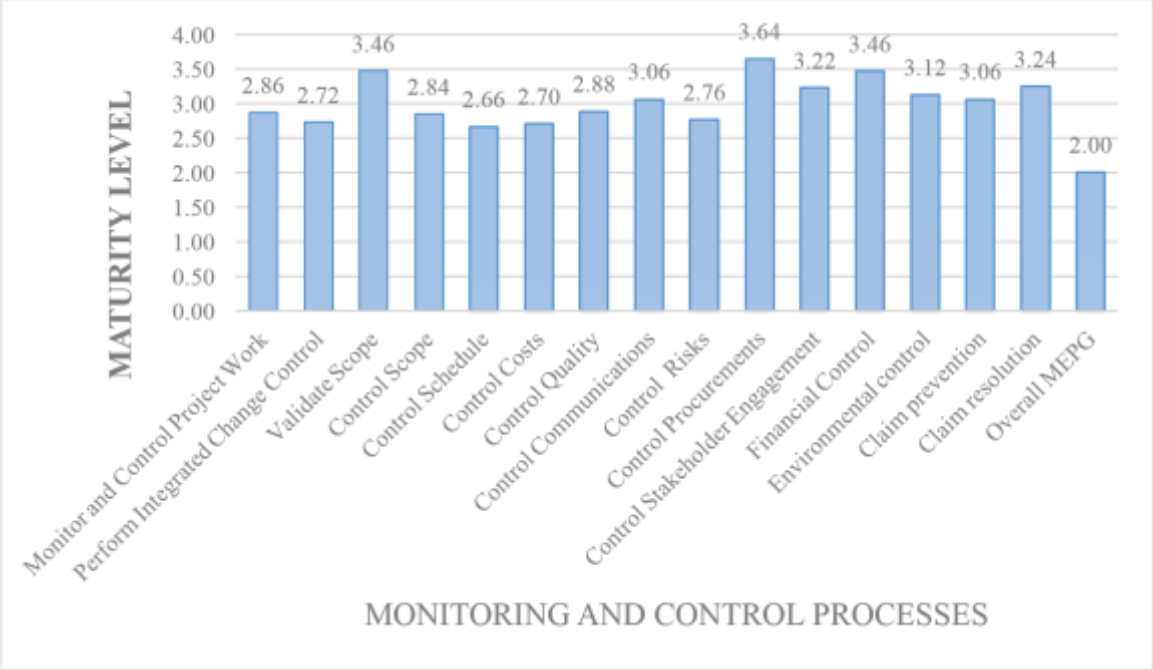

Figure 4-33: Monitoring & Control Process Group Maturity level
Source: Own Survey Data analysis result (2021)

4.9.5. Closing Process Group Maturity

According to the analysis result, mean value of the overall closing process group is 3.6

(figure 4-34:), which indicated that AAHDC Initiation process group Maturity is at Level 3, Organizational Standards and Institutionalized Process Level; This means AAHDC project closing processes are in place and established as organizational standards.

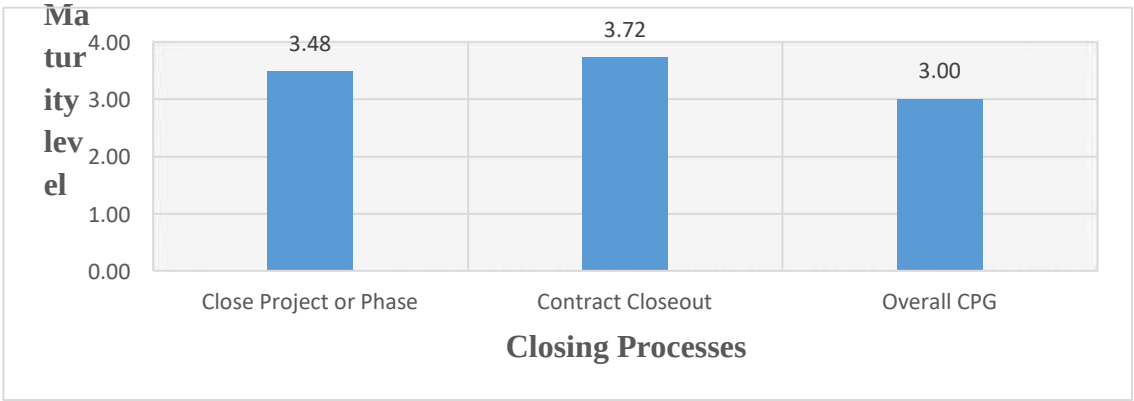

Figure 4-34: Closing Process Group Maturity level
Source: Own Survey Data analysis result (2021)

4.10. Discussions

The above subsequent sections identified the level of implementation of project management knowledge areas components and the maturity level of each process group maturity. According to the assessment result of the process groups, as shown on the Figure 4-35: below, the mean value of the overall AAHDC project management system maturity Level is 2. Hence, according to the staged model representation for the determination of the overall management maturity level of an organization, the assessment result of AAHDC PMS is at maturity level 2. This result also agreed with the maturity level determined by the the knowledge areas.

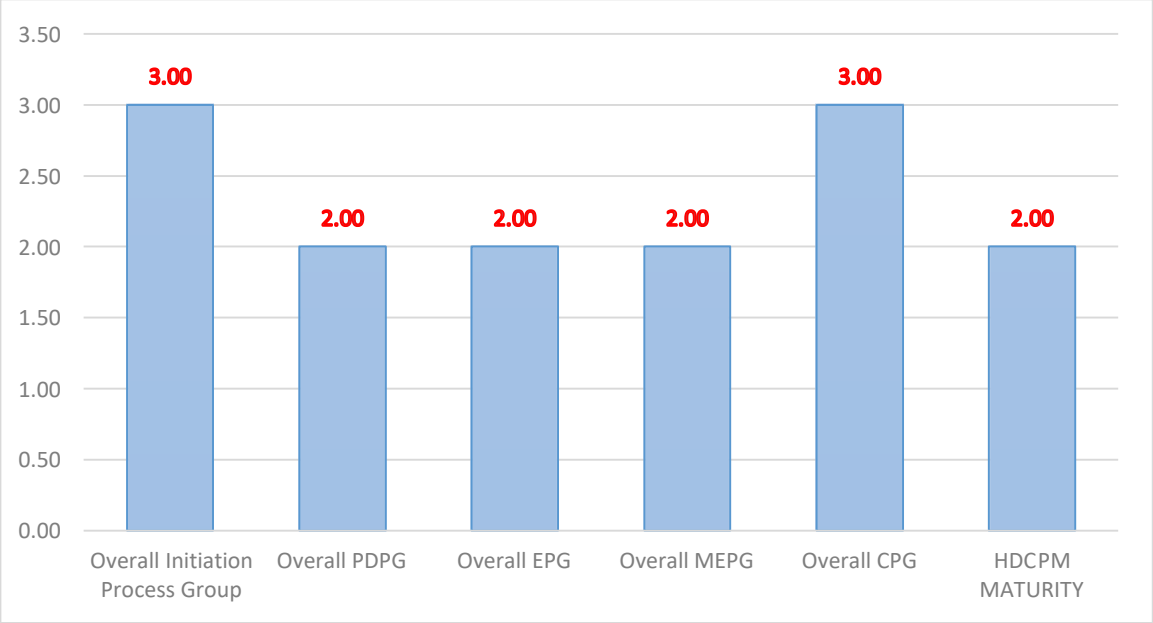

Figure 4-35: Overall AAHDC's Current PMS Maturity level
Source: Own Survey Data analysis result (2021)

Generally, the construction PM process maturity and practices maturity of the AAHDC PMS was found to be at low level. This showed that on average the AAHDC PM Practice maturity found to be at informal process level. This means on the AAHDC PMS perform the knowledge areas informally without following structured approach or guide line, relying solely on the knowledge and experience of the project manager or project team, and in AAHDC PMS, PM processes under each knowledge area are not not institutionalized and standardized. The research finding showed that among the fourteen PM knowledge areas seven practices comparatively are at lower level maturity. It indicates that theses practices are remained back in their maturity level in comparison with the rest seven practices.

Given the fact that, AAHDC PMS is comparatively more concerned in human resource management, communication management, procurement management, stakeholders management, financial management, environmental management and claim management; shown comparatively higher maturity compared with other PM knowledge areas.

CHAPTER FIVE:

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

"Current approaches do not solve current problems." (Pollock, 2003).

- Conclusions on model developing

The studied literature about project management maturity models stated that higher level of project management maturity ensures efficient projects delivery. In effect, a good model for the measurement of project management maturity creates a strategic plan for moving project management forward in an organization.

