ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
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Thesis on:

The relation and effect of project management maturity on the performance of contractors: The case of Ethiopian Grade 1 contractors

Prepared for Partial Fulfillment of the Degree of Executive Master of Business Administration [EMBA]

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Adviser: Dr. Lakew Alemu

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DECLARATION

I, Addisalem Nega, hereby declare that this thesis entitled: The relation and effect of PM Maturity on the performance of contractors: The case of Ethiopian Grade 1 contractors is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted in Addis Ababa University or any other institutions. Now, it is offered for the award of the degree of Executive Master of Business Administration from Addis Ababa University.

Addisalem Nega _____ _____

Signature Date

STATEMENT OF CERTIFICATE

This is to certify that this study entitled: The relation and effect of PM Maturity on the performance of contractors: The case of Ethiopian Grade 1 contractors was undertaken by Addisalem Nega for the partial fulfilment of Executive Masters of Business Administration at Addis Ababa University, is an original work and not submitted earlier for any degree either at this University or any other University. Now, it is submitted for examination with my approval as a thesis.

Dr. Lakew Alemu	_____	_____
Research Advisor	Signature	Date

STATEMENT OF CERTIFICATION OF ORIGINALITY AND QUALITY

This is to certify that the thesis prepared by Addisalem Nega entitled: The relation and effect of PM Maturity on the performance of contractors: The case of Ethiopian Grade 1 contractors was submitted in partial fulfilment of the requirements for the degree of Master of Executive Business Administration compiles with the regulations of the University and meets the accepted standards with respect to originality and quality.

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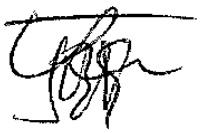
Signature: 

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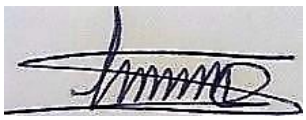
Signature: 

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LIST OF ABBREVIATIONS

CM: Construction Manager

CMM: Construction Management Maturity

DIN: Deutsches Institut für Normung (German Industry Norms)

EC: Ethiopian Calendar

EMBA : Executive Master of Business Management

GDP: Gross Domestic Product

HSSE: Health, Safety, Security, and Environment

KPI: Key Performance Indicators

MoUDC: Ministry of Urban Development and Construction

MS Excel: Microsoft Excel

PM: Project Management

PMBoK: Project Management Body of Knowledge

PMI: Project Management Institute

PMMM: Project Management Maturity Model

PMO: Project Management Office

SPSS: Statistical Package for the Social Sciences

UK: United Kingdom

USA: United States of America

ABSTRACT

The main objective of this study is to assess the relation and effect of Project Management Maturity on the performance of the Grade 1 contractors in Ethiopia in managing their organization and projects, and to determine the areas that need to be focused to improve and development project management excellence in the industry.

To achieve the intended research objective, the researcher used a quantitative research approach by collection of primary and secondary source mainly the primary data which are put to rigorous quantitative analysis. This research used descriptive analysis methods as it tries to describe the status of PM maturity in Grade 1 construction companies and measure the organizational and project performance of the contractors in relation to KPIs. A random sampling technique was used to get a more representative sample for the study because the sample is comprised of a homogeneous group. The study collected and validated data from 53 Grade 1 contractor and conducted full fledge analysis to measure the PM maturity of the contractors and its relation and effect on performance indicators. Project management maturity was evaluated using the maturity level of project management solutions processes described in PMBoK Project performance was evaluated using the key performance indicators proposed by (DETR, 2002).

The data were analyzed by statistical methods such as descriptive statistics, Cronbach's alpha, bivariate correlations, multi-linear analysis, and based on the findings, the PM maturity of Ethiopian grade 1 contractors is found to be 3,11-dimension maturity level of PM Solutions maturity model standards which means that Contractors have Organizational Standards and Institutionalized Process, or all projects use organizationally institutionalized formal standards. In is also found that Ethiopian Grade 1 contractors have a higher maturity level on scope, schedule, cost, quality, resource, procurement and financial management knowledge areas while they have less maturity on integration, communication, risk, stakeholder and HSSE management knowledge areas. In addition to that it is found that PM Maturity of each PM knowledge area can predict performance of contractors, and for that a performance prediction formula model is developed and accordingly it is possible to predict each key performance indicator and set priority project management knowledge excellence areas to improve organizational performance.

Key words: Ethiopian Grade 1 Contractors, Project Management, Project Management Maturity, Organizational Performance, Project Performance, Key Performance Indicators.

CHAPTER 1 – INTRODUCTION

1.1. BACKGROUND OF THE STUDY

The construction industry plays an important role in the economy of Ethiopia with an average GDP share of 18% and a growth rate of 20.7% and creating huge employment opportunities next to agriculture and service sectors (EEA, 2018). However, the industry is highly criticized for its poor project management in terms of adapting general project management procedures, project management functions, tools & techniques; particularly the level of practice in terms of safety, low risk, and time management (Ayalew, 2016; Derso, 2018). Besides, few studies show that the level of management practice in Ethiopia to be one of the lowest compared to other African countries, Europe and North America mainly due to poor managerial capacity of contractors project management capability to perform in business execution and performance, similar to other developing countries (Adams, 1997). Ethiopian contractors are faced with time overrun, cost escalation, serious quality defects, and poor definition of project scope due to poor project management (Ayalew, 2016). This indicates that project management is one of the main challenges of the Ethiopian construction industry, which needs to be researched and improved.

Thus, improving the project management capability of contractors needs to be one of the priorities to improv the capability of Ethiopian contractors by knowing the relation, effect, and gap between the project management knowledge areas with regard to the key performance indicators of construction works. It is utterly important to improve the management skills of contractors in developing countries and this can be done by knowing the gap of knowledge and PM Maturity (Dlungwana, 2004).

Hence, this research will assess the PM Maturity of contractors and study, identifying and suggesting improvement areas of the contractor's PM Maturity which may significantly contribute to the overall improvement of the contractor's capability to deliver projects successfully. In addition to that identifying the relationship between the PM Maturity and key performance indicators as well as knowing the effect will help to focus on specific knowledge areas to be profitable, and competitive in the market.

1.2. STATEMENT OF THE PROBLEM

Currently the Ethiopian construction sector is booming, i.e. building sub-sector by 37% and contributing much to direct and indirect job opportunity as well as urbanization and living standards of people (EEA, 2008). Despite its prominent role and becoming a booming sector, it is also faced with many challenges in its practice. Some of these challenges and gap are project overruns, poor quality, inappropriate procurement systems, and a failure to cope with project requirements and the inability to adopt best practices (Assefa, 2008; Ayalew, 2016; Mengesha, 2004; Zewdu, 2015). Most contractors have enormous project management problems to cope up with the development of the industry to be productive and competitive. Especially during the current unstable market situation, most companies are failing to deliver fast to the market with high-quality standards and efficient resource management, proper planning and implementation.

Studies show that developing the relationship between PM Maturity and the organizational performance of construction companies and knowing the effect within each other, will help companies to improve their project delivery in a systematic and sustained way. Much of the improvement emanates from identifying critical and priority areas, continually assessing results, and taking appropriate action on project management knowledge areas.

For example, Crawford (2015) suggested that to improve organization's service and be competitive in the market place and in projects, it requires knowledge of where the status of the project management practice and maturity level and its implication on the performance of the organization, were desired to go, and the relation between the two perspectives.

To address these challenges, it is important to assess the maturity of the contractors in the area of project management and understand its effect on the key performance indicators. Thus, the critical question is to know, if there is any relation between PM Maturity and project performance in the Ethiopian construction industry considering Grade 1 contractors so as to fill the gap in knowledge and implementation. Grade 1 contractors are classified as the biggest operating entities qualified to undertake construction works such as building, roads, railways, bridges, airports, and dams; and handle project sizes above Eth. Birr 350,000,000.00 as stated in registration information of contractors by MoWDC.

Accordingly, this research tried to find out any research done on the Ethiopian contractors' PM Maturity and its relationship, effect and implication on organizations performance. The one conducted by Yimam (2011) found that the Ethiopian contractors PM Maturity is 0,9 (basic – lower level) compared to the standard for project management effectiveness as defined by the PM Maturity Model. The research was conducted on 13 Grade one contractors and had little to say on the relationship and effect of the PM Maturity on the performance of the contractor.

Another research by Haile (2016) showed that foreign contractors, that of China. have better performance in key performance indicators than the local once because of their project management and implementation capability. As a result, Ethiopian contractors have high-grievance on Chinese contractors for taking high end big project works while they are struggling to finish projects at hand, faced with knowledge gap on understanding of the relation and effect of project management against key performance indicators, resulting into unsuccessful, unproductive and less competitive in the industry.

Hence this research will have a significant contribution to fill the gap, primarily by doing critical studies of determining where the contractor's PM Maturity level is now, and where they need to go, and how these all can correlate with performance indicators and help contractors to increase their capability. The research will try to develop a conceptual framework which links project management body of knowledge areas with performance key indicators.

1.3. RESEARCH QUESTION

The research question deals with the main project management competencies from the contractor's perspective and tries to answer the following research questions.

a. What is the current level of PM Maturity of the Grade 1 local construction contractors?
b. How are Project Management knowledge areas being practiced by the construction companies and contribute to improving their capability to deliver projects?
c. What is the relationship and effect of PM Maturity on key performance indicators and which Project Management knowledge areas have significance to improve the performance of contractors?

d. How can project management maturity predict and impact performance of contractor?

1.4. OBJECTIVES OF THE STUDY

1.4.1. General Objective

The main and general objective of this study is to know and develop a conceptual and statistical relationship model that links project management knowledge areas with the performance of Grade 1 contractors of Ethiopia. The research has assessed the PM Maturity of Grade 1 contractors, its relationship, and the effect of dependent variables such as key performance indicators which could be of critical importance in the organization's success.

1.4.2. Specific Objective

To achieve the general objectives of this study, the following specific objectives are identified. These are:

a) Assessing the current PM Maturity level of Grade 1 contractors of Ethiopia in all PM body of knowledge areas
b) Find out the relationship and effect between PM Maturity level and performance of contractors (Organizational and Project level)
c) Further to this, the research will determine whether and to what extent the project management knowledge maturity of contractors have relation, effect and prediction capability, on key performance indicators and develop conceptual relationship model.
d) And finally, to identify the most highly influential project management areas which are a major impact on performance indicators.

Besides that, key results will be summarized, and suggestions for improvement will be identified to enable organizations to take advantage of it.

1.5. SIGNIFICANT OF THE STUDY

The major significance of this study working in the area of project management is:

a) The maturity assessment result of this research can be used as an initial benchmarking to prioritize and design interventions in the construction sector of Ethiopia. Further, the result can also be used as a source of information to start and compare the success of or impact of the future improvement effort and assist on project management excellence and operational strategies in the construction industry.

b) The study will help in providing clear information of the current state of the Grade 1 contractors in Ethiopia and defines future improvement and development potential.
c) The study is helpful for my professional development and decision-making role in the following ways
    - The research helps me as being a thesis of EMBA in the project management area.
    - Being a project management professional and civil engineer, it can help me in the decision-making role and advisory services in the area.
d) The study could also open the door for other researchers to study more on PM Maturity areas and specifically its relationship with performance indicators and other support services in the construction industry market system.

1.6. SCOPE OF THE STUDY

This study on the effect of PM Maturity on the performance of the contractors is limited in scope to the following:

a) The research is limited to the project management practice maturity and its relationship, effect and impact on the performance of Grade 1 contractors in Ethiopia.

b) Due to a shortage of time, this study is only the perspective of the contractors and it will not consider other stakeholders like project owners, investors, consultants and project management agents which could lead to a different result.

c) The study will cover only Grade 1 contractors in Ethiopia.

1.7. LIMITATION OF THE STUDY

Because of the limitation of time and resources, this study is based on a self-administered questionnaire only to study the Ethiopian Grade 1 contractor PM Maturity and its effect on organizational performance. Other data collection options such as interviews and focus group discussions were not used. Similarly, the research adopted only the American project management institute established questionnaires and that of British construction KPI's standards. Since there are no institutionalized key performance indicators for the Ethiopian

construction industry, this study only considers sources from other countries like the British construction KPI.

In this study there is a limitation to collect more data because of the country's economic and political situation where contractors resisted giving information about their organization. And as a result, it creates limitation which is less data for the analysis of multiple variables which ultimately affects the multilinear linear regression analysis to see the cause and effect relationship clearly. In general, there is a limitation of less data for a lot of variables. Another limitation of the data is its quality where 9 questionnaires were completely rejected due to quality problems.

Problems encountered while conducting this research are delays on replies from the contractor and extended appointment to get the completed questionnaires and reluctant to assess critical points which might expose companies' internal issues.

This research is also not considered the view of the consultants and clients except in the validation of the questionnaire.

1.8. CONCEPTUAL FRAMEWORK

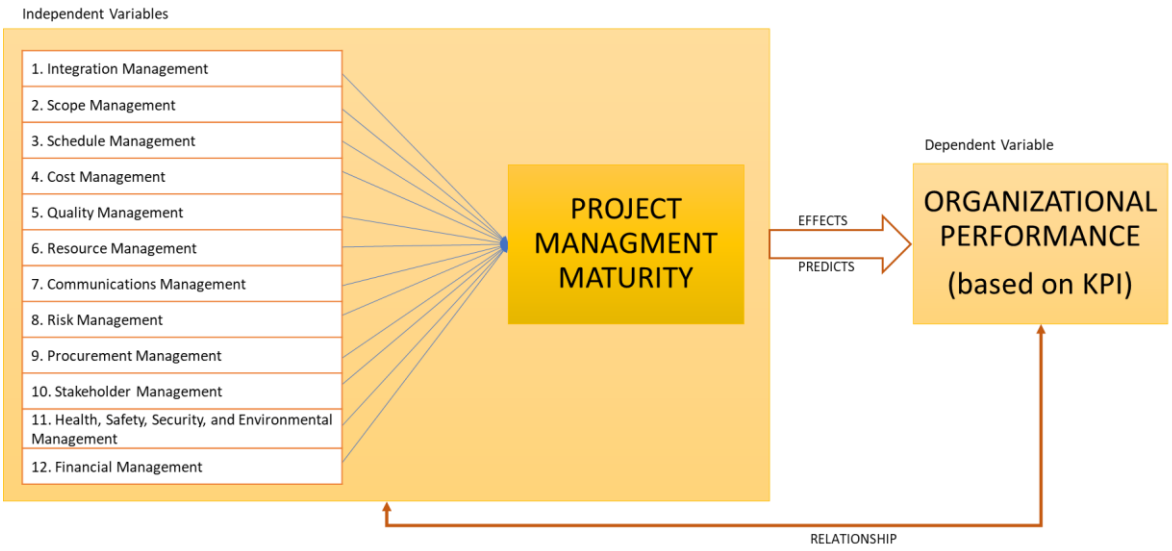

Figure 1: Conceptual framework of the study

1.9. RESEARCH MOTIVATION

In this research on such a very broad topic for my master thesis's, I deliberately and ambitiously work because of the following reasons:

a) I have been working in the sector for the past 15 years and observe gaps in skill, knowledge and managing projects comparing with the global standards and therefore I want to broaden my knowledge on that and support also the sector with new ideas to narrow the gap.
b) My desire to work on the project management area and contribute something to the local construction industry that companies may use recommendation the research.
c) My desire to propose innovative recommendations to G1 contractors based on scientific research on reducing the gaps in project management and ways of improving their performances compared to their international competitors.
d) The desire to give knowledge input on the area of the relation of PM Maturity and performance of contractors.

1.10. ORGANIZATION OF THE RESEARCH REPORT

This research work has five chapters. Accordingly, chapter one deals with introduction which highlights the background about these research work; chapter two focuses on literature and concepts of project management and performance in general; chapter three presents the research methodology and materials and methods adopted for the study; chapter four deals with data presentation, discussion, and interpretation of research results. The last chapter is where the conclusion and recommendations are presented.

CHAPTER 2 – LITERATURE REVIEW

2.1. GENERAL

In this Chapter, all necessary literature related to the concepts of project and project management, PM Maturity in the construction industry, and performance of contractors is discussed in detail. Previous practical studies are reviewed briefly, and the appropriate model used to assess the contractors reviewed.

2.2. DEFINITION OF PROJECT

The term project comes from the Latin term 'projectum' back and means 'thrown forward'. And for project business management definitions have been available since the mid-20th century. Since then lots of definitions have been proposed.

According to the definition of PMI, a project is a temporary endeavour undertaken to create a unique product, service, or result. PMI (2017) further explained a project as a sequence of unique, complex, and connected activities that have one goal or purpose and that must be completed by a specific time, within budget.

Similarly, Kerzner (2009) stated that a project can be defined as any series of activities and tasks that have a specific objective to be completed within certain specifications, have defined start and end dates, have funding limits (if applicable), consume human and non-human resources, are multifunctional . British standard 6079 and Maylor (2010) detailed that project has also been defined as a unique set of co-ordinated activities, with definite starting and finishing points, undertaken by an individual or organization to meet specific performance objectives within a defined schedule, cost and performance parameters'.

The common theme of these definitions revolves around some important features of projects. The features include a defined time frame (temporary), an objective from the inception, resources and their limitations, and specifications and others. J.M. Juran also defined a project in terms of a problem scheduled for solution (Godfrey, 1998).

The task of the project is to deliver a particular product, service or result (Maylor, 2010). Projects must have a single goal. However, very large or complex projects may be divided

into several subprojects, each of which is a project in its own right (Wysocki, 2014). Nicholas (2012) also stated that, a project involves a single, definable purpose and well-defined end-items or deliverables.