The literature survey also concluded that a large number of project management maturity models are currently being used in different industry. In selecting a model Man (2007) described three selection criteria as a). Structure b). Applicability and c) Usage of maturity model for project management maturity assessment.

Based on these criteria, and two of the model's characteristics make it ideal for use in the current study; first, it is based on the ten knowledge areas of the PMBOK Guide; second, it is well known and accepted all over the world; PM solution's PMMM framework is selected for the adaptation and developing a new assessment model called Construction Project Management Maturity Model (Con-PM3) for use in assessing the current level of maturity of AAHDC PMS. Con-PM3 was developed with slit modifications on the base model. Also, the assessment method is not very cumbersome and can easily be used to determine organizations' current level of maturity, as well as the required level of maturity. It can therefore be concluded that the maturity model developed in this research addresses most of the needs of AAHDC PMS.

- Conclusions on AAHDC Project management processes level of implementation According to the survey data, AAHDC PMS is strong in implementing the initiation and closing process groups; whereas weak in the planning & Design, execution and monitoring & controlling process groups; where some processes were at "poor" level of implementation and their lower level of implementation lead to lower maturity level which contributed to the lower maturity level of most of the knowledge area; Consequently, to the maturity of AAHDC PMS.

This indicated that AAHDC has not acquired all the benefits out of the implementation of its current project management processes. Therefore, Current approaches do not solve current problems. The research concludes the need to the improvement on the implementation of some of the processes is mandatory under the AAHDC PMS. In light of this, based on the current level of implementation of the processes found below "fair",

are concluded to be areas of weakness in AAHDC PMS that need special attention to their improvement.

- Conclusions on AAHDC PMS maturity Level

AAHDC current Integration Management, scope Management, time Management, Cost Management, Quality Management, Risk management and Safety Management Practices are known to be at maturity "level 2"; this is because of poor level of implementation of part of processes under the above practices especially the controlling processes that made them hardly step up to the next level of maturity.

Which indicates that in AAHDC PMS there are basic, documented processes in place for the knowledge areas. Although the processes are in place, they are neither institutionalized nor standardized in the organization. Whereas, AAHDC current Human Resource Management, communications management, procurement management, stakeholder management, financial management, environmental management, and claim management practices are at maturity "level 3"; this is because of relatively "good" level of implementation of processes in these knowledge areas.
Generally, it can be concluded that there is a direct relationship between process maturity and practice maturity, which means, more matured processes are associated with more matured or advanced practices. In these cases, where differences were noted, it was generally the knowledge areas with better implementation of specific components under the knowledge areas were most matured.

In conclusion of the main stand of this study, according to the assessment result, AAHDC project management maturity is at **"level 2".** With this maturity level, in this research work as much as this maturity level persists; AAHDC can be defined as where the processes are informally implemented; besides, the processes were not institutionalized and Standardized in the organization. "an organization with Structured project management Process and Standards where all project management processes are in place but not recognized as organizational standards."

AAHDC management has not institutionalized the processes and standards with formal documentation. Therefore, this study concludes that besides keeping areas of strength in implementing part of it's processes in the track, AAHDC PMS should establish an improved project management processes through institutionalizing and standardizing project management processes where the organization fails to implement in stepping up to the next level of maturity; following this argument, the intervention required to improve the situation. Therefore, AAHDC PMS has got a remarkable scope for improvement in the level of maturity of the overall project management system targeting to the next maturity level 3.

5.2. Recommendations

To achieve maturity Level 3, all project management processes must be in place and established as organizational standards. The simple use of project management, even for an extended period of time, does not lead to excellence. Instead, it can result in repetitive mistakes and, what's worse, learning from your own mistakes rather than from the mistakes of others.

Based on the above analysis results, the research recommendations are focused on the areas of improvement that need special consideration towards a substantial change in the current level of implementation of components under the project management knowledge areas; so that AAHDC PMS maturity will be improved. Consequently, the federal housing construction projects believed to successfully achieve their objectives. The following areas of improvement were recommended in this specific research.

> The Con-PM3 Model developed in this study has many potential application areas as well as imperfections and limitations. Improving project management is a series of smaller steps, it is believed that organizations will achieve significant benefit by improving performance level of PM practices. As a recommendation, AAHDC should assess its project management system periodically and benchmark its performances with the use of the Con-PM3's Self-Assessment Questionnaire (Appendix: A) as a checklist in identifying the level of implementation of the standard processes. This helps AAHDC to distinguish its strength and weaknesses in the implementation of the current PM processes and practices.

It is very important for AAHDC management team to have a clear understanding of the fundamental concepts of PM knowledge, skills, tools, and techniques to be applied systematically through the management process groups; Initiating, Planning, Executing, Monitoring and Controlling, and Closing. In order to attain improvement in the level of implementation of the PM processes and transform to the next maturity level from the current low maturity level, AAHDC should:

- ✓ Adopt an accepted project management methodology and use it consistently.
- ✓ Implement a philosophy that drives the company toward project management maturity and communicate it to everyone involved the project management system.
- ✓ Commit to developing effective plans at the beginning of every project.
- ✓ Minimize scope changes by committing to realistic objectives.
- ✓ Recognize that cost and schedule management are inseparable.
- ✓ Select the right person as project manager.
- ✓ Strengthen involvement and support of management team.

- ✓ Cultivate effective communication, cooperation, and trust to achieve rapid project management maturity.
- ✓ Focus on identifying and solving problems early, quickly, and cost effectively.
- ✓ Measure progress periodically.
- ✓ Use project management software as a tool—not as a substitute for effective planning or interpersonal skills.

It is strongly recommended that AAHDC management team should undertake imperative actions to customize and apply the standard lists of the project management processes with their corresponding tools and techniques proposed by the PMI PMBOK Guide, as it contains a comprehensive descriptions of processes under each knowledge area as explained in (Appendix: C).

Determining a maturity score for an organization may give a sense of satisfaction, Particularly if it is relatively high. However, the score alone is not the goal. Perhaps, it may not be so important to know that AAHDC PMS is a Level "X" organization; what is important is to know what specific actions must be implemented to move the identified areas of improvement forward and step up to the next level of maturity. In light of this, AAHDC should give due attention and take necessary actions to the improvement of the level of implementation especially on the processes such as:

- ✓ Integrated change control and monitoring and control work processes in the project integration management practice.
- ✓ Scope controlling process in the project scope management practice
- ✓ Activity sequencing and schedule control processes in the project time management practice
- ✓ Cost control process in the project cost management practice.
- ✓ Controlling quality in the project quality management practice.
- ✓ Planning, managing and controlling communication processes in the project communications management practice.
- ✓ Planning risk, performing qualitative and quantitative risk analysis, planning risk response and control risk processes in the project risk management practice.
- ✓ Closing procurement and contract administration processes in the project procurement management practice.
- ✓ Manage stakeholders' engagement process in the project stakeholders' management practice.

- ✓ Environmental management planning, environmental assurance and environmental control processes in the project environmental management practices.

- ✓ Quantifying, prevention and resolving claim processes in the project claim management practice.

- ✓ Safety management planning and safety plan execution processes in the project safety management practice.

5.3 Recommendations for further studies

This paper presented the results of a descriptive and exploratory survey findings to examine the current level of maturity of AAHDC PMS. Although the findings in this study showed a reasonable level to have been achieved already, there is still quite a lot to do in order to achieve perceived potential.

Further work might be of value to improve and modify the self-assessment questionnaire so that possible specific, internal, external, environmental etc., factors which affect the level of implementation of project management processes in each project management Knowledge areas could be identified in the organization's PMS. Furthermore, based on the results in this study, and using the the current maturity level as a spring board, further research to make periodic assessment and allow to determine the impact of changes that have occurred since the previous benchmarking on the maturity level of the knowledge areas and significant improvements deemed to be recognized

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Appendix: A Self -Assessment Survey Questionnaire

This self-assessment survey is designed to help perform a simple, informal self-assessment of AAHDC project management system maturity.

Cover letter of the questionnaire for respondents

Dear, Madam/Sir respondent:

My name is Thomas Debele. I am currently undertaking MSc in Construction Technology and Management at Addis College.

Even though it is expected that a project Manager should consider all relevant aspect of the project management knowledge areas/processes in managing his project; the degree of implementation and importance of knowledge areas/processes in contributing for or affecting the success of the project is generally expected to vary. Hence, this research tries to gather your professional opinion on the relative implementation level of the Project Management knowledge areas/processes in the Addis Aabab housing construction projects. Identifying the areas of improvement, the output of this research will help us in developing a frame work for development and improvement of the Addis Ababa housing construction project management system.