2.3. DEFINITION OF PROJECT MANAGEMENT

The definition given by PMI for a Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements and accomplished through integration of five process groups (PMI, 2017). These process groups are:

A. Initiating phase

During the initial phase of project, project objective or need is defined where a business problem or opportunity is identified, where sometimes it is known as the business case. To investigate whether each option addresses the project projective objective and to come up with recommended solutions, feasibly studies are conducted. Most of the time feasibility studies try to answer two questions “can we do” and “should we do” the project. The answers to these questions lead to the project initiation and appointment of project manager, whom usually lead to detail project planning.

B. Planning phase

During planning phase, three fundamental components are needed to be completed, i.e. scope of work, scheduling, and estimating the costs. project teams will have to agree on the key activities or task to be undertaken along with the strategy for projecting them. Such activity will have to tie by responsibilities and time frames. The last thing to do will be budgeting which needs to be costed against her respective activities and expenditures are monitories. the team identifies all the work to be done. The project’s tasks and resource requirements are identified, along with the strategy for producing them. This is also referred to as “scope management.” A project plan is created outlining the activities, tasks, dependencies, and timeframes. The project manager coordinates the preparation of a project budget by providing cost estimates for the labour, equipment, and materials costs. The budget is used to monitor and control cost expenditures during project implementation.

This is an excellent time to identify and try to deal with anything that might pose a threat to the successful completion of the project. This is called risk management. In risk management,

"high-threat" potential problems are identified along with the action that is to be taken on each high-threat potential problem, either to reduce the probability that the problem will occur or to reduce the impact on the project if it does occur. This is also a good time to identify all project stakeholders and establish a communication plan describing the information needed and the delivery method to be used to keep the stakeholders informed.

Finally, a quality plan, providing quality targets, assurance, and control measures, along with an acceptance plan, listing the criteria to be met to gain customer acceptance will be documented. At this point, the project would have been planned in detail and is ready to be executed.

C. Executing phase

During the third phase, the implementation phase, the projects will be in action motion and the actual performance of the work is initiated. It is important to maintain control and communicate as needed during implementation. During the implementation phase, project managers are responsible o monitor the day to day Progress of the project and make adjustments as appropriate and documented for any changes for evidences. In any project, a project manager spends most of the time in this step. During project implementation, people are carrying out the tasks, and progress information is being reported through regular team meetings. The project manager uses this information to maintain control over the direction of the project by comparing the progress reports with the project plan to measure the performance of the project activities and take corrective action as needed. The first course of action should always be to bring the project back on course (i.e., to return it to the original plan). If that cannot happen, the team should record variations from the original plan and record and publish modifications to the plan. Throughout this step, project sponsors and other key stakeholders should be kept informed of the project's status according to the agreed-on frequency and format of communication. The plan should be updated and published on a regular basis.

Status reports should always emphasize the anticipated end point in terms of cost, schedule, and quality of deliverables. Each project deliverable produced should be reviewed for quality and measured against the acceptance criteria. Once all of the deliverables have been produced and the customer has accepted the final solution, the project is ready for closure.

D. Project monitoring and controlling phase

Project shall be monitored through its lifecycle, including the executing stage. Monitoring and controlling includes defending the project against scope creep (unapproved changes to the project scope), monitoring the project progress and performance to identify variance from the plan, and recommending preventive and corrective actions to bring the project in line with the planned expectations in the approved project management plan.

Requests for changes, such as change to the project scope, are also included in this stage; they can come from you or from any other project stakeholder. The changes must go through an approval process, and only the approved changes are implemented. The processes used in this stage fall into a group called the monitoring and controlling process group.

E. Closing phase

During the final closure, or completion phase, the emphasis is on releasing the final deliverables to the customer, handing over project documentation to the business, terminating supplier contracts, releasing project resources, and communicating the closure of the project to all stakeholders. The last remaining step is to conduct lessons-learned studies to examine what went well and what didn't.

Project closure is one of the most oft-overlooked phases of the project management life cycle and yet it's no less important than any other phase of the life cycle. Project closure involves the following steps:

- Writing a project closure report. This report includes information such as the project sign off, releasing of the staff, cost management and schedule management strategies, lessons learned through the project, and what the results of the project were.
- Redistributing resources that were assigned to the project.
- Filing any administrative paperwork regarding the project's completion.
- Preparing any stepping stones for the next project.

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

Kleim (1998) also defined project management in a way that combines the above two, stating that Project management is the tools, techniques, and processes for defining, planning, organizing, controlling, and leading a project as it completes its tasks and delivers the results.

2.4. PROJECT MANAGEMENT KNOWLEDGE AREAS

Project management knowledge area represents a complete set of concepts, terms, and activities that make up a professional field, project management field, or area of specialization and they are used on most projects most of the time (PMI, 2017). According to PMI there are ten knowledge areas that are used on most of the time while the PMI Construction extension to the PMBOK Guide added additional two PM knowledge areas for the construction sector to make a total of 12 Knowledge Areas which are discussed below and considered in this study.

To get an impression of the current state of the use of terms in literature and to get economic practice, the international perspective considers significant standards for project management. The main ones are German DIN standard 69901, the British PRINCE 2 standard and the American one Project Management Body of Knowledge (PMBOK). These project management standards are very important for business practice, because they serve as the basis for the certification of project managers as well recognized as authoritative by government agencies. And in this thesis the definition of the PMBOK which define project as a temporary endeavour undertaken to create a unique product, service, or result can be taken as a standard definition for project (PMI, 2017).

2.4.1. Project Integration Management

Project Integration Management includes the processes and activities to identify, define, combine, unify, and coordinate the various processes and project management activities within the Project Management Process Groups. In the project management context, integration includes characteristics of unification, consolidation, communication, and integrative actions that are crucial to controlled project execution through completion, successfully managing stakeholder expectations, and meeting requirements. Project Integration Management includes making choices about resource allocation, making trade-offs among competing objectives and alternatives, and managing the interdependencies among the project management Knowledge Areas (PMI, 2017).

2.4.2. Project Scope Management

Project Scope Management includes the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. Managing the project scope is primarily concerned with defining and controlling what is and is not included in the project (PMI, 2017).

2.4.3. Project Schedule Management

Project Time Management includes the processes required to manage the timely completion of the project (PMI, 2017). The overall purpose of time management is to develop a project schedule, manage to that schedule, and ensure that the project completes within the approved time frame. Time management involves defining project activities, developing the schedule, executing the schedule, and controlling the plans during project execution.

2.4.4. Project Cost Management

Project Cost Management includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget (PMI, 2017). The overall purpose of cost management is to determine the total costs of a project, manage to those costs, and ensure the project completes within the approved budget. Cost management involves estimating the costs of identified resources, developing a project baseline, comparing progress against the baseline, and controlling costs.

2.4.5. Project Quality Management

Project Quality Management includes the processes and activities of the performing organization that determines quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. Project Quality Management uses policies and procedures to implement, within the project's context, the organization's quality management system and, as appropriate, it supports continuous process improvement activities as undertaken on behalf of the performing organization (PMI, 2017). The overall purposes of quality management are (1) satisfying customers, (2) conforming to requirements, (3) achieving fitness for purpose, and (4) ensuring products or services are fit for use. All these activities or tasks are required to make sure an organization's products or

services satisfy all needs for which they are intended (as documented in the statement of work) from the perspectives of processes and the people needed to make quality an effective and efficient aspect of successful project completion. Management oversight is included as a special interest component of this knowledge area because executive support is key to improving and ensuring process quality, as well as the quality of deliverables.

2.4.6. Project Resource Management

Project Resource Management includes the processes to identify, acquire, and manage the resources needed for the successful completion of the project. These processes help ensure that the right resources will be available to the project manager and project team at the right time and place (PMI, 2017). Construction projects utilize a variety of resources, such as human resources, machinery and tools, equipment and bulk materials, and others. Factors such as project site location, type, and size should be taken into account when mobilizing, utilizing, and demobilizing resources. Project Resources Management includes aspects such as acquiring, handling, storing, and monitoring validity terms for particular goods, as well as staffing, team building, and honing interpersonal skills. The human resources who manage and execute project activities manipulate other resources in order to build the product of the project.

2.4.7. Project Communications Management

Project Communications Management includes the processes that are required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and the ultimate disposition of project information. Project managers spend most of their time communicating with team members and other project stakeholders, whether they are internal (at all organizational levels) or external to the organization. Effective communication creates a bridge between diverse stakeholders who may have different cultural and organizational backgrounds, different levels of expertise, and different perspectives and interests, which impact or have an influence upon the project execution or outcome (PMI, 2017).

The overall purpose of communications management is to oversee and control project data processes from collection to categorization to dissemination to utilization and decision making.

2.4.8. Project Risk Management

Project risk management includes the processes for conducting risk management planning, identification, analysis, response planning, and controlling on a project. Project risk management is essential for successful project management and should be applied throughout a project's life cycle. The root objectives of project risk management are to increase the likelihood and impact of positive events or opportunities while decreasing the likelihood and impact of negative events or threats to the project. Project risk management can be considered an extension of other project management processes, for example, addressing the uncertainty in project estimates and validity of assumptions. Project risk management assists stakeholders by providing greater certainty about project outcomes, reducing risk exposure, determining project strategies for bidding and contract negotiation, and estimating the cost and schedule for contingency reserves (PMI, 2016).

2.4.9. Project Procurement Management

The Project Procurement Management section presents additional considerations for planning, executing, monitoring and controlling, and closing procurement on construction projects. It includes the processes required to acquire design and engineering services and construction-related materials, equipment, machinery, and services. It includes the acquisition of all goods and services to design and construct a new residential home, transportation route, electrical or water utility, public infrastructure, or manufacturing facility, or the disposition/decommissioning of an outdated facility, often including the financing for these procurements (PMI, 2016).

2.4.10. Project Stakeholder Management

Project stakeholder management includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution (PMI, 2017). Specifically in the construction industry it involves managing the stake holders on the side of the owner and the contractor which means the owner typically mobilizes stake holders such as Financing institutions; Professional designers and technical consultants, architects, and engineers; agency construction manager (CM), Inspection third parties; Licensors of proprietary technology and process engineers; Lawyers and external

legal advisors; Insurance companies; and Administrative and regulatory organizations while the contractor mobilizes Subcontractors, Lawyers and external legal advisors, Insurance companies, and Equipment and material suppliers. Other stakeholders may be involved in the project due to their own interests, such as local communities (PMI, 2016).

2.4.11. Project Health, Safety, Security, and Environmental Management (HSSE)

Despite the PMBOK Guide does not include this knowledge area as a dedicated section to HSSE management, it is generally accepted as a primary component for managing construction projects. Because project health, safety, security, and environmental management processes include all activities of the project sponsor/owner and the performing organization. These activities determine safety and environmental policies, objectives, and responsibilities to ensure the project is planned and executed in a manner that prevents accidents so as to avoid personal injury, fatalities, or property damage. For convenience, the term safety management is used throughout this Construction Extension to include both safety management and health management. Project safety and environmental management interacts with all other project management processes and Process Groups (PMI, 2016).

2.4.12. Project Financial Management

Project Financial Management determines how the project will be financed, including the processes to acquire and manage the financial resources for the project. It is more concerned with revenue sources and monitoring net cash flows for the construction project than with managing day-to-day costs. While construction professionals are skilled in the technical side of their work, they often lack financial management knowledge and understanding. Research has shown that project managers in construction need to know financial management fundamentals in order to better understand and navigate the financial decisions that are part of every construction project.

This section presents important considerations on financial management relative to privately funded construction projects. Government or public construction funding may vary by the country and jurisdiction where the financial solution is being considered.

2.5. PROJECT MANAGEMENT MATURITY

The trend of using maturity models for increasing organization's performance have been increasing in recent years (Crawford, 2010). Maturity in organizational context is a state that creates perfect condition for organization to achieve its desired objectives (Mateen, 2015). Mateen (2015) also quoted Andersen (2003) who stated that maturity, when applied to projects of organization, provides perfect condition to handle projects. The use of maturity models in the diagnosis of Project Management culture in organizations; especially aim to identifying weaknesses and strengths in their project management processes, so that it can then define a set of actions and measures to better its performance as an organization (Ferreira, 2015)

2.6. BENEFITS OF PROJECT MANAGEMENT MATURITY

The main advantage of project management is that is helps project managers to manage projects effectively, enabling them to resolve problems more quickly and the main benefits of project management are listed below (INI, 2020).

- improve chances of achieving the desired result
- gain a fresh perspective on project, and how it fits with business strategy
- priorities business' resources and ensure their efficient use
- set the scope, schedule and budget accurately from the start
- stay on schedule and keep costs and resources to budget
- improve productivity and quality of work
- encourage consistent communications amongst staff, suppliers and clients
- satisfy the various needs of the project's stakeholders
- mitigate risks of a project failing
- increase customer satisfaction
- gain a competitive advantage and boost your bottom line

2.7. PROJECT MANAGEMENT MATURITY MODELS FOR THE CONSTRUCTION SECTOR

Maturity Models are process models (measurement tools) that are developed to assess the maturity of organization's (can also be business unit, or department) processes and practices to identify opportunities for improvement and point out strengths and weaknesses. Maturity models are also used as a framework to guide improvement efforts (Cleland, 2002). The

majority of maturity models generally consist of description of maturity levels, model of Processes to be assessed, Assessment tools and a model that guides the improvement path to the next level of maturity. The majority of maturity models have adapted the CMM's five levels of maturity stage beginning from lower level of maturity, initial (Level 1), to the highest level of maturity, continuous improvement (Level-5). According Chrissis (2003) the commonly used concept of five stages or maturity levels goes back to Crosby in Quality Is Free, which described a five-level scale with "world-class" as level 5, as sighted by Yimam (2012).

The application and development modern project management technology, PM Maturity model made great progress and become a tool. The development and application of project management has entered a new era. As a tool of measuring, comparing and improving the ability of project management, PM Maturity model has become the academic circles. Through the evaluations of definition of the process, perfection and the effectiveness of the management and control, PM Maturity models have become a favorable tool for improving a strategic ability and market competitiveness (Chang, 2014). Every construction investment is a project requiring close coordination, the freedom of access to the information, the application of special activity techniques and most of all the high level of maturity of construction project management. Maturity assessment is an instrument to help an organization in assessing and determining the degree of maturity of its implementation process.

An assessment of the organization using the model, Identified the gaps or areas for improvement, create a plan to implement changes and reassess after the changes were implemented the organization should consider the continued use of the model, either for monitoring existing levels of maturity or continuing to advance toward new goals new in maturity. These decisions should be based on the needs of the organization, the value that the subsequent changes have on the organization, and the ability of the organization to make the necessary changes. Despites the lack of standard, more and more project management practitioners are beginning to embrace the value of maturity models (PMI, 2017)

The construction industry can use project management and systematic PM Maturity models to improve their project implementation performance. However, the maturity level of Grade 1 construction companies in Ethiopia in relation to performance is so far little known, or specific research papers are not available to this date. However, these days more and more

companies interested on project management as a core strategy for remaining competitive in today's highly competitive business environment. Yimam (2012) recommended to do further research to determine the overall PM capability of the industry while he is doing his master's thesis specifically on the Ethiopian contractor's maturity level models.

There are a number of PM Maturity models to determine the maturity of an organization, some of which include:

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

Choosing a Model for PM Maturity Assessment

According to Man (2007) the evaluation of maturity models for PMMMs could be developed along three dimensions. These are structure, applicability and usage.

Using the above three criteria and other characteristics of the models, the researcher has chosen to apply the PM Maturity Model (PMMM) that was presented by PM Solutions to assess the PM Maturity of the PMO of the Ethiopian Grade 1 contractors.

The reason is that the model is well structured with a two-dimensional framework which is based on accepted industry standards. The first dimension reflects the level of maturity. It is based on the structure of the SEI Capability Maturity Model. The second dimension depicts the key areas of project management addressed. It adopts the structure of the PMI's nine knowledge areas. The model has been used by many researchers in assessment of PM Maturity of various organizations. It is relatively easy to use, and the outcomes of the model are applicable to enhance the maturity of organizations towards project management.

In addition, using the model has the following advantages:

- Has well defined knowledge areas and processes devised by the PMI.

- Has well defined maturity levels.
- Integrates various PM Maturity models.
- It illustrates a series of steps to help an organization improve its overall PM effectiveness.
- Up to date knowledge areas and processes can be included.

2.8. PROJECT MANAGEMENT MATURITY MEASUREMENT

Like the CMM and PMMM by Kerzner (2001), the PM Maturity by PM Solutions also follows the five levels of process maturity and PM knowledge areas from the Project Management Institute's PMBOK guide. The model is helpful to measure an organization's PM Maturity and to direct organizations towards important PM capabilities that organizations should acquire in order to achieve project management growth and excellence. The five levels of PM Solutions are mentioned below

- Level 1: Initial Process - Not established practices or standards. Metrics and project documentation are informally collected.
- Level 2: Structured Process and Standards - Basic metrics and project documentation are present but no organizational standard is set.
- Level 3: Organizational Standards and Institutionalized Process - All projects use organizationally institutionalized formal standards.
- Level 4: Managed Process - Metrics are used to manage projects and integrated into other corporate systems to maximize overall organizational performance.
- Level 5: Optimizing Process - Lessons Learned is routinely studied to improve PM processes.

2.9. PERFORMANCE MANAGEMENT

2.9.1 Definition

A performance management is a systematic approach to improve their goals through an ongoing process of establishing strategic performance objectives, measuring performance, collecting, analyzing, reviewing, reporting performance data and using that data (Kim, 2007).

2.9.2. Performance Measurement

Performance measurement is defined as the process of evaluating performance relative to a defined goal. It provides a sense of where we are and, more importantly, where we are going (Rose, 1995). Rose (1995) further stated that measurement can guide steady advancement toward established goals and identify shortfalls or stagnation. Willis (1996) maintained the importance of measuring performance because it will indicate status and direction of a project.

Performance measurement is also the process of quantifying the efficiency and effectiveness of actions. For a performance measurement system to be regarded as a useful management process, it should act as a mechanism that enables assessment to be made, provides useful information and detects problems, allowing judgment against certain predetermined criteria to be performed (Neely, 2005).

However, Kumaraswamy (1999) considered variety criteria in measuring a project and organizational performance. This includes meeting budget, schedule, the quality of workmanship, stakeholder's satisfaction, transfer of technology, and health and safety. Similarly, Chan (2000) noted that various other key components also used in measuring project performance such as health and safety, environmental performance, user expectation/satisfaction, actor's satisfaction and commercial value. Therefore, in this study, nine variables have been identified for measuring project performance. They are cost, time, quality, clients' satisfaction, health and safety and functionality.

According to Sarhan (2013) the most common performance measurement technique for construction organizations are the key performance indicators (KPIs) and many organizations still rely heavily on the experience of their managers as means for performance measurement.

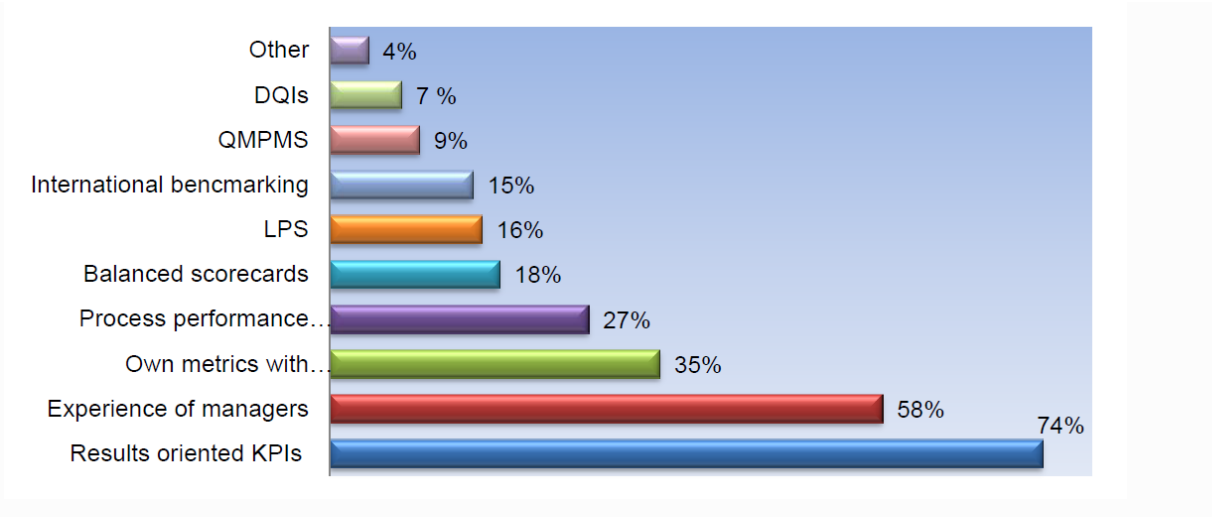

Figure 2: Techniques used by construction organizations for performance measurement (Sarhan, 2013)

2.9.3. Key performance indicators

The existent literature on performance measurement systems in construction industry focuses primarily on benchmarking systems based on KPIs. The important consideration in selecting KPIs for assessment and getting the right data is the accuracy of the data flowing into the KPI, and the reliability of the KPI in predicting construction performance. In this regard, it is advantageous to select the KPI to get the relevant information and how accurate the data to reflect the performance of the organization

Following the publication of Egan's Report, Egan (1998), the first initiative of benchmarking in the construction industry was launched in the United Kingdom (UK), with the appointment of 10 "Key Performance Indicators", and is currently led by Construction Excellence Organization and working groups.

The parameters consist of consist of seven project performance indicators; construction cost, construction time, cost predictability (design and construction), time predictability (design and construction), defects, client satisfaction with the product and client satisfaction with the service; and three company performance indicators namely; safety, profitability and productivity. However, most of these indicators, such as construction cost, construction time, quality, client satisfaction with the product and service, profitability and productivity, promote result-orientated thinking, whereas predictability of design cost and time, and

predictability of construction cost and time, and safety can be regarded as process-orientated thinking.

Other relevant benchmarking platforms emerged in the Construction industry, which focuses on construction performance measures, such as the initiatives was developed in Brazil, Denmark, Portugal, Chile and the United States of America (Costa, 2006). This benchmarking programs generally allow: a) guide to performance measurement; b) provide benchmarks that can be used by various companies to establish business goals and objectives; and c) identify and disseminate best practices in the industry through reports, networking and benchmarking clubs.

Table 1: Summary of available previous studies on performance indicators at company level[1]

No.	Author	Country	Performance Indicators
1	(DETR, 2002)	UK	1. Profitability 2. Productivity 3. Return on capital employed 4. Return on value added 5. Ratio of value added 6. Interest cover 7. Repeat business
2	(DTI, 2002)	UK	1. Customer satisfaction 2. People 3. Environment
3	(M. El-Mashaleh, 2003) and (M. El-Mashaleh, Minchin, R., O'Brien, W., 2007)	USA	1. Schedule performance 2. Cost performance 3. Client satisfaction 4. Safety 5. Profitability
4	(Yu, 2007)	Korea	1. Profitability 2. Growth 3. Stability 4. Customer satisfaction 5. Market share 6. Development 7. Technological capability 8. Business efficiency 9. Informatization 10. Organization competency
5	(Nudurupati, 2007)	UK	1. Quality 2. Clients satisfaction 3. Employee satisfaction 4. Environment impact 5. Safety 6. Time 7. Cost
6	(Wang, 2010)	USA	1. profitability 2. Return on capital 3. Cash flow 4. Reliability

[1] (Source: 1-7. Adopted from Hany Abd Elshakour M. Ali, Ibrahim A. Al-Sulaihi *, Khalid S. Al-Gahtani Source: 8-10 - Adopted from Mbugua et al., (1999) cited in Takim, R and Akintoye, A (2002).)

			5. Customer focus 6. Market shear 7. Quality 8. Internal business 9. Innovation and learning 10. Environment
7	(Horta, 2010)	Portugal	1. Productivity 2. Profitability 3. Growth 4. Safety 5. Customer satisfaction 6. Predictability
8	Latham (1994)	UK	1.Client satisfaction 2.Public interest 3.Productivity 4.Project performance 5.Quality 6.Research & development 7.Training and recruitment 8.Financial
9	Egan (1998)	UK	1.Construction cost 2.Construction time 3.Defects 4.Client satisfaction (product) 5.Client satisfaction (service) 6.Profitability 7.Productivity 8.Safety 9.Cost predictability (const.) 10.Time predictability (const.)
10	Construction Productivity Network (1998)	UK	1.People 2.Processes 3.Partners 4.Products

The important consideration in selecting KPIs for assessment and getting the right data is the accuracy of the data flowing into the KPI, and the reliability of the KPI in predicting construction performance. In this regard it is advantageous to select the KPI to get the relevant information and how accurate the data to reflect the performance of the organization. The KPI started by Egan (1998) and developed by the (CBPP-KPI, 2002) believed to be the best KPI in the construction industry.

According to Egan (1998) and later developed by the UK working groups CBPP-KPI (2002), Key Performance Indicators (KPIs) for the construction industry can be identified in 10 parameters for benchmarking projects in order to achieve a good performance. However, most of these indicators, such as construction cost, construction time, quality, client satisfaction with the product and service, profitability and productivity, promote result-orientated thinking, whereas predictability of design cost and time, and predictability of construction cost and time, and safety can be regarded as process-orientated thinking.

In this study, looking at the different approaches and parameters, the client satisfaction has been considered for service and product together because of the fact that the construction contractors in Ethiopia are mainly working on the delivery of product. In detail the 10 key performance indicators can be described below.

a) Quality

In the construction industry, quality is defined as the totality of features required by a product or services to satisfy a given need, or fitness for purpose (Parfitt, 1993) . In other words, the emphasis of quality in construction industry is on the ability to conform to established requirements. Requirements are the established characteristics of a product, process or service as specified in the contractual agreement and a characteristic is any specification or property that defines the nature of those products, processes or services, which are determined initially by the client.

b) Time

It is very important for construction projects to be completed on time, as the clients, users, stakeholders and the general public usually looks at project success from the macro view where their first criterion for project success appeared to be the completion time (Lim, 2000). Salter (2003) and Odeh (2002) mentioned that time variance is one of the techniques for assessing project performance in construction projects.

c) Cost

Cost is defined as the degree to which the general conditions promote the completion of a project within the estimated budget (Bubshait, 1994). Salter (2003) indicated that cost variance was the most common technique used to measure design performance. It is not only confined to the tender sum, but the overall cost that a project incurs from inception to completion, which includes any costs arise from variations, modification during construction period and the cost arising from the legal claims, such as litigation and arbitration. It can be measured in terms of unit cost, percentage of net variation over final cost (Chan, 2000).

d) Predictability Cost

For construction works predictability cost is defined as the prediction of a construction cost estimate, as compared to the median of competitive bids, where prediction is defined as an

assertion on the basis of data, theory or experience, but in advance of proof. Predictability cost measures how well outturn costs compare with original estimates.

e) Predictability Time

For construction works predictability time is defined as the prediction of a construction time estimate, as compared to the median of competitive bids, where prediction is defined as an assertion on the basis of data, theory or experience, but in advance of proof. Predictability time It measures how closely the project was delivered to the original time table.

f) Clients' satisfaction

Satisfaction is regarded as a function of comparison between an individual's perception of an outcome and its expectation for that outcome (Locke, 1970). In the construction industry, client's satisfaction has remained an elusive and challenging issue for some considerable time. Dissatisfaction is widely experienced by clients of the construction sector and may be caused by many aspects but is largely attributable to overrunning project costs, delayed completion, inferior quality and incompetent service providers including contractors and consultants.

g) Productivity

Provide a suite of KPIs which facilitate measures of business performance on a project or company basis along the supply chain, either within a single company or within a market sector. It is a company value added per employee expressed in money.

h) Profitability

Profitability is often seen as the company profit expressed as a percentage of turnover and the most important KPI but is realistically the demonstrable result of hitting other KPIs such as cost and time. Profitability is also important for organization to stay competitive and successful.

i) Health and safety

Health and safety described as the degrees to which the general conditions promote the completion of a project without major accidents or injuries (Bubshait, 1994). The measurement of safety is mainly focused on the construction period as most accidents occur

during this stage. Health and safety provide a suite of KPIs which facilitate measures of the frequency of lost time and reportable accidents and fatalities.

2.10. RELATIONSHIP BETWEEN PROJECT MANAGEMENT AND PERFORMANCE INDICATORS

Despite the practicing project management informally , it began to emerge as a distinct profession in the mid-20th century, especially with the publication of PMI a manual called "A Guide to the Project Management Body of Knowledge (PMBOK® Guide)" in 1987 to identify the recurring elements for project management process. The complete Project Management Body of Knowledge includes proven traditional practices that are widely applied, as well as innovative emerging practices for the profession with widespread consensus as to their value and usefulness.

The purpose of performance measurement with key performance indicators is to help organizations understand how decision-making processes or practices led to success or failure in the past and how that understanding can lead to future improvements in the management process and practice of their organization with regard to the project management body of knowledge areas. Hence Effectiveness and efficiency of project management implementation are important for improving performance of an organization. In the past project management literature, there are many studies investigating the effects of different project management practices on project performance as mentioned by Dow (1999), operational performance as mentioned by Choi (1998), and business performance as mentioned by Adam (1997). Most of the findings have indicated that project management practices have a clear and significant relationship with project and operational performance. Furthermore, a research shows that project management can assist a company to obtain competitive advantages by meeting customer needs when delivering quality products to the marketplace at a right time and reasonable cost. The results also indicate that the quality dimensions which have been used in the research are correlated with business performance (Forker, 1996).

The success of a construction project management can be indicated by project performance. The performance of a project will be dependent on various factors including project complexity, contractual arrangements, relationships between participants in the project,

competency of project manager, and the abilities of the key members in projects. Project performance is usually judged and quantified by performance measurement. Performance measurement is the common method to collect and report the information related to the inputs, efficiency, and effectiveness of a construction project (Takim, 2003). Furthermore, measurements are crucial for tracking, forecasting, and controlling the important variables in the end to ensure the success of projects (Love, 2000) Generally, it has been widely accepted that time, cost, and quality are the major concerned factors in the performance measurements of a project (Barkley, 1994). Moreover, these three major components are noted as "iron triangle" or the magic triangle (Atkinson, 1999) and (Hensler, 2005).

On the other hand, there are other criteria that have been suggested to be considered in a performance measurement (Kumaraswamy, 1999). Those criteria include meeting the budget, schedule, quality of workmanship, stakeholders' satisfaction, safety and health, and transfer of technology. At the same time, some researchers also noted that there are other various key components such as design performance, safety and health, performance of environmental management, expectation or satisfaction of the end user, client's satisfaction, and commercial value that are used in project performance measurement (Chan, 2000)Hence, there are 10 major variables that have been identified to measure projects performance which has relation with project management Nevertheless, the impact of each body of project knowledge on those performance indicators are to be clarified in this research (Egan, 1998).

Project management and project performance which can be measured in KPI go hand in hand and it is ideally difficult to achieve the needed performance without a proper management plan and implementation. In today's industry, projects are getting more and more complex with more technical tools, cross country collaboration among resources, faster delivery to market, high quality standards, proper resource management etc. and in order to manage all these we need a proper plan and implementation or else the project is doomed to fail; hence project management is needed and the relationship with performance is directly proportional. From this, it is obvious to agree that the project management helps in increasing the overall performance of the project, all that is needed is making use of basic management processes like initiation, planning, execution, monitoring and closure in a project lifecycle (UK, 2018).

The top three KPIs and its relationship with project management is illustrated in the following diagram where cost, time and quality performances are the key performance indicators for the solid project management triangle (Hensler, 2005).

Figure 3: The iron or magical triangle of project management (Hensler, 2005)

CHAPTER 3 – METHODOLOGY

3.1. GENERAL

Research methodology is a plan of action that shows how the problems are investigated, what information are collected using which methods, and how this information is analysed to arrive at conclusions and come up with recommendations.

The philosophy of this research is positivism and associated with quantitative research. Also used to predict what may happen at a future date. In positivism studies the role is to measure in trustworthy and role of the researcher is limited to data collection and interpretation in an objective way.

3.2. RESEARCH DESIGN

To achieve the intended research objective, the research used quantitative approach by collection of quantitative data to put to rigorous quantitative analysis. This research is manly descriptive and quantitative research as it tries to describe the status of PM maturity in Grade 1 construction companies and measure the organizational and project performance of the contractors in relation to KPIs. Most of the time descriptive research methods are used to show the characteristics of the Ethiopian Grade one contractors and their state of affairs as they exist at present.

The research type involves descriptive research and considers both primary data and secondary data where the primary data collected through structured questionnaire, which was considered to be the most appropriate tool to reach the population of the research with limited time. The literature review was conducted to extract the variables for the assessment and to have a conceptual bases on the subject matter. Accordingly, the survey was designed based on variables extracted from literatures and organized in three parts which include questions related to respondent profiles, PM Maturity and performance related issues.

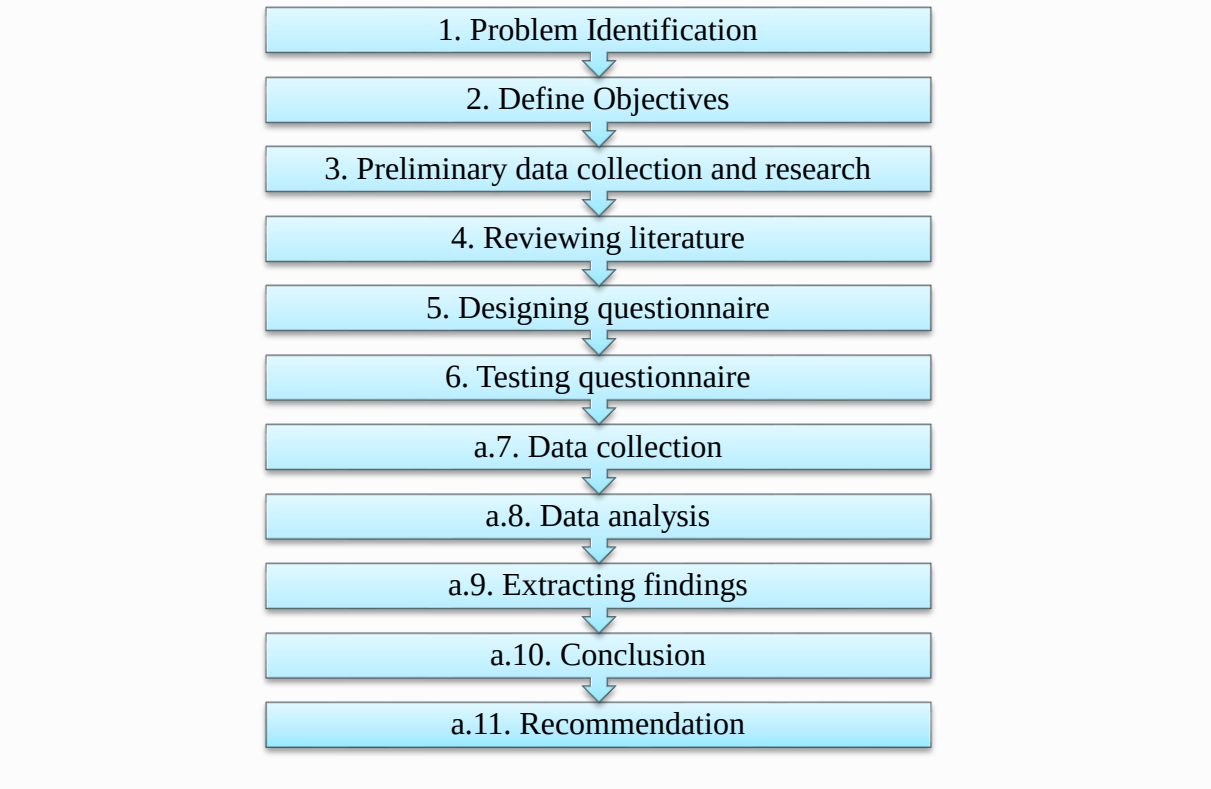

Figure 4: Research process steps

3.3. RESEARCH STRATEGY

A research strategy introduces the main components of a research project such as the research topic area and focus, the research perspective, the research design, and the research methods. It refers to how the researcher propose to answer the research questions set and how the researcher will implement the methodology.