This survey is part of academic research and its intended goal is to assess AAHDC Project Management Process Maturity and associated factors that affect the Addis Ababa Housing Construction Management Practice and to recommend areas that need to be considered to develop and improve Project Management Practice. As a part of this research, the principal PMI's Project Management Body of Knowledge Areas, the Processes and the Process Groups are studied. With this survey, the researcher would like to meet the following specific objectives:

1. To develop a suitable maturity assessment model to be applied in assessing AAHDC project management system.
2. To evaluate the level of implementation of the standard PMI's Project Management Knowledge Areas' components in AAHDC project management system.
3. To assess AAHDC current project management maturity level based on PMI's knowledge areas.
4. To suggest areas of improvements based on measured attributes for better and efficient projects delivery

Hence, you are kindly requested to fill out the questionnaire and return it to the researcher. All the information you provide will be kept in strict confidentiality and it will be only used for academic research purpose. Please give answer for all and each question carefully and your response for all questions is encouraged and appreciated.

I value your participation and thank you for the commitment of time, energy and effort.

If you have any further questions, I can be reach at the address below.

Sincerely,

Thomas Debele Robi
Addis College

APPENDIX A1 PART ONE OF SURVEY QUESTIONNAIRE

Table A1: PARTICIPANTS GENETAL DETAIL

INSTRUCTIONS 1: – Please, give your details and response /opinions/ by ticking one of the boxes provided for each category

PARTICIPANTS GENAAHDCL DETAIL			
1	Age	20 - 29	
		30 - 39	
		40 - 50	
		> 50	
2	Sex	Male	
		Female	
3	Education Level	Diploma	
		BSc Degree	
		MSc	
		PhD	
4	Occupational Level	Higher Level Manager	
		Middle Level Manager	
		Lead Engineer	
		Senior Engineer	
		Engineer	
		Junior Engineer	
5	Number of working experience as a project manager	< 2 Years	
		2 - 5 Years	
		6 - 10 years	
		> 10 years	
6	Number of years worked in AAHDC	(please specify the year)	
7	Field of specialization	Civil Engineer	
		Construction Management	
		Highway Engineer	
		Geo-technical Engineer	
		Other (Specify)	

APPENDIX: A2 PART TWO OF SURVEY QUESTIONNAIRE

e-mail, thomasdebelerobi@gmail.com Mobile +251911746622

Based on your overall experience in housing construction projects in Addis Ababa, please scale (5 to 1) the project management knowledge area practices with respect to their applicability in AAHDC in what you consider their application and utilization.
The five-point scale ranged as: 5 point - for practices fully and consistently performed and you consider it is in a Very Good Practice, 4 point - for practices fully performed but not consistently and you consider it is in a Good Practice, **3 point** - for **partially performed practice** and you consider it is in a **Fair** Practice, **2 point** - for the **existed practices but not performed** and you consider it is in a **Poor** Practice, **1 point** - for **No Standard Practices** and you consider it is in a **Very Poor** Practice.

Please, give your reposes/opinions/ by ticking one of the boxes provided for each category.

Sr. No.	**PROJECT MANAGEMENT KNOWLEDGE AREAS**	**In a Very Poor Level**	**In a Poor level**	**In a Fair level**	**In a Good level**	**In a Very Good level**
		1	2	3	4	5
	PROJECT INTEGRATION MANAGEMENT					
1	Develop Project Charter					
2	Develop Project Management Plan					
3	Direct and Manage Project Work					
4	Monitor and Control Project Work					
5	Perform Integrated Change Control					
6	Close Project or Phase					
	PROJECT SCOPE MANAGEMENT					
7	Plan Scope Management					
8	Collect Requirements					
9	Define Scope					
10	Create WBS					
11	Validate Scope					
12	Control Scope					
	PROJECT TIME MANAGEMENT					
13	Plan Schedule Management					
14	Define Activities					
15	Sequence Activities					
16	Estimate Activity Resources					
17	Estimate Activity Durations					
18	Develop Schedule					

19	Control Schedule					
	PROJECT COST MANAGEMENT					
20	Plan Cost Management					
21	Estimate Costs					
22	Determine Budget					
23	Control Costs					
	PROJECT QUALITY MANAGEMENT					
24	Plan Quality Management					
25	Perform Quality Assurance					
26	Control Quality					
	PROJECT HUMAN RESOURCE MANAGEMENT					
27	Plan Human Resource Management					
Sr. No.	**PROJECT MANAGEMENT KNOWLEDGE AREAS**	In a Very Poor Level	In a Poor level	In a Fair level	In a Good level	In a Very Good level
		1	2	3	4	5
28	Acquire Project Team					
29	Develop Project Team					
30	Manage Project Team					
	PROJECT COMMUNICATIONS MANAGEMENT					
31	Plan Communications Management					
32	Manage Communications					
33	Control Communications					
	PROJECT RISK MANAGEMENT					
34	Plan Risk Management					
35	Identify Risks					
36	Perform Qualitative Risk Analysis					
37	Perform Quantitative Risk Analysis					
38	Plan Risk Responses					
39	Control Risks					
	PROJECT PROCUREMENT MANAGEMENT					
40	Plan Procurement Management					
41	Conduct Procurements					
42	Control Procurements					
43	Close Procurements					
44	Contract Administration					
45	Contract Closeout					

	PROJECT STAKEHOLDER MANAGEMENT					
46	Identify Stakeholders					
47	Plan Stakeholder Management					
48	Manage Stakeholder Engagement					
49	Control Stakeholder Engagement					
	PROJECT FINANCIAL MANAGEMENT					
50	Financial planning					
51	Financial Control					
52	Administration and Records.					
	PROJECT ENVIRONMENTAL MANAGEMENT					
53	Environmental Management planning.					
54	Environmental assurance.					
55	Environmental control.					
	PROJECT CLAIM MANAGEMENT					
56	Claim identification					
57	Claim Management Planning					
58	Claim Quantification					
59	Claim prevention					
60	Claim resolution					
	PROJECT SAFETY MANAGEMENT					
61	Safety Planning.					

Source: Adapted & modified from Crawford, 2015

Appendix: B. Data Analysis Outputs

Table B1: Frequency percentage of Multiple responses

Management Practices	Likert Scale	Frequency	Occupation status of the respondent			Total
			Higher level manager	Middle level manager	Lower level manager	
Integration Management Practice	In a very poor practice	N(%)	1(0.3)	6(2.0)	1(0.3)	8(2.7)
	In a poor practice	N(%)	0(0.0)	37(12.3)	20(6.7)	57(19.0)
	In a Fair practice	N(%)	1(0.3)	51(17.0)	38(12.7)	90(30.0)
	In a good practice	N(%)	3(1.0)	64(21.3)	53(17.7)	120(40.0)
	In a very good practice	N(%)	1(0.3)	10(3.3)	14(4.7)	25(8.3)
Time Management practice	In a very poor practice	N(%)	0(0.0)	8((2.3)	1(0.3)	9(2.6)
	In a poor practice	N(%)	1(0.3)	33(9.4)	17(4.9)	51(14.6)
	In a Fair practice	N(%)	3(0.9)	46(13.1)	38(10.9)	87(24.9)
	In a good practice	N(%)	3(0.9)	87(24.9)	68(19.4)	158(45.1)
	In a very good practice	N(%)	0(0.0)	22(6.3)	23(6.6)	45(12.9)
Cost Management practice	In a very poor practice	N(%)	0(0.0)	2(1.0)	0(0.0)	2(1.0)
	In a poor practice	N(%)	1(0.5)	26(13.0)	14(7.0)	41(20.5)
	In a Fair practice	N(%)	2(1.0)	21(10,5)	18(9.0)	41(20.5)
	In a good practice	N(%)	1(0.5)	54(27.0)	31(15.5)	86(43.0)
	In a very good practice	N(%)	0(0.0)	9(4.5)	21(10.5)	30(15.0)
Scope Management practice	In a very poor practice	N(%)	0(0.0)	6(2.0)	0(0.0)	6(2.0)
	In a poor practice	N(%)	3(1.0)	27(9.0)	14(4.7)	44(14.7)
	In a Fair practice	N(%)	2(0.7)	55(18.3)	26(8.7)	83(27.7)
	In a good practice	N(%)	1(0.3)	73(24.3)	70(23.3)	144(48.0)
	In a very good practice	N(%)	0(0.0)	7(2.3)	16(12.7)	23(7.7)
Quality Management Practice	In a poor practice	N(%)	0(0.0)	22(14.7)	12(8.0)	34(22.7)
	In a Fair practice	N(%)	3(2.0)	28(18.7)	19(12.7)	50(33.3)
	In a good practice	N(%)	0(0.0)	32(21.3)	25(16.7)	57(38.0)
	In a very good practice	N(%)	0(0.0)	2(1.3)	7(4.7)	9(6.0)
Human Resource Management practice	In a very poor practice	N(%)	0(0.0)	8(4.0)	0(0.0)	8(4.0)
	In a poor practice	N(%)	0(0.0)	4(2.0)	3(1.5)	7(3.5)
	In a Fair practice	N(%)	0(0.0)	53(26.5)	29(14.5)	82(41.0)
	In a good practice	N(%)	4(2.0)	39(19.5)	39(19.5)	82(41.0)
	In a very good practice	N(%)	0(0.0)	8(4.0)	13(6.5)	21(10.5)
Communication Management Practice	In a poor practice	N(%)	0(0.0)	28(18.7)	1(0.7)	29(19.3)
	In a Fair practice	N(%)	0(0.0)	38(25.3)	34(22.7)	72(48.0)
	In a good practice	N(%)	3(2.0)	12(8.0)	17(11.3)	32(21.3)
	In a very good practice	N(%)	0(0.0)	6(4.0)	11(7.3)	17(11.3)
Risk Management Practice	In a very poor practice	N(%)	0(0.0)	33(11.0)	4(1.3)	37(12.3)
	In a poor practice	N(%)	5(1.7)	56(18.7)	27(9.0)	88(29.3)
	In a Fair practice	N(%)	1(0.3)	59(19.7)	56(18.7)	116(38.7)
	In a good practice	N(%)	0(0.0)	17(5.7)	37(12.3)	54(18.0)
	In a very good practice	N(%)	0(0.0)	3(1.0)	2(0.7)	5(1.7)
Procurement Management Practice	In a very poor practice	N(%)	0(0.0)	4(1.6)	2(0.8)	6(2.4)
	In a poor practice	N(%)	0(0.0)	22(8.8)	10(4.0)	32(12.8)
	In a Fair practice	N(%)	1(0.4)	37(14.8)	31(12.4)	69(27.6)
	In a good practice	N(%)	4(1.6)	50(20.0)	36(14.4)	90(36.0)
	In a very good practice	N(%)	0(0.0)	27(10.8)	26(10.4)	53(21.2)
Stakeholder Management Practice	In a poor practice	N(%)	0(0.0)	10(5.0)	9(4.5)	19(9.5)
	In a Fair practice	N(%)	3(1.5)	60(30.0)	28(14.0)	91(45.5)
	In a good practice	N(%)	1(0.5)	38(19.0)	36(18.0)	75(37.5)
	In a very good practice	N(%)	0(0.0)	4(2.0)	11(5.5)	15(7.5)
Finance Management	In a poor practice	N(%)	0(0.0)	13(8.7)	8(5.3)	21(14.0)
	In a Fair practice	N(%)	0(0.0)	22(14.7)	5(3.3)	27(18.0)

Practice	In a good practice	N(%)	3(2.0)	36(24.0)	34(22.7)	73(48.7)
	In a very good practice	N(%)	0(0.0)	13(8.7)	16(10.7)	29(19.3)
Environment Management Practice	In a very poor practice	N(%)	0(0.0)	3(2.0)	3(2.0)	6(4.0)
	In a poor practice	N(%)	3(2.0)	14(9.3)	6(4.0)	23(15.3)
	In a Fair practice	N(%)	0(0.0)	46(30.7)	24(16.0)	70(46.7)
	In a good practice	N(%)	0(0.0)	17(11.3)	18(12.0)	35(23.3)
	In a very good practice	N(%)	0(0.0)	4(2.7)	12(8.0)	16(10.7)
Claim Management Practice	In a very poor practice	N(%)	0(0.0)	0(0.0)	1(0.4)	1(0.4)
	In a poor practice	N(%)	3(1.2)	52(20.8)	17(6.8)	72(28.8)
	In a Fair practice	N(%)	2(0.8)	34(13.6)	11(4.4)	47(18.8)
	In a good practice	N(%)	0(0.0)	41(16.4)	53(21.2)	94(37.6)
	In a very good practice	N(%)	0(0.0)	13(5.2)	23(9.2)	36(14.4)
Project safety management practice	In a very poor practice	N(%)	2(2)	8(8)	4(4)	14(14)
	In a poor practice	N(%)	0(0)	12(12)	6(6)	18(18)
	In a Fair practice	N(%)	0(0)	26(26)	14(14)	40(40)
	In a good practice	N(%)	0(0)	8(8)	15(15)	23(23)
	In a very good practice	N(%)	0(0)	2(2)	3(3)	5(5)

Table B2: Project Management Knowledge Areas Maturity Level

No	Project Management Knowledge Areas	Project Management Processes	Mean	Maturity Level
1	Project Integration Management Process	PIMKA1 - Develop Project Charter PIMKA2 - Develop Project Management Plan PIMKA3 - Direct and Manage Project Work PIMKA4 - Monitor and Control Project Work PIMKA5 - Perform Integrated Change Control PIMKA6 - Close Project or Phase	3.3600 3.6600 3.8600 2.8600 2.7200 3.4800	2
2	Project Scope Management Process	PSMKA1 - Plan Scope Management PSMKA2 - Collect Requirements PSMKA3 - Define Scope PSMKA4 - Create WBS PSMKA5 - Validate Scope PSMKA6 - Control Scope	3.5200 3.5000 3.8000 3.5600 3.4600 2.8400	2
3	Project Time Management Process	PTMKA1 - Plan Schedule Management PTMKA2 - Define Activities PTMKA3 - Sequence Activities PTMKA4 - Estimate Activity Resources PTMKA5 - Estimate Activity Durations PTMKA6 - Develop Schedule PTMKA7 - Control Schedule	3.8400 3.9600 3.5600 3.5400 3.7200 3.3000 2.6600	2
4	Project Cost Management Process	PCMKA1 - Plan Cost Management PCMKA2 - Estimate Costs PCMKA3 - Determine Budget PCMKA4 - Control Costs	3.7200 3.7200 3.8800 2.7000	2
5	Project Quality Management Process	PQMKA1 - Plan Quality Management PQMKA2 - Perform Quality Assurance PQMKA3 - Control Quality	3.6800 3.2600 2.8800	2
6	Project Human Resource Management Process	PHRMKA1 - Plan Human Resource Management PHRMKA2 - Acquire Project Team PHRMKA3 - Develop Project Team PHRMKA4 - Manage Project Team	3.3800 3.5200 3.5800 3.5400	3

7	Project Communication Management Process	PCOMMKA1 - Plan Communications Management PCOMMKA2 - Manage Communications PCOMMKA3 - Control Communications	3.4400 3.2400 3.0600	3
8	Project Risk Management Process	PRMKA1 - Plan Risk Management PRMKA2 - Identify Risks PRMKA3 - Perform Qualitative Risk Analysis PRMKA4 - Perform Quantitative Risk Analysis PRMKA5 - Plan Risk Responses PRMKA6 - Control Risks	2.9200 2.8000 2.5600 2.3400 2.6600 2.7600	2
		PPMKA6 - Contract Closeout	3.7200	
9	Project Stakeholders Management Process	PSTAKMKA1 - Identify Stakeholders PSTAKMKA2 - Plan Stakeholder Management PSTAKMKA3 - Manage Stakeholder Engagement PSTAKMKA4 - Control Stakeholder Engagement	3.7800 3.4000 3.3200 3.2200	3
10	Project Financial Management Process	PFMKA1 - Financial planning PFMKA2 - Financial Control PFMKA3 - Administration and Records	4.0800 3.4600 3.6600	3
11	Project Environmental Management Process	PEMKA1 - Environmental Management planning PEMKA2 - Environmental assurance PEMKA3 - Environmental control	3.4000 3.1200 3.1200	3
12	Project Claim Management Process	PCLMKA1 - Claim identification PCLMKA2 - Claim Management Planning PCLMKA3 - Claim Quantification PCLMKA4 - Claim prevention PCLMKA5 - Claim resolution	3.7600 3.3400 3.4400 3.0600 3.2400	3
13	Project Safety Management Process	PSAFMKA1 - Safety Planning PSAFMKA2 - Safety Plan Execution	2.9800 2.7600	2
14	Project Procurement Management Process	PPMKA1 -Plan Procurement Management PPMKA2 - Conduct Procurements PPMKA3 - Control Procurements PPMKA4 - Close Procurements PPMKA5 - Contract Administration	3.8800 3.8600 3.6400 3.7000 3.1200	3

Source: Own Survey Data analysis result (2021)