There are three different conditions that indicate the type of strategy that should be used in a research (Saunders, 2009).

These conditions are:

a. the type of research question,
b. the control that the investigator has in the actual behavioral events and
c. the focus on contemporary events

Considering the above three conditions the researcher has used mainly primary data collection strategy through a survey where a self-administered questionnaire prepared and

distributed by email and hand in the research environment which is deemed the most effective as compared to administering them via survey monkey or face-to-face interviews.

3.4. POPULATION

The Ethiopian construction contractors licensing has different categories which are classified mainly in four groups. Anyone who wants to work as contractor and participate in Construction industry in Ethiopia needs to have construction license from Ethiopian Ministry of Urban Development and Construction; there is grading in different categories are;

- General Contractors (GC 1-10) to work any civil construction works except water works;
- Building Contractor (BC 1-10) to work in construction of buildings;
- Road Construction (RC 1-10) to participate in road construction; and
- Special contractors (SC 1-4) specialized in single area of construction like foundation drilling.

And for foreign contractors there is only GC-1, BC-1, RC-1 or SC-1 registration allowed.

The research considers all construction categories but focuses mainly on Grade I contractors due to limitation of time and because of Grade I contractors are the highest classification in the industry and currently undertaking large projects in building, roads, railways, bridges, airports, dams and other related works.

The research also considers Grade I contractors who are registered and recently renewed their license in the populations to answer the objectives. The population is used to assess the PM Maturity and performance of the organizations.

The research has been conducted mainly in Addis Ababa, Ethiopia as almost all of the companies are headquartered in the capital city.

3.5. SAMPLE SIZE DETERMINATION

Sample size determination refers to the number of items to be selected from the universe to constitute a sample. It is the first step a researcher must do before data collection. The size of sample should neither be excessively large, nor too small. It should be optimum. An optimum sample is one which fulfills the requirements of efficiency, representativeness, reliability and

flexibility. While deciding the size of sample, researcher must determine the desired precision as also an acceptable confidence level for the estimate and hence 95% confidence level is used to calculate the sample size.

Sampling is the process of selecting enough elements from the population of targeted interest area, so that a study of the sample and an understanding of its properties or characteristics would make it possible to generalize such properties or characteristics to the population elements.

Sample size can be calculated as the following equation for 95% confidence level (Kish, 1995).

$n = n' / [1 + (n'/N)]$

Where:

N = total number of populations

n= sample size from finite population

n' = sample size from infinite population = S^2/V^2; where S^2 is the variance of the population elements and V is a standard error of sampling population. (Usually S = 0.5 and V = 0.06).

3.6. SAMPLING SIZE

The best sampling method for this research was random sampling to get a more representative sample for the study because when a population from which a sample is to be selected does comprise a homogeneous group.

A total of 126 Grade I contractors registered at the Ministry of Urban Development and Construction (MoUDC) and considered as a population size for sample calculation.

$n = n' / [1 + (n'/N)]$

$n' = S^2/V^2 = (0.5)2 / (0.06)2 = 69.44$

Population (N) = 126 Contractors

$n = 69.44 / [1 + (69.44 / 126)] = 69.44/1.55 = 45$

A minimum of 45 contractor samples should be collected to research the topic.

3.7. DATA COLLECTION INSTRUMENT

The research used both secondary and primary data sources to achieve the objectives of the study. The researcher referred to more than 70 references to support the study objectives and

examine an alternative perspective. The secondary data sources include articles from scientific papers and journals, websites, professional books, manuscripts and study papers.

The research basically used primary data collection using structured questionnaire. The tool was adopted and designed to collect data that can help in giving answers for the research questions and to address the identified problem statements. The researcher designed the questionnaire and administered a self-assessment technique on 59 Grade 1 contractors who had been actively engaged in construction industry, licensed and registered in 2010 EC. The data was filled by engineering professionals at the ranking of managerial positions and department heads. The respective professionals were requested to do self-assessment of their demographic information, organizational PM Maturity and performance, and impact of key performance indicators.

The research was finally able to collect data of all questionnaires from the respondents and yet was also to validate only 53 Grade 1 contractors' data for the analysis.

3.8. DATA COLLECTION PROCEDURE

For the purpose of the research, data was collected through a specially designed questionnaire survey form that evaluates the significance of different KPIs for respondents' operations.

First of all, the questionaries' was tested on s seven expertise who have proficient experience on project management, research area and project implementation so that they evaluate the quality of questionnaire and check whether the questions are relevant and easily understood by the respondents. The results of the testing phase significantly helped to improve the quality of the questions and augmented its clarity and further use by all prospective participants. Based on the obtained comments, the final questionnaire was distributed to the sample contractors.

The final questionnaire included the following three parts;

a) Background information: This includes the demographic questions about the respondents, Years of experience academic qualification, organization and job classification. This information helped the researcher to validate the outcome of the

survey, as the research requires involvement of professionals who participated in different projects.

b) PM Maturity assessment: In this part of the questionnaire, professionals were asked to self-assess and rank the PM Maturity of their organization's practice respectively. Besides, respondents were asked to assess the significance of selected PMBOK and KPIs' and their relevance for Ethiopian contractors using a Likert scale grading system. The evaluation scale was a five-point Likert scale (very high=5, high = 4 medium=3, low=2 and very low=1).
c) Performance Assessment. This part of the questionnaire deals with the assessment of the organization's performance, project performance in relation to key performance indicators using Likert scale as above. In addition to that the impact of PM Maturity on the key performance indicator has been assessed.

3.9. VALIDITY TEST

Validity test indicates the degree to which an instrument measures what it is supposed to measure in a given sample size. There are different ways of testing validity of questionnaire. In the case of this research, content validity test is applied to check whether measuring instrument provides adequate coverage of the topic under research. Besides, the research used such testing to check whether the questionnaire actually represents the reality of what is intended to be measured and tried to provide adequate coverage of the investigative measurement questions in the questionnaire.

Validity in relation to questionnaires refers to the ability of questionnaire to measure what is intend it to measure. This means it is concerned that what is find with questionnaire actually represents the reality of what to be measured. This presents with a problem as if the reality of what were measured is actually known (Saunders, 2009). This is done by providing adequate coverage of the investigative measurement questions in the questionnaire. Besides the research also tried to come up with judgement of what is 'adequate coverage' was made through careful definition of the research through the literature reviewed. Prior discussion was made with experts who have good experience in the research and project management area. Experts group was used to assess whether each measurement question in the questionnaire is 'essential', 'useful but not essential', or 'not.

3.10. RELIABILITY TEST

The research conducted reliability test to ensure the consistency and dependability of the test score of the assessment. A brief piloting of the questionnaire was carried out whereby all available information on the topic of interest was sorted to have a clear picture of what has been done and whether there is room for further research in this area. The study followed a questionnaire test procedure that involves administering the same measurement instrument such as questionnaire to the same individuals under the same conditions for seven days to fill the questionnaire and comment also if something should be adjusted or not. The questionnaire is tested with seven individuals who's qualification ranges from Phd to Bsc level. All feedbacks were collected and the findings in questionnaire were adjusted.

Besides, the research applied internal consistency method that involved correlating the responses to each question in the questionnaire with those to other questions in the questionnaire. It therefore helped to measure the consistency of responses across either all the questions or a sub-group of the questions from the questionnaire.

The research also applied Cronbach's alpha to measure internal consistency ("reliability") of the questionnaire as there are multiple Likert questions in a questionnaire that form a scale and the researcher wish to determine if the scale is reliable.

3.11. ANALYSIS

To conduct a full, fledge analysis, the researcher used different techniques and methods. First, the researcher tried to calculate the descriptive statistics of the data captured which will support the detail computation of certain measures along with searching for patterns of relationship that exist among data-groups. The descriptive statistic results include, means and standard deviations, as well as the test statistic, degrees of freedom, obtained value of the tests.

Then, the data collected by questionnaire was analysed using SPSS percentage, mean, correlation and multi linear regression analysis method to examine the relationship and effect among the 12 Project management body of knowledge areas and KPI variables.

The analysis tried to find out relationships or differences supporting or conflicting with original or new hypotheses should be subjected to statistical tests of significance to determine with what validity data can be said to indicate any conclusions, using correlation analysis and

linear regression to show the relationship between the dependant and independent variables to see the positive or negative linearity as well as cause and effect relationships (Kothari, 2004).

Finally, based the analysis, key findings were reported and come to conclusions and recommendations.

CHAPTER 4 – DATA ANALYSIS, INTERPRETATION AND DISCUSSION

In this chapter the data collected from Grade 1 contractors are presented and described using illustrative tables, graphs and diagrams. The demographic data obtained from the questionnaire is presented and followed by the determination and analysis of the PM Maturity level, the organizational performance of the contractors and the relation and effect between PM Maturity and key performance indicators is analysed and major finding are summarized, presented and discussed. The response rate is 100% of the sample size and the data obtained through the distributed questionnaire were analysed and interpreted by using descriptive statics.

Data Analysis is done using SPSS 20th Version and MS Excel.

4.1. RELIABILITY TEST

Reliability test ensure the consistency and dependability of the test score of the assessment. Cronbach's alpha tests to see if multiple-question Likert scale surveys are reliable. The alpha coefficient for the 243 items is 0,981 (<0,9 refers to be excellent internal content) suggesting that the items have relatively high internal consistency

Table 2: Cronbach's Alpha reliability test result

Reliability Statistics

Cronbach's Alpha	N of Items
,981	243

4.2. DEMOGRAPHIC INFORMATION ANALYSIS

The section presents a summarized result of the demographics of the respondents which includes the education level, work experience, project management experience and trainings.

Respondents Position in the organization

The table below describes the total number of respondents are 53 people working in different position of the organization. Out of them 41,5% of the respondents are project managers, 22,6% are technical managers, 18,9% are general managers, 7,5% project coordinators, 5,7% Project engineers and 3,8% deputy general managers. It is clearly showing that 86,8% of the respondents have managerial position.

Table 3: Frequency distribution of respondent's position

Position or role in the company	Frequency	Percent	Cumulative Percent
Deputy General Manager	2	3,8	3,8
General Manager	10	18,9	22,6
Office Engineer	3	5,7	28,3
Project Coordinator	4	7,5	35,8
Project Manager	22	41,5	77,4
Technical Manager	12	22,6	100,0
Total	**53**	**100,0**	

Respondents Qualification

The table below shows that the educational qualification of the respondents where 52.8% are holders of second degree and more while 47.2% are holders of first degree.

Table 4: Frequency distribution of respondent's qualification

Qualification of the Respondent	**Frequency**	**Percent**	**Cumulative Percent**
1st Degree	25	47,2	47,2
2nd degree and more	28	52,8	100,0
Total	**53**	**100,0**	

Respondents Work Experience

Regarding the work experience of the respondents 13.2% have more than 20 years' experience while 35.8% have work experience from 16-20 years. 5,7% have 0-5 years' work experience and the remaining 13,2% are experience ranging from 6-10 years. More than 80% of the respondents have work experience of more than 11 years which qualify them as senior staffs in engineering practices.

Table 5: Respondents work experience frequency and percent

Respondent's Work Experience	Frequency	Percent	Cumulative Percent
0-5 Years	3	5,7	5,7
6-10 Years	7	13,2	18,9
11-15 Years	17	32,1	50,9
16-20 Years	19	35,8	86,8
More Than 20 Years	7	13,2	100,0
Total	**53**	**100,0**	

Respondents Project Management Certification

The table below shows the certification of the respondents in project management trainings. The majority of the respondents 62.3% have not received any project management certification from any organization or institute while 37,7% of the respondents have received Project Management Certification.

Table 6: Respondents PM qualification frequency and percent

Respondent's PM Certification	Frequency	Percent	Cumulative Percent
Yes	20	37,7	37,7
No	33	62,3	100,0
Total	**53**	**100,0**	

4.3. ORGANIZATIONAL INFORMATION ANALYSIS

In this section the general information about the organization with regard to the business category, experience in project management, organizational capacity and certification and application of performance indicators has been assessed.

General Organizational category

The table below list down the category of the contractors responded to the self-assessment questionnaire. 96,2% of the contractors are working in building, road or as general contractor for all activities. The remaining 3,8% contractors are working in different category other than the usual sectorial category.

Table 7: Contractors category frequency and percent

Category	Frequency	Percent	Cumulative Percent
GC (General Contractors)	21	39,6	39,6
BC (Building Contractors)	28	52,8	92,5
RC (Road Contractors)	2	3,8	96,2
Other (special, water etc)	2	3,8	100,0
Total	**53**	**100,0**	

Project management experience of the G1 contractors

The table below shows the project management experience of the organization where the respondents are working. 56,6% of the contraction companies are more than 16 years' experience in the construction industry and project management. And most of the contractors (77,4%) have experience more than 11 years. Only 22,6% of the contractors have less than 10 years' experience.

Table 8: Experience of Contractors in the construction business frequency and percent

Experience of the Organization	Frequency	Percent	Cumulative Percent
0-5 Years	5	9,4	9,4
6-10 Years	7	13,2	22,6
11-15 Years	11	20,8	43,4
16-20 Years	15	28,3	71,7
More than 20 Years	15	28,3	100,0
Total	**53**	**100,0**	

Capacity Building Trainings and ISO Certification of the organizations

The tables below show the organizational capacity in terms of participating in capacity building programs and ISO certification. When it comes to capacity building training 39.6% of the companies have participated in capacity building program while 54% did not and 5.7% of the respondents did not know whether their company participated or not. In addition to that 20.8% of the companies qualified and certified with ISO while 17% are in process and 50.9% are neither certified nor in process to be certified. 6% of the companies are also other type of certification.

Table 9: Contractors capacity Building program participation frequency and percent

Participation of the Organization in Capacity Building Program	**Frequency**	**Percent**	**Cumulative Percent**
Yes	21	39,6	39,6
No	29	54,7	94,3
I do not know	3	5,7	100,0
Total	**53**	**100,0**	

Table 10: Contractors ISO qualification frequency and percent

ISO Certification	**Frequency**	**Percent**	**Cumulative Percent**
ISO Certified	11	20,8	20,8
In Process	9	17,0	37,7
Neither Certified nor in Process to be certified	27	50,9	88,7
Other	6	11,3	100,0
Total	**53**	**100,0**	

Key Performance Indicator's (KPI) Application

The table below shows that 77,4% of the contractors are using KPI to assess and evaluate the performance of their organization or projects. 22,6% do not use KPI.

Table 11: Contractors performance measurement system application frequency and percent

Use any performance measurement systems	Frequency	Percent	Cumulative Percent
No	12	22,6	22,6
Yes	41	77,4	100,0
Total	53	100,0	

4.4. PROJECT MANAGEMENT MATURITY LEVEL RESULT AND ANALYSIS

In this section the result of the PM Maturity level assessment of Grade 1 contractors based on the 12-project management body of knowledge areas and the PM Solutions measurement level classification presented. These Maturity levels are stated in chapter 2.8.

The following table shows the PM Maturity level of the Ethiopian Grade 1 contractors

Table 12: PM Maturity level category of Grade 1 contractors (Survey result)

No.	PM Knowledge Areas	PM Solutions Maturity Level				
		Level 1	Level 2	Level 3	Level 4	Level 5
		Initial Process	Structured Process and Standards	Organizational Standards and Institutionalized Process	Managed Process	Optimizing Process
1	Integration Management		2,7574			
2	Scope Management			3,1195		
3	Schedule Management			3,6981		
4	Cost Management			3,7453		
5	Quality Management			3,3302		
6	Resource Management			3,4748		
7	Communications Management		2,7028			
8	Risk Management		2,4394			
9	Procurement Management			3,2075		
10	Stakeholder Management		2,8491			
11	Health, Safety, Security, and Environmental Management (HSSE)		2,4906			
12	Financial Management			3,6642		
Project Management Maturity Level		**3,1191**				

Based on the assessment of 53 contractor's data obtained through questionnaire and measured by according to the five project levels of the PM Maturity Model levels PM Solutions, the project management levels are analysed qualitatively to classify the maturity levels of Ethiopian Grade 1 contractors. The result shows that the contractors are at the level 3 with an average maturity level of 3,1191. Maturity Level 3 contractors have Organizational Standards and Institutionalized Process which means all projects use organizationally institutionalized formal standards.