Table B3: Project Management Process Groups Maturity Level

No	process group	Project Management Processes	N	Minimum	Maximum	Mean	process group maturity Level
1	Initiation	Develop Project Charter	50	1	5	3.36	3.00
		Identify Stakeholders	50	2	5	3.78	
2	Planning & Design	Develop Project Management Plan	50	2	5	3.66	2.00
		Plan Scope Management	50	1	5	3.52	
		Collect Requirements	50	2	5	3.50	
		Define Scope	50	2	5	3.80	
		Create WBS	50	2	5	3.56	
		Plan Schedule Management	50	2	5	3.84	
		Define Activities	50	2	5	3.96	
		Sequence Activities	50	1	5	3.56	
		Estimate Activity Resources	50	1	5	3.54	
		Estimate Activity Durations	50	1	5	3.72	
		Develop Schedule	50	1	5	3.30	
		Plan Cost Management	50	2	5	3.72	
		Estimate Costs	50	2	5	3.72	
		Determine Budget	50	2	5	3.88	
		Plan Quality Management	50	2	5	3.68	
		Plan Human Resource Management	50	1	5	3.38	
		Plan Communications Management	50	2	5	3.44	
		Plan Risk Management	50	1	5	2.92	
		Identify Risks	50	1	5	2.80	
		Perform Qualitative Risk Analysis	50	1	4	2.56	
		Perform Quantitative Risk Analysis	50	1	4	2.34	
		Plan Risk Responses	50	1	5	2.66	
		Plan Procurement Management	50	1	5	3.88	
		Plan Stakeholder Management	50	2	5	3.40	
		Financial planning	50	2	5	4.08	
		Environmental Management planning	50	1	5	3.40	
		Claim identification	50	2	5	3.76	
		Claim Management Planning	50	2	5	3.34	
		Safety Planning	50	1	5	2.98	
3	Execution	Perform Quality Assurance	50	2	5	3.26	2.00
		Acquire Project Team	50	1	5	3.52	
		Develop Project Team	50	1	5	3.58	
		Manage Project Team	50	1	5	3.54	
		Manage Communications	50	2	5	3.24	
		Conduct Procurements	50	1	5	3.86	
		Contract Administration	50	2	5	3.12	
		Manage Stakeholder Engagement	50	2	5	3.32	
		Administration and Records	50	2	5	3.66	

		Environmental assurance	50	1	5	3.12	
		Claim Quantification	50	2	5	3.44	
		Safety Plan Execution	50	1	5	2.76	
4	Monitoring & Controlling	Monitor and Control Project Work	50	2	4	2.86	2.00
		Perform Integrated Change Control	50	1	4	2.72	
		Validate Scope	50	2	5	3.46	
		Control Scope	50	1	5	2.84	
		Control Schedule	50	1	5	2.66	
		Control Costs	50	1	5	2.70	
		Control Quality	50	2	5	2.88	
		Control Communications	50	2	5	3.06	
		Control Risks	50	1	4	2.76	
		Control Procurements	50	1	5	3.64	
		Control Stakeholder Engagement	50	2	5	3.22	
		Financial Control	50	2	5	3.46	
		Environmental control	50	1	5	3.12	
		Claim prevention	50	1	5	3.06	
		Claim resolution	50	2	5	3.24	
5	Closing	Close Project or Phase	50	2	5	3.48	3.00
		Contract Closeout	50	2	5	3.72	

Appendix: C. Overview of PMI Project Management Knowledge areas with their components

Figure: C1 Overview of Project Integration Management (PMI, 2013)

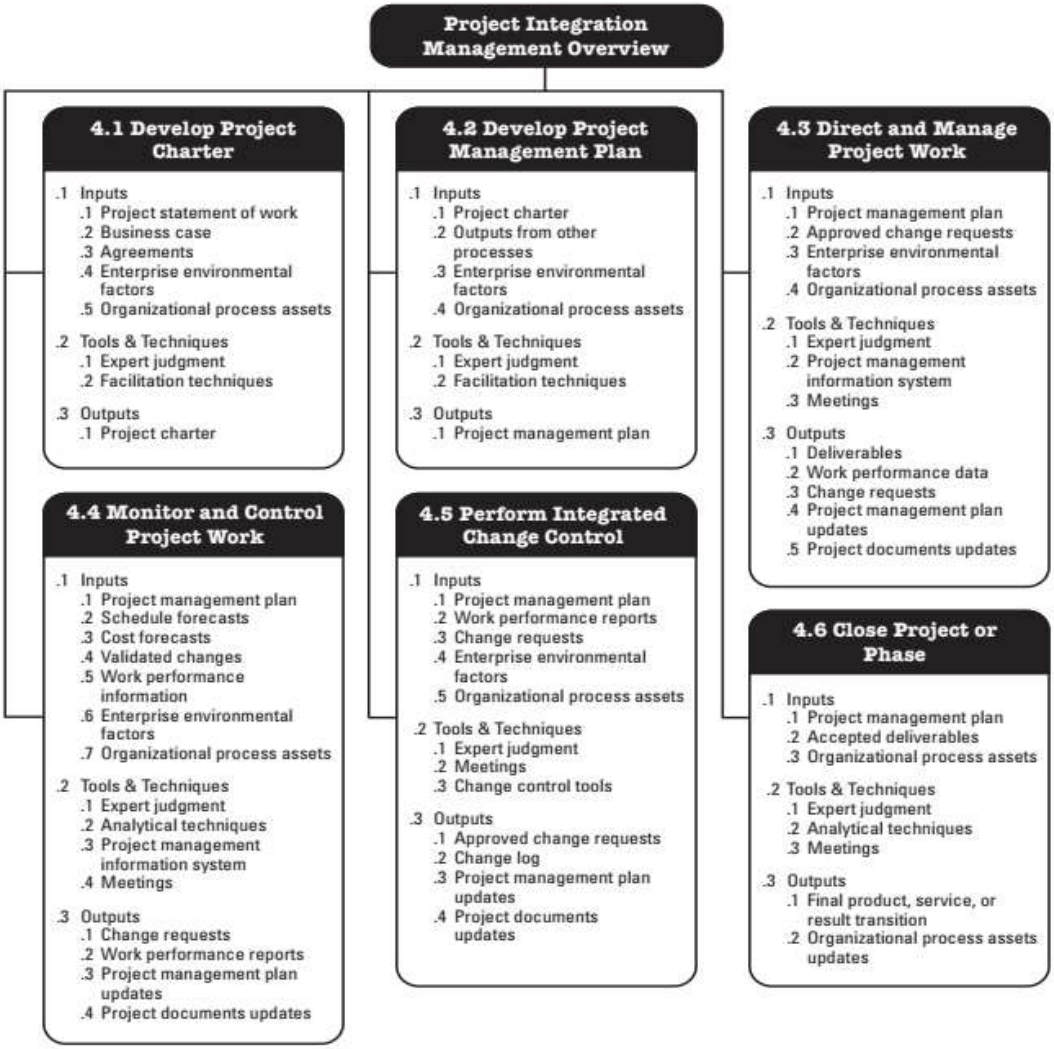


Figure: C2 Overview of Project Scope Management (PMI, 20

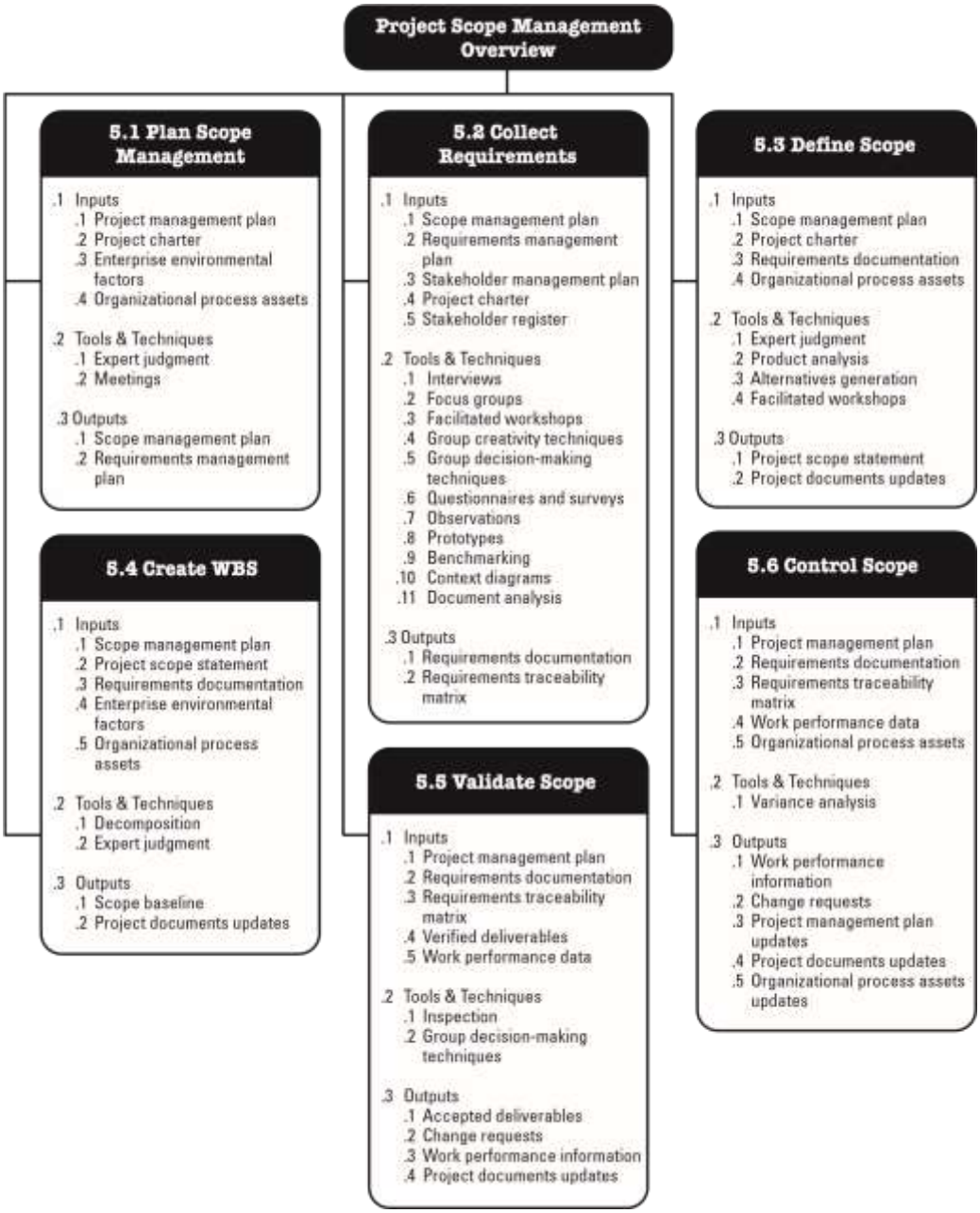


Figure: C3 Overview of Project Time Management (PMI, 2013)

Figure: C4 Overview of Project Cost Management (PMI, 2013)

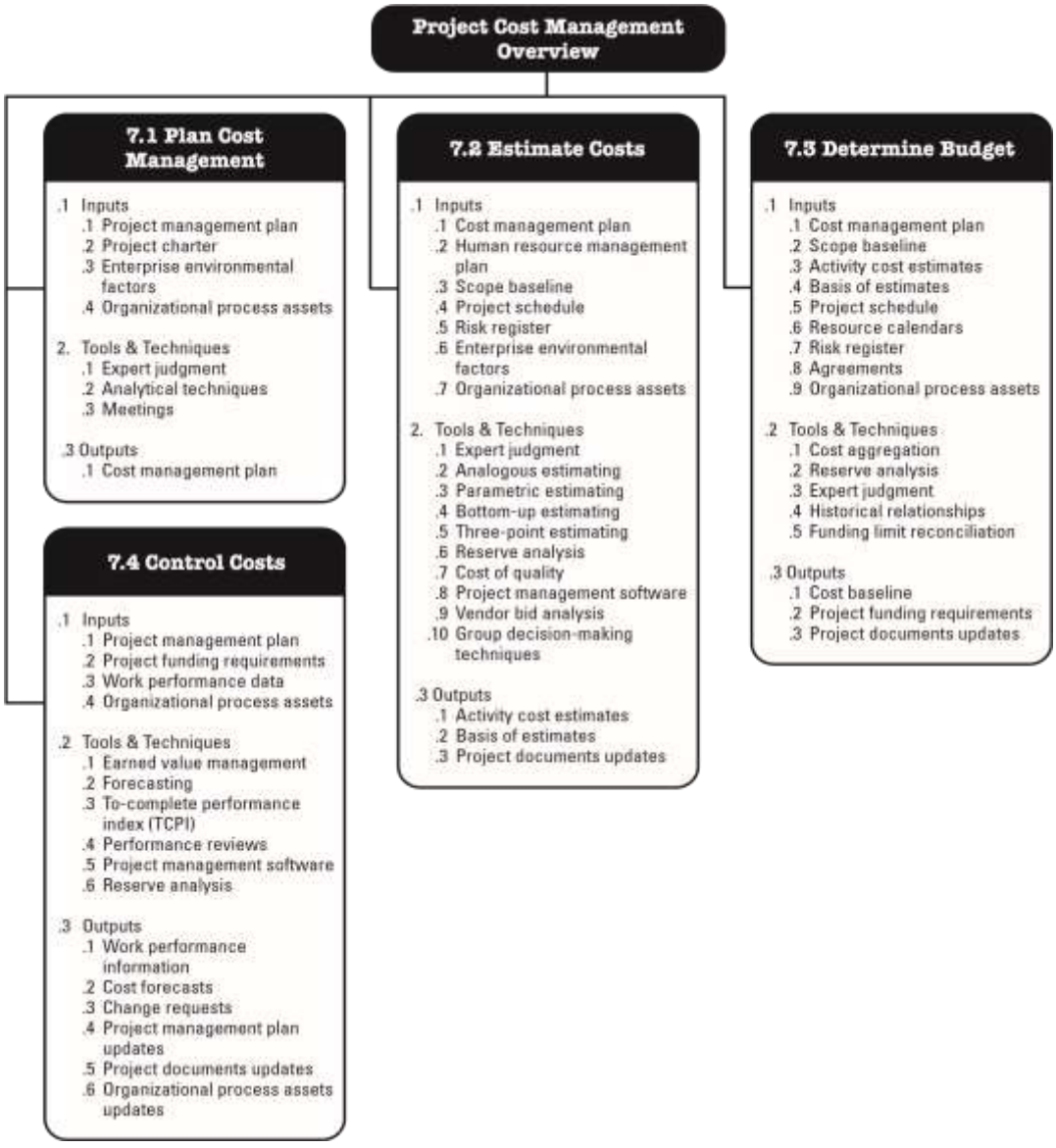


Figure: C6 Overview of Project Communications Management (PMI, 2013)

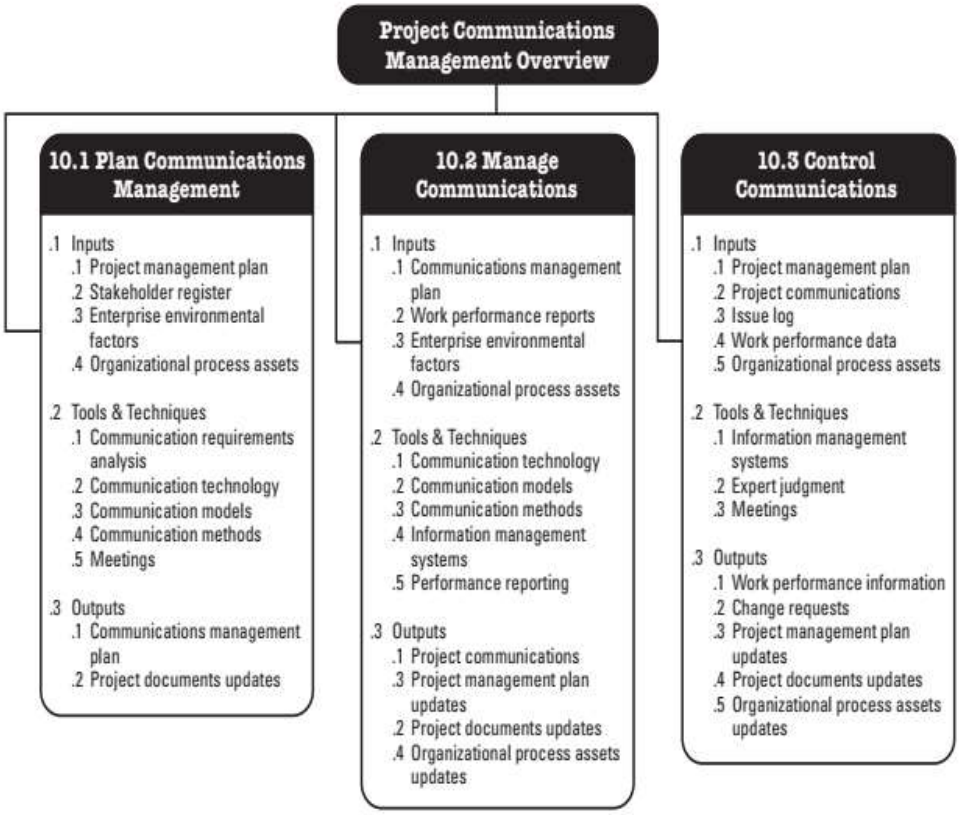


Figure: C5 Overview of Project Quality Management (PMI, 2013)