The detail result however shows that Grade one contractors are level to in the areas of project integration, communication, risk, stakeholders and health found to be Level to in Risk Management and Health, Safety, Security and Environmental management areas. This shows

that Contractors are managing their organizations based on structured process, but no organizational standards are in place or set for this specific PM knowledge areas.

On the other hand, contractors are at Maturity level 3 with regard to the knowledge areas of scope, schedule, cost, quality, resource, procurement and financial management. This means that all projects use organizationally institutionalized formal standards such as.

- scope management planning and definition, validation and change control while they set work requirement collection and work breakdown structure.
- time management planning, activity definition, sequencing, resource & duration estimating and schedule development, control and integration.
- Cost planning, estimating, control and budget determination
- Quality planning, assurance, control and management oversight
- Resource planning, estimating, acquiring, development and management of team
- Procurement planning, Requisition & solicitation, control & Vendor management and procurement closure
- Financial management planning, budget planning, monitoring and controlling and application of standardized formats, process and tools are in use.

In general level 3 means that 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.

The figure below shows the result of the maturity level of the Grade 1 contractors in Ethiopia. It represents the level of maturity of the 12 project management capabilities an organization required to manage its organization or project. There are five levels of maturity and the current level of maturity level of the contractors represented in orange.

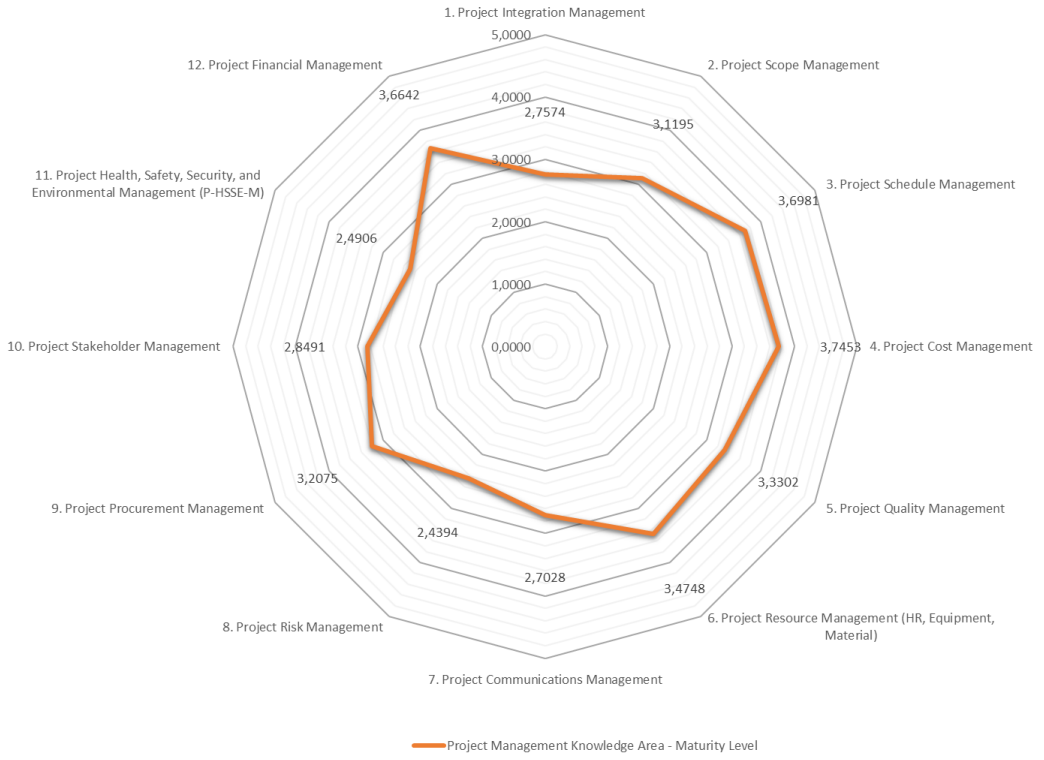

Figure 5: PM Maturity results of Grade 1 contractors (Survey result)

The following table also shows that the number of respondents, the distribution of the results and mean (average maturity level = 3,1191) and the standard deviation.

Table 13: Average maturity level of Grade 1 contractors

	N	Minimum	Maximum	Mean	Std. Deviation
Average Project Management Maturity	53	1,65	4,77	3,1191	,61304
Valid N (listwise)	53				

4.5. RESULT OF PERFORMANCE OF CONTRACTORS

Organizational Performance

The following table shows the overall performance of the organization with respect to the KPI parameters. The result indicates that the organizational performance of Ethiopian Grade 1 contractors is 3,0252 which is medium level.

Table 14: Rate of the overall organizational performance of Grade 1 contractors with respect to KPI parameters

	N	Minimum	Maximum	Mean	Std. Deviation
Quality (Impact of the defects of the final product)	53	1,00	5,00	2,9811	,90915
Construction Time (Improvement of time year on year)	53	1,00	5,00	3,0943	,79091
Construction Cost (Improvement of capital cost year on year with regard to contract and industry bench mark)	53	1,00	4,00	3,1509	,76952
Predictability Cost (Actual cost against the cost predicted at tender)	53	1,00	5,00	3,0943	,81487
Predictability Time (Actual time against the time predicted at tender)	53	1,00	4,00	3,0377	,73281
Client Satisfaction-Service/Product (Client satisfaction with the delivered product and project team)	53	1,00	5,00	3,2264	,86916
Productivity (Value added per person working on the project)	53	1,00	5,00	3,0000	,83205
Profitability (Profitability of the Construction Company)	53	1,00	5,00	2,9434	,79458
Safety (Accident Incident Rate for the Company)	53	1,00	5,00	2,6981	,77422
Organizational Performance	**53**	**1,22**	**4,56**	**3,0252**	**,63292**

The top 6 key organizational performance indicators of the Ethiopian G1 Contractors based on the result of the survey and above table are client satisfaction (3,22), cost (3,15), time (3,09), Predictability cost (3,09) predictability time (3,03) and productivity (3,03).

Project performance

The following table shows the overall project management and implementation performance of an organization with respect to the KPI parameters. The result indicates that the organizational performance is 3,0335 which is medium level. It also indicates that in the construction industry the performance of the organization is dependent of the performance of the projects, this can be also viable in a correlation of organizational performance and project performance.

Table 15: Rate of the overall project performance of Grade 1 contractors with respect to KPI parameters

	N	Minimum	Maximum	Mean	Std. Deviation
Quality (Impact of the defects of the final product)	53	2,00	5,00	3,0566	,79458
Construction Time (Improvement of time year on year)	53	1,00	5,00	3,0755	,78076
Construction Cost (Improvement of capital cost year on year with regard to contract and industry bench mark)	53	1,00	5,00	3,1509	,79412
Predictability Cost (Actual cost against the cost predicted at tender)	53	1,00	5,00	3,0377	,80771
Predictability Time (Actual time against the time predicted at tender)	53	1,00	5,00	3,0566	,90756
Client Satisfaction-Service/Product (Client satisfaction with the delivered product and project team)	53	1,00	5,00	3,2642	,85824
Productivity (Value added per person working on the project)	53	1,00	5,00	3,0755	,82855
Profitability (Profitability of the Construction Company)	53	1,00	5,00	2,9245	,85145
Safety (Accident Incident Rate for the Company)	53	1,00	5,00	2,6604	,83074
Project Performance	53	1,33	4,67	3,0335	,66402
Valid N (listwise)	53				

The top 6 key project performance indicators of the Ethiopian G1 Contractors based on the result of the survey and above table are client satisfaction (3,26), cost (3,15), time (3,07), Predictability cost (3,03) predictability time (3,05) and productivity (3,07).

4.6. RELATION BETWEEN PROJECT AND ORGANIZATIONAL PERFORMANCE

The following table shows the descriptive statistics of PM Maturity (M=3,1191 and SD=0,61304) and organizational performance (M = 3,0252 and SD = 0,63292), N = 53

Table 16: Descriptive statistics of project and organizational performance

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Organizational Performance	53	1,22	4,56	3,0252	,63292	,401	-,304	,327	1,354	,644
Project Performance	53	1,33	4,67	3,0335	,66402	,441	-,033	,327	,343	,644
Valid N (listwise)	53									

The following table and diagram show that there is positive correlation between organizational performance and project performance. Pearson correlation number 0.872 shows also that the there is a strong linear relationship between them. This means also the performance of the project increase (or decreases), then most of the time the organizational performance value is also seen to respectively increase (or decrease) and this makes the two variables can be said to be positively correlated.

The reasons for strong relation between the organizational and project performance were almost the same rank on the top 6 KPIs such as client satisfaction, cost, time, Predictability cost predictability time and productivity.

Table 17: Correlation between organizational and project performances

		Organizational Performance	Project Performance
Organizational Performance	Pearson Correlation	1	,872**
	Sig. (2-tailed)		,000
	N	53	53
Project Performance	Pearson Correlation	,872**	1
	Sig. (2-tailed)	,000	
	N	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

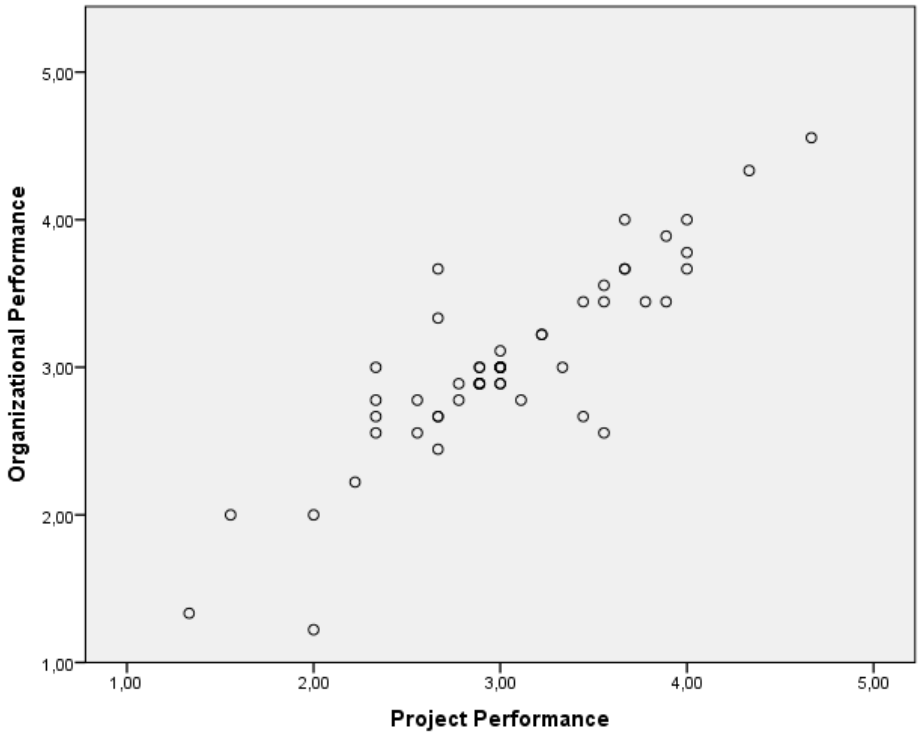

Figure 6: Scatterplot Correlation diagram between organizational and project performances

Based on the above correlation diagram project and organizational performance appear to be positively correlated.

4.7. RELATIONSHIP BETWEEN PROJECT MANAGEMENT MATURITY AND ORGANIZATIONAL PERFORMANCE OF CONTRACTORS

4.7.1. Descriptive statistics

Descriptive statistics can be useful for two purposes in such a way to provide the basic information about variables in a data base and to highlight potential relationship between variables

Table 18: Descriptive statistics of PM Maturity and organizational performance

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Average Project Management Maturity	53	1,65	4,77	3,1191	,61304	,376	-,012	,327	,655	,644
Organizational Performance	53	1,22	4,56	3,0252	,63292	,401	-,304	,327	1,354	,644
Valid N (listwise)	53									

The above table shows the descriptive statistics of the PM Maturity (M=3,1191 and SD=0,61304) and organizational performance (M = 3,0252 and SD = 0,63292), N = 53. The means for average PM Maturity and organizational performance uses to measure the central tendency of the data set. The standard deviations (0,61304 and 0,63292) are shows how close the samples are relating to the population.

4.7.2. Testing the assumption of correlation

The correlation between PM Maturity and performance of contractor can be calculated using person correlation between the two variables. Based on the results, we can state the following:

- PM Maturity and Performance of organization have a statistically significant linear relationship ($p < .001$) and.
- The direction of the relationship is positive (i.e., PM Maturity and organizational performance are positively correlated), meaning that these variables tend to increase together (i.e., greater maturity is associated with greater performance).
- The magnitude, or strength, of the association is approximately moderate ($0,3 < | r | < 0,7$).
- The relationship between two variables is generally considered strong when their r value is larger than 0.7. Here we can say that the relationship between the two

variables r value is moderate because less than 0.7 (r=0.667). The correlation r measures the strength of the linear relationship between two quantitative variables.

Table 19: Pearson correlation of PM Maturity and organizational performance

Correlations

		Average Project Management Maturity	Organizational Performance
Average Project Management Maturity	Pearson Correlation	1	,667**
	Sig. (2-tailed)		,000
	N	53	53
Organizational Performance	Pearson Correlation	,667**	1
	Sig. (2-tailed)	,000	
	N	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

The above table also shows that the variables are positively correlated, which means they both tend to increase (or decrease) in tandem. In conclusion, the it indicates that the strength of association between the variables is high (r = 0.667), and that the correlation coefficient is very highly significantly different from zero (P < 0.001). Also, we can say that 66.7% (0,667) of the variation in organizational performance explained by the average project management maturity.

The following scatterplot shows and provide a general illustration of the positive relationship between the PM Maturity and Organizational performance of contractors. The points on the scatterplot closely resemble a straight line and illustrates a linear relationship.

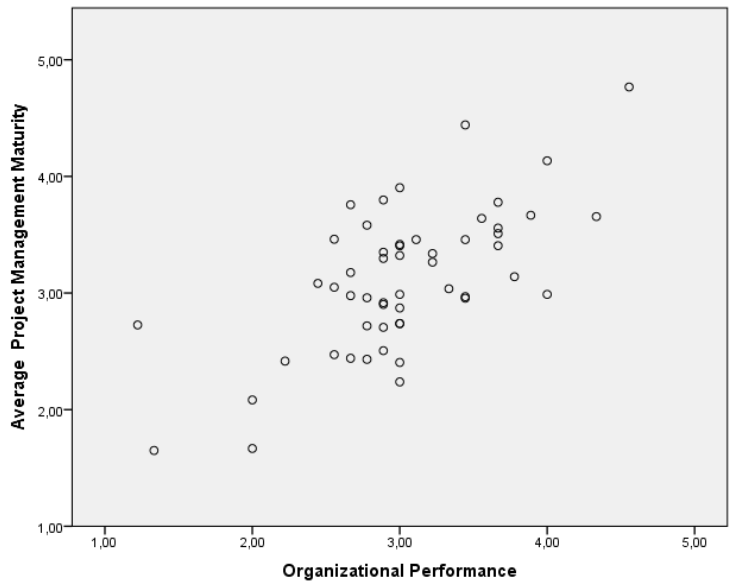

Figure 7: Scatterplot Correlation diagram between PM Maturity and organizational performance

Table 20: Correlation of project management body of knowledge areas and organizational performance in detail

Correlations

		Organizational Performance	Integration Management Maturity	Scope Management Maturity	Schedule Management Maturity	Cost Management Maturity	Quality Management Maturity	Resource Management Maturity	Communications Management Maturity	Project Risk Management	Procurement Management Maturity	Project Stakeholder Management	Health, Safety, Security, and Environmental Mgmt. Maturity	Project Financial Management	Average Project Management Maturity
Organizational Performance	Pearson Correlation	1													
	N	53													
Integration Management Maturity	Pearson Correlation	,426	1												
	Sig. (2-tailed)	,001													
	N	53	53												
Scope Management Maturity	Pearson Correlation	,440	,832	1											
	Sig. (2-tailed)	,001	,000												
	N	53	53	53											
Schedule Management Maturity	Pearson Correlation	,567	,411	,571	1										
	Sig. (2-tailed)	,000	,002	,000											
	N	53	53	53	53										
Cost Management Maturity	Pearson Correlation	,503	,392	,496	,737	1									
	Sig. (2-tailed)	,000	,004	,000	,000										
	N	53	53	53	53	53									
Quality Management Maturity	Pearson Correlation	,474	,668	,683	,552	,516	1								
	Sig. (2-tailed)	,000	,000	,000	,000	,000									
	N	53	53	53	53	53	53								
Resource Management Maturity	Pearson Correlation	,438	,536	,572	,648	,681	,617	1							
	Sig. (2-tailed)	,001	,000	,000	,000	,000	,000								
	N	53	53	53	53	53	53	53							
Communications Management Maturity	Pearson Correlation	,424	,748	,652	,434	,389	,649	,613	1						
	Sig. (2-tailed)	,002	,000	,000	,001	,004	,000	,000							
	N	53	53	53	53	53	53	53	53						
Project Risk Management	Pearson Correlation	,583	,560	,511	,433	,468	,628	,512	,699	1					
	Sig. (2-tailed)	,000	,000	,000	,001	,000	,000	,000	,000						
	N	53	53	53	53	53	53	53	53	53					
Procurement Management Maturity	Pearson Correlation	,693	,471	,434	,573	,652	,596	,652	,597	,697	1				
	Sig. (2-tailed)	,000	,000	,001	,000	,000	,000	,000	,000	,000					
	N	53	53	53	53	53	53	53	53	53	53				
Project Stakeholder Management	Pearson Correlation	,588	,734	,550	,390	,406	,615	,479	,682	,635	,604	1			
	Sig. (2-tailed)	,000	,000	,000	,004	,003	,000	,000	,000	,000	,000				
	N	53	53	53	53	53	53	53	53	53	53	53			
Health, Safety, Security, and Environmental Mgmt. Maturity	Pearson Correlation	,443	,532	,380	,272	,361	,510	,311	,557	,671	,555	,615	1		
	Sig. (2-tailed)	,001	,000	,005	,049	,008	,000	,023	,000	,000	,000	,000			
	N	53	53	53	53	53	53	53	53	53	53	53	53		
Project Financial Management	Pearson Correlation	,607	,298	,332	,582	,649	,422	,577	,333	,612	,670	,383	,447	1	
	Sig. (2-tailed)	,000	,030	,015	,000	,000	,002	,000	,015	,000	,000	,005	,001		
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	
Average Project Management Maturity	Pearson Correlation	,667	,803	,769	,699	,714	,814	,763	,813	,817	,804	,792	,701	,669	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	,000	,000	,000	,000	,000	,000	,000	
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53

The above correlation table shows that the observable pattern is that all the variables highly correlate with each other.

Table 21: Model summary of PM Maturity and organizational performance.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,667[a]	,445	,434	,47630	,445	40,821	1	51	,000

a. Predictors: (Constant), Average Project Management Maturity

The adjusted R square tells as that 43.4% of the variance of dependent variable (Performance) is explained by the independent variable (PM Maturity).

Table 22: Anova result and significant relation of two variables

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9,261	1	9,261	40,821	,000[b]
	Residual	11,570	51	,227		
	Total	20,831	52			

a. Dependent Variable: Organizational Performance

b. Predictors: (Constant), Average Project Management Maturity

The analysis of the variance (ANOVA) shows that there is statistically significant relation (sig.0.000) between the two variables.

Table 23: Unstandardized coefficients to show significance of contribution to the outcome

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	,878	,342		2,565	,013	,191	1,565
	Average Project Management Maturity	,688	,108	,667	6,389	,000	,472	,905

a. Dependent Variable: Organizational Performance

The standardized coefficient tells that a one unit of change on the PM Maturity, there will be a change of 0,688 in the performance of the contractors with a higher significance contribution of the outcome.

4.8. RELATIONSHIP AND EFFECT BETWEEN PROJECT MANAGEMENT MATURITY AND KEY PERFORMANCE INDICATORS

4.8.1. General

In this section of the research the relationship and effect of PM Maturity with the key performance indicators has been investigated. To analyses and found out the result a collinear and multiple linear regression analysis have been carried out to see the relationship and predict the effect of the project management on the key performance indicators.

Before conducting the multi linear regression analysis, five key assumptions tested and limitation on the assumptions are described.

a) Linearity relationship testing

In the linear relationship assumption, the regression model can be expressed in a linear way to check whether there is a linear relationship in the data. For that it is important to check the scatterplot diagram of the two variables. The scatter plot indicates a good linear relationship, which means it allows to conduct a linear regression analysis.

Linear regression relationship needs the relationship between the independent variable (PM Maturity level) and dependent variables (Key performance indicator) to be linear.

The following diagramed shows the output of SPSS analysis in a combination of scattered plot and histogram. The scattered plot shows the distribution of the data in a linear form while the histogram explains the normal distribution of the data sample and skewness to the center.

Visual inspection of the following diagram of scatterplot shows a positive and linearity relationship but it is not that much clear enough to conclude and use for linear regression.

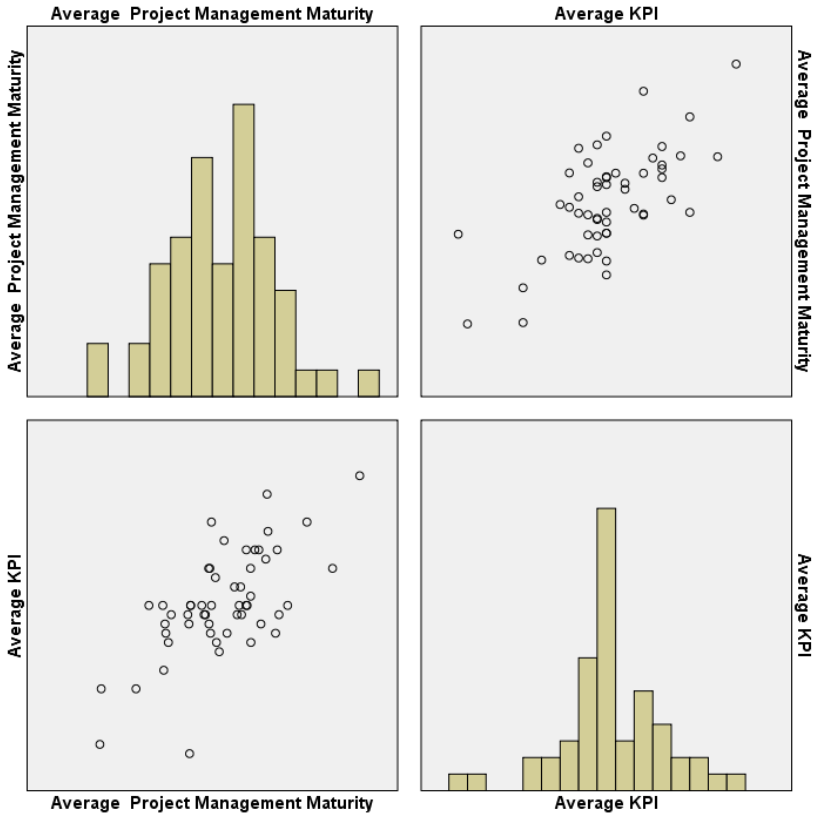

Figure 8: Linearity relationship testing output 1

Since the linearity is not clear and perfect, the second option to test the laniary is by plotting the residual against all the predicator variables and the normal P-P curve which shows linearity of the data.

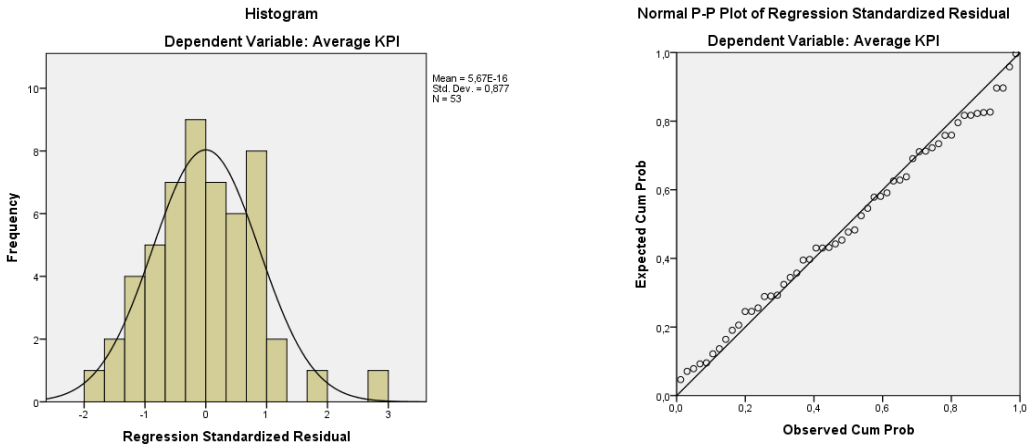

Figure 9: Linearity relationship testing output 2

The normality of residuals with a normal P-P plot shows that the points generally follow the normal (diagonal) line with no strong deviations. This indicates that the residuals are

normally distributed. The second option clearly shows that the data can be used for linear regression.

b) Multivariate Normality Testing

Multivariate normality testing is used to determine whether a set of multivariate observation could have come from a multivariate normal distribution. The normality test can be conducted in three ways.

i. Normal distribution histograms

The following histogram for sample dependent variables looks normal distribution and most of the data skewed to the middle section.

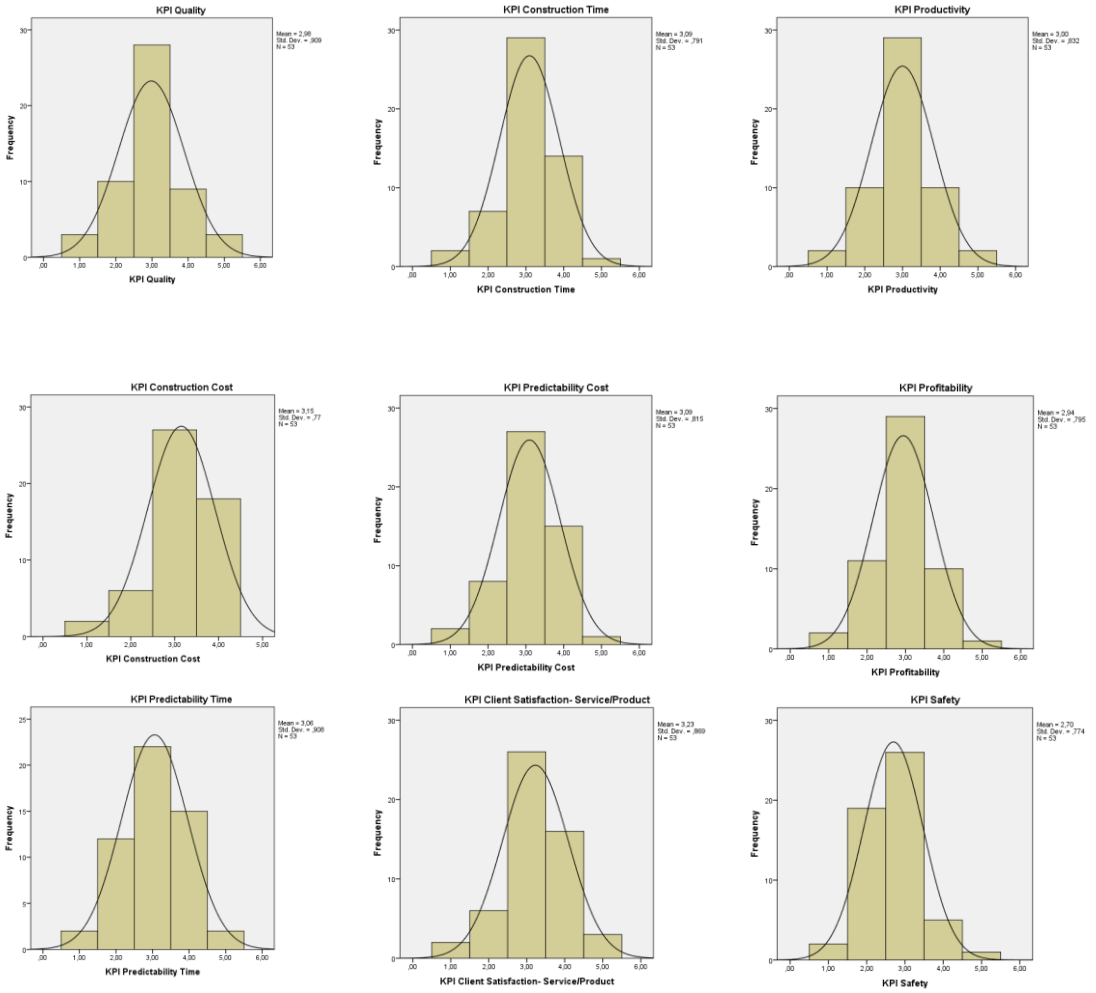

Figure 10: Multivariate normality distribution histogram of the dependent variables

ii. Descriptive test

In the descriptive way of testing the data normality distribution is checked against its skewness and kurtosis. The result looks as follows

Table 24: Descriptive statistics output for multivariate normality testing

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
KPI Quality	53	1,00	5,00	2,9811	,90915	,038	,327	,452	,644
KPI Construction Time	53	1,00	5,00	3,0943	,79091	-,414	,327	,742	,644
KPI Construction Cost	53	1,00	4,00	3,1509	,76952	-,795	,327	,679	,644
KPI Predictability Cost	53	1,00	5,00	3,0943	,81487	-,400	,327	,404	,644
KPI Predictability Time	53	1,00	5,00	3,0566	,90756	-,114	,327	-,281	,644
KPI Client Satisfaction-Service/Product	53	1,00	5,00	3,2264	,86916	-,283	,327	,533	,644
KPI Productivity	53	1,00	5,00	3,0000	,83205	,000	,327	,602	,644
KPI Profitability	53	1,00	5,00	2,9434	,79458	-,136	,327	,479	,644
KPI Safety	53	1,00	5,00	2,6981	,77422	,331	,327	,651	,644
Valid N (listwise)	53								

For normal distribution data the skewness value ranges from -1 to +1 and the dependent variables have values between the range. The Kurtosis values are less than 3 and hence the data is considered as normally distributed.

iii. Shapiro-Wilk test

The most robust normality test is the Shapiro-Wilk test where a test can be conducted with a null hypothesis tests which means that the population is normally distributed, against the alternative hypothesis that it is not normally-distributed. If the test p-value is less than the predefined significance level ($p<0.001$), the null hypothesis will be rejected, and it can be concluded that the data are not from a population with a normal distribution. If the p-value is greater than the predefined significance level, the null hypothesis cannot be rejected.

The following result shows that all of the KPIs have a significance vale of the of $P<0.001$ and the null hypothesis can be rejected. Hence the data is not considered as normally distributed.

Table 25: Shapiro-Wilk test output

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
KPI Quality	,265	53	,000	,880	53	,000
KPI Construction Time	,283	53	,000	,849	53	,000
KPI Construction Cost	,271	53	,000	,805	53	,000
KPI Predictability Cost	,265	53	,000	,862	53	,000
KPI Predictability Time	,211	53	,000	,897	53	,000
KPI Client Satisfaction-Service/Product	,246	53	,000	,876	53	,000
KPI Productivity	,274	53	,000	,870	53	,000
KPI Profitability	,283	53	,000	,863	53	,000
KPI Safety	,255	53	,000	,852	53	,000

a. Lilliefors Significance Correction

c) No auto correlation

In this test the data of the regression have to be free from auto correlation and can be checked as follows using Durbin Watson statistics where there are three rules regarding the value of Durbin Watson.

The rules are

- If Durbin Watson value < 2, it implies positive Auto Correlation
- If Durbin Watson value > 2, it implies negative Auto Correlation
- If Durbin Watson value = 2, it implies no Auto Correlation

And Durbin Watson need a time ordering data.

Table 26: Model summary for no auto correlation test

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,796[a]	,634	,525	,43643	1,980

a. Predictors: (Constant), Project Financial Management, Integration Management Maturity, Health, Safety, Security, and Environmental Mgmt. Maturity, Schedule Management Maturity, Quality Management Maturity, Resource Management Maturity, Project Stakeholder Management, Cost Management Maturity, Project Risk Management, Procurement Management Maturity, Communications Management Maturity, Scope Management Maturity

b. Dependent Variable: Average KPI

As the value of the Durbin-Watson d is 1,980 lies between the lower limit (dL = 0.973) and upper limit (dU = 2.225) with 5% significance percent the Points of dL and dU, and Durbin Watson takes the values between 0 to 4 inclusive. If it is around two, that means no rejection the null hypothesis of no correlation between the error terms. Therefore, we can assume that there is no first order linear auto-correlation in our multiple linear regression data.

However, Durbin Watson requires to have the data natural ordering in time series. The data shall be measure in time series but in this questionnaire, there is no time ordering because each questionnaire is field by one person without a time ordering. Hence Durbin Watson is irrelevant if its value could not be exactly 2.

d) Homoscedasticity Test

This test describes a situation in which the error term or random disturbance in the relationship between the PM Maturity levels of each body of knowledge areas (independent variables) and the dependent variable (KPIs) is the same across all values of the PM Maturity levels (independent variables). The homoscedasticity assumption means that the variance around the regression line is the same for all values of the predictor variable (X).

The following scatterplot diagram shows a validity of homoscedasticity assumption. For the lower values on the X-axis, the points are all very near the regression line.

The fit line helps to shows weather the amount of error or the distance from the line to the dots tend to increase as when moving further up to the line or decrease when moving downwards or stays consistent. The following diagram shows a random displacement of scores that take on a dispersed shape with no clustering or systematic pattern. This means that the diagram shows the assumption of homoscedasticity is met.