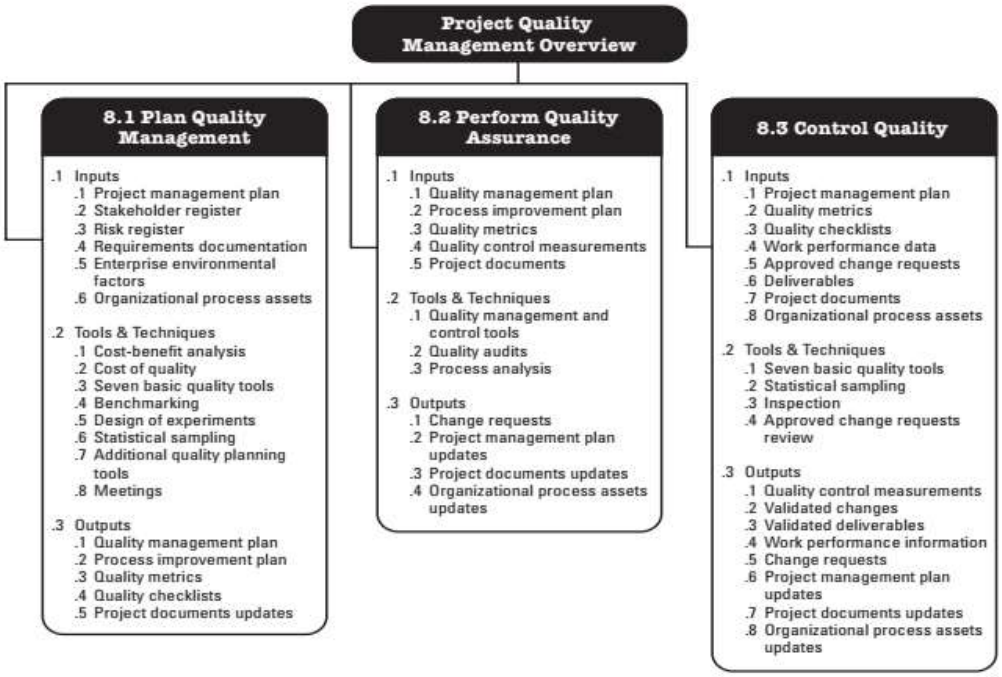


Figure: C9 Overview of Project Procurement Management (PMI, 2013)

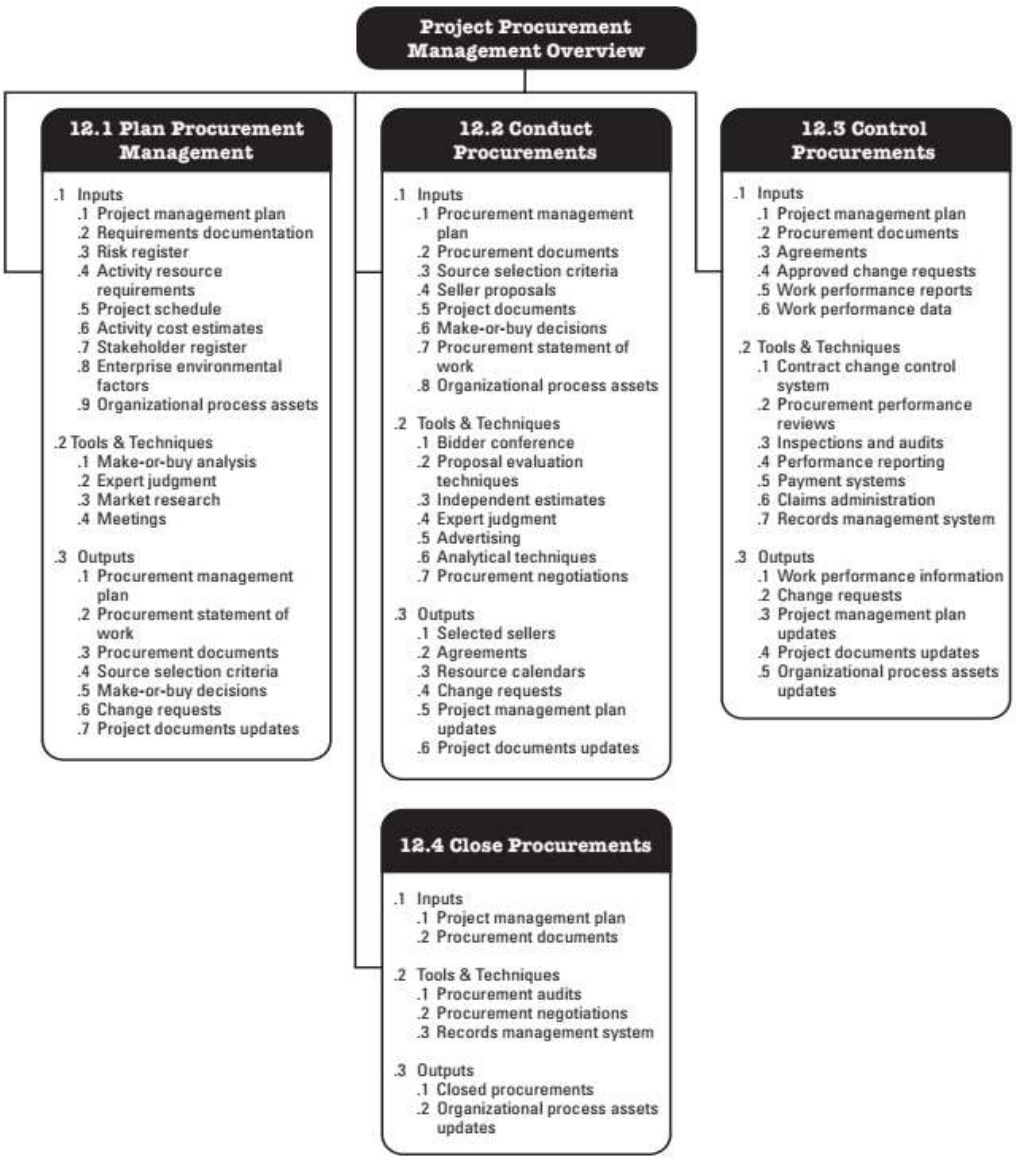
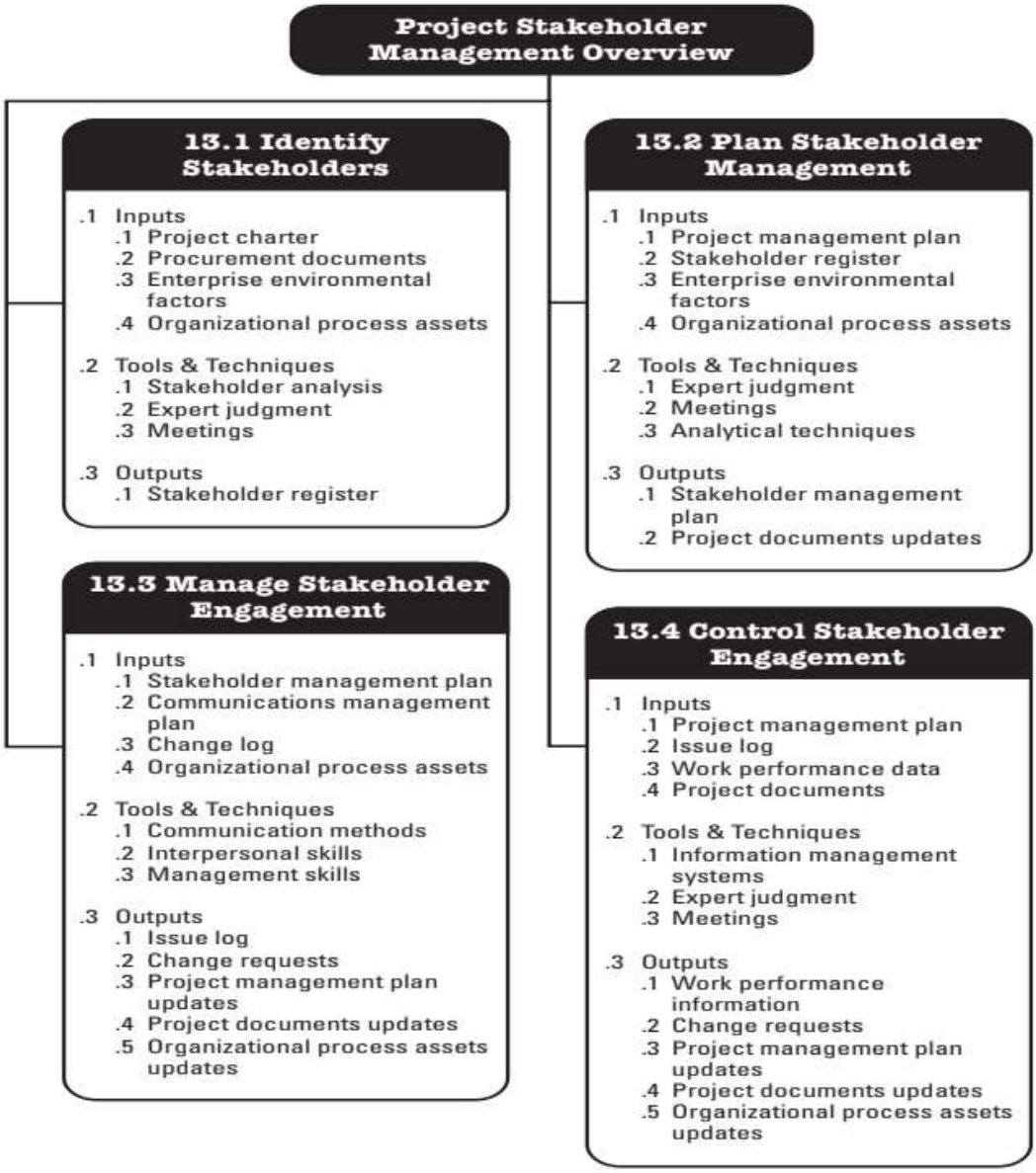