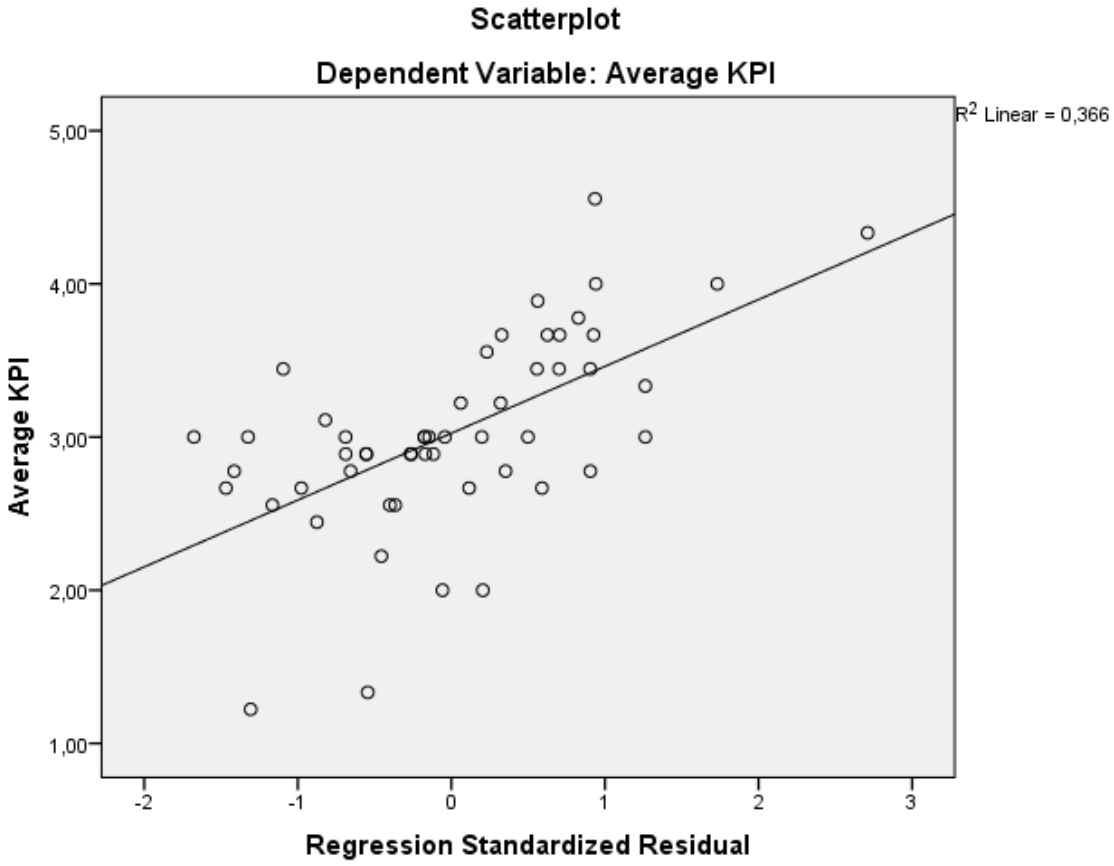

Figure 11: homoscedasticity assumption test output

e) Multicollinearity

Multicollinearity occurs when the PM Maturity levels of each knowledge area as independent variables in a regression model are correlated. These correlation are however a problem because independent variables should be independent. If the degree of correlation between these variables is high enough, it can cause problems when the models is developed and interpreted. This means predictors or independent variables must not be highly correlated each other.

In the regression analysis the presence of multicollinearity implies that one is using redundant information in the model, which can easily lead to unstable regression coefficient estimates.

In order to check the multicollinearity, the following tests has been checked

I. Correlation analysis:

This is to test the high correlation coefficient among the predictors which implies that Multicollinearity is suspected

The following table shows correlation table of the independent variables. The Pearson correlation coefficient is for all predictors are less than 1 and it shows that there is no complete collinearity among the predictors. And there is also no collinearity at all because the coefficients are more than zero. If the coefficient is more than 0,7 it may be Multicollinearity suspected but cannot be sure unless it reaches 0,9. Since the linearity does not exceed the level of 0,9 (cut point); which means, there is no threat of Multicollinearity.

The nine dependent variables such as quality, time cost, client satisfaction…etc with several independent variables has some of the following limitations for multiple analysis.

The key goal of a regression analysis is isolating a relationship between an independent variable and one or more independent variable(s), so that the coefficients attached to the independent variable(s) can be interpreted as the mean change in the change in one of the independent variables, holding other independent variables constant. The last point of holding other independent variables constant is an important assumption and can easily be violated if there is a high correlation between the independent variables. This means change in one of the explanatory variables results in a simultaneous change in the other explanatory variables with which it has a high correlation, making inference difficult. This is a limitation in the Multiple regression analysis.

Table 27: Correlation table among independent variables

Correlations

		Integration Management Maturity	Scope Management Maturity	Schedule Management Maturity	Cost Management Maturity	Quality Management Maturity	Resource Management Maturity	Communications Management Maturity	Project Risk Management	Procurement Management Maturity	Project Stakeholder Management	Health, Safety, Security, and Environmental Mgmt. Maturity	Project Financial Management
Integration Management Maturity	Pearson Correlation	1											
	N	53											
Scope Management Maturity	Pearson Correlation	,832	1										
	Sig. (2-tailed)	,000											
	N	53	53										
Schedule Management Maturity	Pearson Correlation	,411	,571	1									
	Sig. (2-tailed)	,002	,000										
	N	53	53	53									
Cost Management Maturity	Pearson Correlation	,392	,496	,737	1								
	Sig. (2-tailed)	,004	,000	,000									
	N	53	53	53	53								
Quality Management Maturity	Pearson Correlation	,668	,683	,552	,516	1							
	Sig. (2-tailed)	,000	,000	,000	,000								
	N	53	53	53	53	53							
Resource Management Maturity	Pearson Correlation	,536	,572	,648	,681	,617	1						
	Sig. (2-tailed)	,000	,000	,000	,000	,000							
	N	53	53	53	53	53	53						
Communications Management Maturity	Pearson Correlation	,748	,652	,434	,389	,649	,613	1					
	Sig. (2-tailed)	,000	,000	,001	,004	,000	,000						
	N	53	53	53	53	53	53	53					
Project Risk Management	Pearson Correlation	,560	,511	,433	,468	,628	,512	,699	1				
	Sig. (2-tailed)	,000	,000	,001	,000	,000	,000	,000					
	N	53	53	53	53	53	53	53	53				
Procurement Management Maturity	Pearson Correlation	,471	,434	,573	,652	,596	,652	,597	,697	1			
	Sig. (2-tailed)	,000	,001	,000	,000	,000	,000	,000	,000				
	N	53	53	53	53	53	53	53	53	53			
Project Stakeholder Management	Pearson Correlation	,734	,550	,390	,406	,615	,479	,682	,635	,604	1		
	Sig. (2-tailed)	,000	,000	,004	,003	,000	,000	,000	,000	,000			
	N	53	53	53	53	53	53	53	53	53	53		
Health, Safety, Security, and Environmental Mgmt. Maturity	Pearson Correlation	,532	,380	,272	,361	,510	,311	,557	,671	,555	,615	1	
	Sig. (2-tailed)	,000	,005	,049	,008	,000	,023	,000	,000	,000	,000		
	N	53	53	53	53	53	53	53	53	53	53	53	
Project Financial Management	Pearson Correlation	,298	,332	,582	,649	,422	,577	,333	,612	,670	,383	,447	1
	Sig. (2-tailed)	,030	,015	,000	,000	,002	,000	,015	,000	,000	,005	,001	
	N	53	53	53	53	53	53	53	53	53	53	53	53

The above correlation table shows a diagnostic where the average amount of correlations suggests that the linear regression estimates will be reliable, but the other limitation with regard to the sample size and degree of freedom to run regression analysis is something to do with the degrees of freedom (df) of the model which encompasses the notion that the amount of independent information one has is limited by the number of parameters that can be estimated. The sample size of this study might have an impact on the results of the regression estimates. This is because it affects the degrees of freedom of the model. Degree of freedom (df) in multiple regression for ordinary least square (OLS) is the number of observations minus the number of estimated parameters. It is given by df = n-k-1 where n is sample size, k is number of parameters (equivalent to number of independent variables). This shows that increasing the number of parameters decreases the degree of freedom of the model. This results in imprecise estimates and low statistical power of the test of the model.

II. Value of tolerance (Tolerance < 0.1)

If the tolerance is below 0.1 there will be a problem of Multicollinearity. The table below shows that the tolerance is all above 0,1 which implies there is no Multicollinearity problem.

Table 28: Collinearity Statistics test output

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	Integration Management Maturity	,161	6,229
	Scope Management Maturity	,205	4,872
	Schedule Management Maturity	,344	2,904
	Cost Management Maturity	,315	3,171
	Quality Management Maturity	,360	2,781
	Resource Management Maturity	,310	3,227
	Communications Management Maturity	,251	3,978
	Project Risk Management	,268	3,729
	Procurement Management Maturity	,294	3,406
	Project Stakeholder Management	,323	3,092
	Health, Safety, Security, and Environmental Mgmt. Maturity	,425	2,353
	Project Financial Management	,345	2,901

a. Dependent Variable: Average KPI

III. Variance inflation factor (VIF>10, VIF = 1/Tolerance

The above table shows that the VIF is between 2,353 to 6,229 which show all factors are below 10,0 and satisfy the multicollinearity of the independent variables but could not be sure since they near to the bottom line.

4.8.2. Multiple regression analysis

Multiple regression analysis is used when to predict values of an outcome from several predictors. The analysis refers to a set of techniques for explaining the straight-line relationships among two or more variables where the regression estimates the standardized coefficients (Beta, β)

The basic prediction equation expresses a linear relationship between an independent variable (x= *PM Maturity*, a predictor variable) and a dependent variable (y= *Key Performance indicator*, a criterion variable) can formulated as follows

$$Y = mx + b$$

Where m is the slope of the relationship and b is the y intercept constant

When there is multiple predictor independent variables and a constant we can use the standardized prediction equation. The standardized prediction equation predicts the effect of PM Maturity on each key performance indicator which can be formulated based on the result of the regression information and the standardized coefficients (beta) or the slope of the regression line as stated below

$$\hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

$$\begin{aligned}\hat{Y} = \beta_0 + \beta_{IntegM} X_{IntegM} + \beta_{ScopeM} X_{ScopeM} + \beta_{ScheduleM} X_{ScheduleM} + \beta_{CostM} X_{CostM} \\ + \beta_{QualityM} X_{QualityM} + \beta_{ResourceM} X_{Resource} \\ + \beta_{CommunicationM} X_{CommunicationM} + \beta_{RiskM} X_{RiskM} \\ + \beta_{ProcurementM} X_{ProcurementM} + \beta_{StakeholderM} X_{StakeholderM} \\ + \beta_{HSSEM} X_{HSSEM} + \beta_{FinancialM} X_{FinancialM}\end{aligned}$$

Where,

$\hat{Y}$ = dependent Variable (PM effect on KPI Performance) to be predict.
X = Independent variable used to predict the response.

The above equation estimates or predicts exactly how much $\hat{Y}$ (the dependent variable performance) will be changed when the independent X (the independent variable changes by a certain amount.

The standardized regression coefficients (β also referred to as "Beta") are interpreted as the predicted change on the key performance indicators variable in standard deviation units (i.e., z-score units) per one standard deviation unit (again, z-score unit) increase on PM Maturity level (controlling for the remaining PM Maturity variables).

Prediction of the effect of PM Maturity on average KPI

The next table shows the multiple linear regression model summary which shows that the adjusted R^2 square tells as that 63,4% of the variance of dependent variable (KPI) is explained by the independent variables (PM Maturity levels). And a measure of unexplained variations

called standard errors is 0,43643. This means that the linear regression explains 63,4% of the variance in the data.

Table 29: Model summary of PM Maturity and average KPI

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,796[a]	,634	,525	,43643

a. Predictors: (Constant), Project Financial Management, Integration Management Maturity, Health, Safety, Security, and Environmental Mgmt. Maturity, Schedule Management Maturity, Quality Management Maturity, Resource Management Maturity, Project Stakeholder Management, Cost Management Maturity, Project Risk Management, Procurement Management Maturity, Communications Management Maturity, Scope Management Maturity

Table 30: ANOVA of PM Maturity and PM effect on KPI (average)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13,212	12	1,101	5,781	,000[b]
	Residual	7,619	40	,190		
	Total	20,831	52			

a. Dependent Variable: Average KPI

b. Predictors: (Constant), Project Financial Management, Integration Management Maturity, Health, Safety, Security, and Environmental Mgmt. Maturity, Schedule Management Maturity, Quality Management Maturity, Resource Management Maturity, Project Stakeholder Management, Cost Management Maturity, Project Risk Management, Procurement Management Maturity, Communications Management Maturity, Scope Management Maturity

The above output table is the F-test. The linear regression's F-test has the null hypothesis that the model explains zero variance in the dependent variable (in other words $R^2 = 0$). The F-test is highly significant; thus, we can assume that the model explains high significant amount of the variance in the average KPI rate.

First, we test the F-test to see whether the entire regression is statically significant or not. In the ANOVA table the p- value is less than 0,05 and it can be concluded that the regression is statistically significant for a sample size n=53.

However, in the following table the level of significance for each detailed KPI is also not fulfilled except procurement and stakeholder's management maturity. Considering the overall significance level $p < 0.001$ and the limitation of the regression model, the prediction formula is formulated based on the coefficients table below.

Table 31: Unstandardized coefficients (Beta) output

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,768	,406		1,892	,066
	Integration Management Maturity	-,061	,162	-,090	-,378	,707
	Scope Management Maturity	,151	,165	,194	,918	,364
	Schedule Management Maturity	,218	,129	,275	1,690	,099
	Cost Management Maturity	-,122	,153	-,136	-,801	,428
	Quality Management Maturity	-,059	,135	-,069	-,435	,666
	Resource Management Maturity	-,199	,180	-,190	-1,106	,275
	Communications Management Maturity	-,116	,142	-,156	-,820	,417
	Project Risk Management	,071	,139	,095	,512	,611
	Procurement Management Maturity	,403	,163	,437	2,475	,018
	Project Stakeholder Management	,250	,117	,360	2,141	,038
	Health, Safety, Security, and Environmental Mgmt. Maturity	-,036	,096	-,055	-,377	,709
	Project Financial Management	,196	,142	,226	1,386	,173

a. Dependent Variable: Average KPI

The above table shows the multiple linear regression estimates including the intercept and the significance levels. In this multiple linear regression analysis, we find a non-significant intercept, which we can interpret as: for every 1-level increase of performance we will see, a negative and positive influence of the project management maturity level.

The significance levels information in the table above also allows us to check for multicollinearity in our multiple linear regression model. Tolerance should be > 0.1 (or VIF < 10) for all variables, which they are but the VIF are little lower.

To build the prediction equation of the effect of PM Maturity on performance indicators index, the coefficients of the regression calculation result put it together in the formula and the result shows as follows. The following unstandardized coefficients (Beta) is used to formulate the formula.

$$\hat{Y} = 0{,}768 - 0{,}061X_{IntegM} + 0{,}151X_{ScopeM} + 0{,}218X_{ScheduleM} - 0{,}122X_{CostM} - 0{,}059X_{QualityM} - 0{,}199X_{Resource} - 0{,}116X_{CommunicationM} + 0{,}071X_{RiskM} + 0{,}403X_{ProcurementM} + 0{,}250X_{StakeholderM} - 0{,}036X_{HSSEM} + 0{,}196X_{FinancialM}$$

For each dependent variable, which is the 9 key performance indicators can be predicted as per the following unstandardized coefficients summary table for the impact of PM Maturity levels on Key Performance Indicators (Summary from Regression calculation).

Table 32: unstandardized coefficients (Beta) of KPIs

No.	PMBOD Areas (Independent Variables	Unstandardized Coefficients for the impact of PM Maturity levels on Key Performance Indicators (Summary from Regression calculation)								
		KPI- Quaity	KPI -Time	KPI - Cost	KPI - Pred. cost	KPI - Pred. Time	KPI - Client Sat	KPI - Productivity	KPI - Profitability	KPI -Safety
	(Constant)	1,423	,314	1,202	1,311	-,942	,664	,385	,136	,644
1	Integration Management Maturity	,588	-,126	-,273	-,255	-,692	,285	-,056	-,345	-,023
2	Scope Management Maturity	-,305	,259	,313	,215	,621	,224	,203	,219	,049
3	Schedule Management Maturity	,525	,201	,274	,146	,458	,096	,413	,105	-,195
4	Cost Management Maturity	-,486	,066	,255	,355	-,098	-,322	-,498	-,456	,074
5	Quality Management Maturity	-,119	-,107	-,217	-,003	,046	-,088	,054	,014	-,014
6	Resource Management Maturity	-,186	-,325	-,297	-,592	-,149	-,347	-,061	,449	-,060
7	Communications Management Maturity	-,328	-,199	-,160	-,277	,153	-,329	-,117	-,084	,541
8	Project Risk Management	,363	,149	,200	,093	-,565	,050	,152	,100	-,395
9	Procurement Management Maturity	,770	,281	,314	,347	,506	,478	,468	,074	,620
10	Project Stakeholder Management	-,144	,309	,363	,544	,344	,335	,240	,318	-,227
11	Health, Safety, Security, and Environmental Mgmt. Maturity	-,131	-,013	,080	-,080	,136	-,031	-,099	,020	,021
11	Project Financial Management	,021	,339	-,214	,019	,281	,486	,140	,432	,211

Looking in to the positivity and negativity of the coefficients, each PM Maturity level of have positive as well as negative relationships. But it shows that they have relationships in both directions.