Figure: C10. Overview of Project Stakeholder Management (PMI, 2013)



Appendix: D. Definition of PMMM Levels

Level 1: Initial Process

Although there is a recognition that project management processes exist, there are no established practices or standards, and individual project managers are not held to specific accountability by any process standards. Documentation is loose and ad hoc. Management understands the definition of a project, that there are accepted processes, and is aware of the need for project management. Metrics are informally collected on an ad hoc basis.

Level 2: Structured Process and Standards

Many project management processes exist within the organization, but they are not considered organizational standards. Documentation exists on these basic processes. Management supports the implementation of project management, but there is neither consistent understanding and involvement nor an organizational mandate to comply for all projects. Functional management is involved in the project management of larger, more visible projects, and these are typically executed in a systematic fashion. There are basic metrics to track project cost, schedule, and technical performance, although data may be collected or correlated manually. Information available for managing a project is often a mix between summary-level data and detail-level data.

Level 3: Organizational Standards and Institutionalized Process

All project management processes are in place and established as organizational standards. These processes involve clients and internal customers as active and integral members of the project team. Nearly all projects use these processes with minimal exception—management has institutionalized the processes and standards with formal documentation existing on all processes and standards. Management is regularly involved in input and approval of key decisions and documents and in key project issues. The project management processes are typically automated. Each project is evaluated and managed in light of other projects.

Note: At Level 3, the processes must become tailor able to the characteristics of each project. An organization cannot blindly apply all processes equally to all projects. Consideration must be given to the differences between projects. The important point is to note how the processes are tailored, that is, to determine whether there is a process to customize the implementation of applicable processes and policies to a particular project.

Level 4: Managed Process

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.

Level 5: Optimizing Process

Processes are in place and actively used to improve project management activities. Lessons learned are regularly examined and used to improve project management processes, standards, and documentation. Management and the organization are focused not only on effectively managing projects, but also on continuous improvement. The metrics collected during project execution are used to both understand the performance of a project and to make organizational management decisions for the future.

Appendix: E. Self-Assessment Checklist of PM Solutions of

PMMM Self-Assessment Survey Checklist					
	Project Management Maturity Levels				
	1	*2*	*3*	*4*	*5*
Project Integration Management					
Project Charter Development	☐	☐	☐	☐	☐
Project Management Plan Development	☐	☐	☐	☐	☐
Project Execution	☐	☐	☐	☐	☐
Monitoring and Controlling Project Work	☐	☐	☐	☐	☐
Integrated Change Control	☐	☐	☐	☐	☐
Project or Phase Closure	☐	☐	☐	☐	☐
Project Management Office (PMO)	☐	☐	☐	☐	☐
Project Scope Management					
Scope Management Planning	☐	☐	☐	☐	☐
Requirements Collection	☐	☐	☐	☐	☐
Scope Definition	☐	☐	☐	☐	☐
Work Breakdown Structure	☐	☐	☐	☐	☐
Scope Validation	☐	☐	☐	☐	☐
Scope Change Control	☐	☐	☐	☐	☐

PMMM

PMMM Self-Assessment Survey Checklist (*Continued*)					
	Project Management Maturity Levels				
	1	*2*	*3*	*4*	*5*
Project Communications Management					
Communications Management Planning	☐	☐	☐	☐	☐
Communications Management (Information Distribution)	☐	☐	☐	☐	☐
Communications Control	☐	☐	☐	☐	☐
Issues Tracking and Management	☐	☐	☐	☐	☐
Project Risk Management					
Risk Management Planning	☐	☐	☐	☐	☐
Risk Identification	☐	☐	☐	☐	☐
Qualitative Risk Analysis	☐	☐	☐	☐	☐
Quantitative Risk Analysis	☐	☐	☐	☐	☐
Risk Response Planning	☐	☐	☐	☐	☐
Risk Control	☐	☐	☐	☐	☐
Risk Documentation	☐	☐	☐	☐	☐
Project Procurement and Vendor Management					
Procurement Management Planning	☐	☐	☐	☐	☐
Procurements Requisition and Solicitation	☐	☐	☐	☐	☐
Procurement Control and Vendor Management	☐	☐	☐	☐	☐
Procurement Closure	☐	☐	☐	☐	☐
Project Stakeholder Management					
Stakeholder Identification	☐	☐	☐	☐	☐
Stakeholder Management Planning	☐	☐	☐	☐	☐
Managing Stakeholder Engagement	☐	☐	☐	☐	☐
Controlling Stakeholder Engagement	☐	☐	☐	☐	☐

Continued

PMMM Self-Assessment Survey Checklist (*Continued*)					
	Project Management Maturity Levels				
	1	*2*	*3*	*4*	*5*
Project Time Management					
Time Management Planning	▭	▭	▭	▭	▭
Activity Definition	▭	▭	▭	▭	▭
Activity Sequencing	▭	▭	▭	▭	▭
Activity Resource Estimating	▭	▭	▭	▭	▭
Activity Duration Estimating	▭	▭	▭	▭	▭
Schedule Development	▭	▭	▭	▭	▭
Schedule Control	▭	▭	▭	▭	▭
Schedule Integration	▭	▭	▭	▭	▭
Project Cost Management					
Cost Management Planning	▭	▭	▭	▭	▭
Cost Estimating	▭	▭	▭	▭	▭
Budget Determination	▭	▭	▭	▭	▭
Cost Control	▭	▭	▭	▭	▭
Project Quality Management					
Quality Management Planning	▭	▭	▭	▭	▭
Quality Assurance	▭	▭	▭	▭	▭
Quality Control	▭	▭	▭	▭	▭
Management Oversight	▭	▭	▭	▭	▭
Human Resources Planning					
Human Resources Management Planning	▭	▭	▭	▭	▭
Project Team Acquisition	▭	▭	▭	▭	▭
Project Team Development	▭	▭	▭	▭	▭
Project Team Management	▭	▭	▭	▭	▭
Professional Development Management	▭	▭	▭	▭	▭

PMMM Self-Assessment Survey Checklist (*Continued*)					
	Project Management Maturity Levels				
	1	*2*	*3*	*4*	*5*
Knowledge Area Maturity Level					
Project Integration Management	☐	☐	☐	☐	☐
Project Scope Management	☐	☐	☐	☐	☐
Project Time Management	☐	☐	☐	☐	☐
Project Cost Management	☐	☐	☐	☐	☐
Project Quality Management	☐	☐	☐	☐	☐
Project Human Resources Management	☐	☐	☐	☐	☐
Project Communications Management	☐	☐	☐	☐	☐
Project Risk Management	☐	☐	☐	☐	☐
Project Procurement and Vendor Management	☐	☐	☐	☐	☐
Project Stakeholder Management	☐	☐	☐	☐	☐
Organizational Maturity Level	☐	☐	☐	☐	☐