Prediction of the PM Maturity effect on each KPI

In order to predict the dependent variable, the significance level of each independent variables must be highly determinant. However, the independent variables are less significant to show the cause and effect relationship except procurement and stakeholders management independent variables. But the following prediction formula of the effect of PM Maturity on each key performance indicators can show only that they have relationships which can be also described in the following empirical formulae:

$$\hat{Y}_{Quality} = 1{,}423 + 0{,}588X_{IntegM} - 0.305X_{ScopeM} + 0{,}525X_{ScheduleM} - 0{,}486X_{CostM} - 0{,}119X_{QualityM} - 0{,}186X_{Resource} - 0{,}328X_{CommunicationM} + 0{,}363X_{RiskM} + 0{,}770X_{ProcurementM} - 0{,}144X_{StakeholderM} - 0{,}131X_{HSSEM} + 0{,}021X_{FinancialM}$$

$$\hat{Y}_{Time} = 0{,}314 - 0{,}126X_{IntegM} + 0.259X_{ScopeM} + 0{,}201X_{ScheduleM} + 0{,}066X_{CostM} - 0{,}107X_{QualityM} - 0{,}325X_{Resource} - 0{,}199X_{CommunicationM} + 0{,}149X_{RiskM} + 0{,}281X_{ProcurementM} + 0{,}309X_{StakeholderM} - 0{,}013X_{HSSEM} + 0{,}339X_{FinancialM}$$

$$\hat{Y}_{Cost} = 1{,}202 - 0{,}273X_{IntegM} + 0.313X_{ScopeM} + 0{,}274X_{ScheduleM} + 0{,}255X_{CostM} - 0{,}217X_{QualityM} - 0{,}297X_{Resource} - 0{,}160X_{CommunicationM} + 0{,}200X_{RiskM} + 0{,}314X_{ProcurementM} + 0{,}363X_{StakeholderM} + 0{,}080X_{HSSEM} - 0{,}214X_{FinancialM}$$

$$\hat{Y}_{Pred\ Cost} = 1{,}311 - 0{,}255X_{IntegM} + 0.215X_{ScopeM} + 0{,}146X_{ScheduleM} + 0{,}355X_{CostM} - 0{,}003X_{QualityM} - 0{,}592X_{Resource} - 0{,}277X_{CommunicationM} + 0{,}093X_{RiskM} + 0{,}347X_{ProcurementM} + 0{,}544X_{StakeholderM} - 0{,}080X_{HSSEM} + 0{,}019X_{FinancialM}$$

$$\hat{Y}_{Pred\ Time} = -0{,}942 - 0{,}692X_{IntegM} + 0.621X_{ScopeM} + 0{,}458X_{ScheduleM} - 0{,}098X_{CostM} + 0{,}046X_{QualityM} - 0{,}149X_{Resource} + 0{,}153X_{CommunicationM} - 0{,}565X_{RiskM} + 0{,}506X_{ProcurementM} + 0{,}344X_{StakeholderM} + 0{,}136X_{HSSEM} + 0{,}281X_{FinancialM}$$

$$\hat{Y}_{Client\ Sat} = 0{,}664 + 0{,}285X_{IntegM} + 0.224X_{ScopeM} + 0{,}096X_{ScheduleM} - 0{,}322X_{CostM} - 0{,}088X_{QualityM} - 0{,}347X_{Resource} - 0{,}329X_{CommunicationM} + 0{,}050X_{RiskM} + 0{,}478X_{ProcurementM} + 0{,}335X_{StakeholderM} - 0{,}031X_{HSSEM} + 0{,}486X_{FinancialM}$$

$$\hat{Y}_{Productivity} = 0{,}334 - 0{,}056X_{IntegM} + 0.203X_{ScopeM} + 0{,}413X_{ScheduleM} - 0{,}498X_{CostM} + 0{,}054X_{QualityM} - 0{,}061X_{Resource} - 0{,}117X_{CommunicationM} + 0{,}152X_{RiskM} + 0{,}468X_{ProcurementM} + 0{,}240X_{StakeholderM} - 0{,}099X_{HSSEM} + 0{,}140X_{FinancialM}$$

$$\hat{Y}_{Profitability} = 0{,}136 - 0{,}345X_{IntegM} + 0.219X_{ScopeM} + 0{,}105X_{ScheduleM} - 0{,}456X_{CostM} + 0{,}014X_{QualityM} + 0{,}449X_{Resource} + 0{,}084X_{CommunicationM} + 0{,}100X_{RiskM} + 0{,}074X_{ProcurementM} + 0{,}318X_{StakeholderM} + 0{,}020X_{HSSEM} + 0{,}432X_{FinancialM}$$

$$\hat{Y}_{Safety} = 0{,}644 - 0{,}023X_{IntegM} + 0.049X_{ScopeM} - 0{,}195X_{ScheduleM} + 0{,}074X_{CostM} - 0{,}014X_{QualityM} - 0{,}060X_{Resource} + 0{,}541X_{CommunicationM} - 0{,}395X_{RiskM} + 0{,}620X_{ProcurementM} - 0{,}227X_{StakeholderM} + 0{,}021X_{HSSEM} + 0{,}211X_{FinancialM}$$

The above formulae imply that each project management body of knowledge maturity can predict the dependent variables, the key performance indicators. The coefficient of each independent variable is either negative or positive depend on the relation with the performance indicator. A change of one unit the project management maturity has positive or negative effect on the key performance indicators.

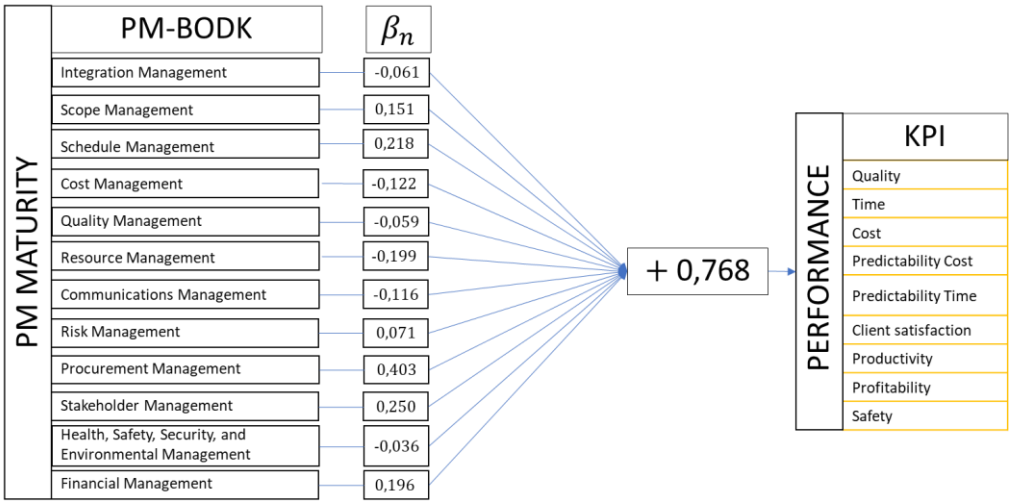

Figure 12: Prediction model determined from the linear regression analysis.

4.9. IMPACT RATIO OF PROJECT MANAGMENT MATURITY ON KPI

The percent of impact of each PM Maturity on key performance indicators has been calculated using MS Excel and the result is illustrated in the following table.

Table 33: Project management detailed impact analysis on key performance indicators

No.	List of project management body of knowledge that affects performance in construction projects	Degree of Impact on Quality	Degree of Impact on Time	Degree of Impact on Cost	Degree of Impact on Predictability Cost	Degree of Impact on Predictability Time	Degree of Impact on Client satisfaction	Degree of Impact on productivity	Degree of Impact on profitability	Degree of Impact on health and safety
1	Integration Management	2,79	3,15	2,96	2,83	2,98	3,26	3,02	2,96	2,74
2	Scope Management	3,25	3,92	3,83	3,81	4,06	3,51	3,91	3,94	2,83
3	Schedule Management	3,36	4,28	4,11	3,89	4,19	4,32	4,19	4,15	2,70
4	Cost Management	3,49	3,89	4,43	4,09	3,83	3,85	4,17	4,21	2,68
5	Quality Management	4,23	3,57	3,83	3,55	3,45	4,38	3,36	3,60	2,68
6	Resource Management	3,45	3,74	3,75	3,60	3,77	3,75	3,79	3,75	2,72
7	Communications Management	2,87	3,02	3,00	2,81	2,98	4,13	2,87	2,83	2,70
8	Risk Management	2,58	2,64	3,02	2,79	2,85	3,49	2,79	2,94	3,17
9	Procurement Management	3,15	3,66	3,53	3,43	3,30	3,43	3,49	3,57	2,70
10	Stakeholder Management	2,57	2,91	2,85	2,64	2,75	4,19	2,87	2,91	2,58
11	Health, Safety, Security, and Environmental Management	2,49	2,60	2,66	2,60	2,57	3,75	2,64	2,66	4,19
12	Financial Management	3,13	3,55	3,96	3,75	3,53	3,58	3,66	3,96	2,55
	Average	**3,11**	**3,41**	**3,50**	**3,32**	**3,36**	**3,81**	**3,40**	**3,46**	**2,85**
	Average all	**3,36**								

The above table shows the average impact result dimension of each project management knowledge areas on the key performance indicators. The result indicates that the degree of impact of project management area on client satisfaction (3,81), cost (3,50), profitability (3,46) and time (3,41) counts more for the Grade one contractors. This also means that contractors believe good project management hast relatively high impact on client satisfaction because it may indicate continuity of work and reputation while cost and profitability indicates the survival performance indicators of their companies. A well-managed company insures the timely completion of projects, within the allocated cost and good profitability margin. Hence the result is a good indication.

The following table also describes the ranking of project management body of knowledge areas impact of the key performance indicators. All of them have less than 10% influence with the marginal difference of average 2% and it implies that the ranking shows that there is no major exaggerated area which as outlier or dominant effect.

Table 34: Result of project management impact on KPI. Ranking order and amount sharing

No.	List of project management body of knowledge that affects performance in construction projects	Average	% Share	Rank
1	Integration Management	2,97	7,37%	9
2	Scope Management	3,67	9,12%	3
3	Schedule Management	3,91	9,71%	1
4	Cost Management	3,85	9,56%	2
5	Quality Management	3,63	9,01%	4
6	Resource Management	3,59	8,92%	5
7	Communications Management	3,02	7,51%	8
8	Risk Management	2,92	7,25%	10
9	Procurement Management	3,36	8,35%	7
10	Stakeholder Management	2,92	7,25%	11
11	Health, Safety, Security, and Environmental Management	2,91	7,22%	12
12	Financial Management	3,52	8,74%	6
	sum	**40,27**	**100%**	

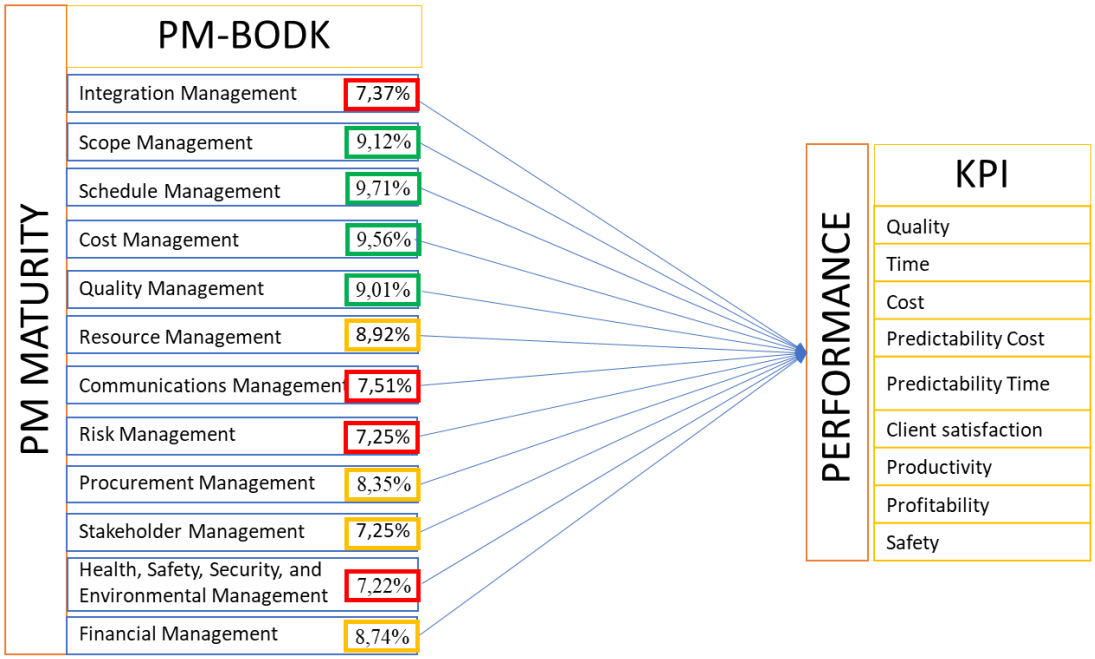

Figure 13: Result model of impact of project management body of knowledge areas on KPI

The result however gives signal that the impact of the PM Maturity of schedule, cost and scope and quality management have the highest impact on the performance of the contractor

while resource, financial, procurement and stakeholder's management count a medium level impact and the rest project management areas count the lowest level.

The literature implication also suggests that cost, quality and time are the top project management magical key indicators (Hensler, 2005) and other sources (Belayneh, 2019) also adds scope with the three key indicators and form the balance quadrant for project management.

The highest group impacts 37,39%, the medium group impacts 33,26% and the lower group impacts 29,35% accordingly.

CHAPTER 5 - SUMMARY OF MAJOR FINDINGS

A. PM Maturity of Ethiopian contractors reached level 3

Based on the assessment the Ethiopian Grade 1 contractors PM Maturity has increased to 3,1 (medium level) dimension in the last 10 years comparing studies conducting 10 years ago by (Yimam, 2011) where the researcher developed his own model to measure PM Maturity and found out a level of 0,99 (low) . This means that the Grade contractors are at a level 3 based on the PM Solutions scale where their projects use organizationally institutionalized formal standards. The increment of the maturity could be because of more than 80% of the respondents have a work experience of more than 11 years, 52% of them have qualification of second-degree level and37,5% of them are taking regular training on project management areas. In addition to that it could be that the organization 80% of them are now acquired work experience for more than 11 years and certified with ISO (39,2%) which enable them to manage their organization more efficient.

B. PM Maturity predict performance of contractors

A multiple linear regression was calculated to predict the effect of PM maturity on key performance indicator (dependent Variable) based on the Maturity level of the PM knowledge areas. A significance regression equation was found (F (12,40) = 5,781, p<0,001), with an R^2 = 0,634. PM Maturity predicted the effect on KPI ($\hat{Y}$) is:

$$\hat{Y} = 0{,}768 - 0{,}061X_{IntegM} + 0{,}151X_{ScopeM} + 0{,}218X_{ScheduleM} - 0{,}122X_{CostM} - 0{,}059X_{QualityM} - 0{,}199X_{Resource} - 0{,}116X_{CommunicationM} + 0{,}071X_{RiskM} + 0{,}403X_{ProcurementM} + 0{,}250X_{StakeholderM} - 0{,}036X_{HSSEM} + 0{,}196X_{FinancialM}$$

where each independent variable is coded as 1=very low, 2 = low, 3=medium, 4=high and 5= very

Overall PM Maturity level found to be high significant predictor as it can be visible, but it has also limitation. However, looking in to the detail and regressing each KPI with the PM maturity level, the significance of the data is become less but it shows a relationship and predictable capacity. Even so one of the mail goal of these research is to predict the effect of PM Maturity on the key performance indicators, the regression analysis shows that the model

could fit in the average situation and fit questionably its purpose in detail because of less significance levels of the data for each KPI as a result of less number of sample size.

C. PM Maturity and Organizational performance have a positive and significant relationship.

The descriptive statistics result confirms that the PM Maturity (M=3,1191 and SD=0,61304) and organizational performance (M = 3,0252 and SD = 0,63292), N = 53 shows how close the samples are relating to the population. In the other hand the person correlation analysis between the two variables shows that PM Maturity and Performance of organization have a statistically significant linear relationship ($p < .001$).

Other additional findings are:

a) Project and organizational performance have a strong linear relationship.

The organizational performance of Grade 1 contractors with respect to key performance indicators is medium (3,0252). The numbers are just to provide quantitative assessments of the level between 1 to f 5 which is at average level. And also, the project implementation performance of Grade 1 contractors with respect to key performance indicators is medium (3,0335). Pearson correlation number 0.872 confirms that the there is a strong and positive linear relationship between the two variables with significant level $p < 0.01$.

b) PM Maturity have significant relation with key performance indicators

PM maturity has significant relation on key performance indicators. Schedule, cost and scope and quality management have the highest share on the key performance indicators.

CHAPTER 6 - CONCLUSION AND RECOMMENDATION

6.1. CONCLUDING REMARKS

This master's thesis research in Executive Master of Business Management has tried to assess the maturity of project management practices in the Ethiopian grade 1 contractors.

Further, the research found out the relationship and effect between PM Maturity and performance of contractors (Organizational and Project level) and developed conceptual relationship model that contractor can utilize the result to prioritize and improve their capability to perform and compete in the industry and researcher can continue with the idea to investigate more contractors aby collecting additional data.

The assessment form and steps can also be used by contractors for self-assessment purpose and to guide additional improvement effort in their project management process and practice. Though, this thesis research on such a wide area is meant only to assess the contractors project management practice and its relationship with performance, and it is a starting work to assess the contractors towards a long journey to the development of modern project management practice in their organization.

Moreover, the research has also identified key project management areas that has significant relation on the key performance indicators which they can be research more on the topic considering more data.

The main goal of the research was to see the gap in project management practices by assessing the PM Maturity levels and its relationship and effect with performance in detail and propose new perspectives for further assessments and investigation on the area. And this study assumed that further studies will address the remaining gaps specially of the significance relationships of the variables and other details.

6.2. RECOMMENDATIONS

This research is a starting point to see the engineering part of project management with business subject perspective. Hence this research recommends the following key points.

a) Conducting a detailed research to identify the processes and practices to be assessed by project management agents, consultants and clients partly or jointly so that different perspective could give different results

b) Conducting also detailed maturity assessments by category of contractors such as buildings, road, general contractors.

c) Developing general agreed project management assessment generic models for the Ethiopian construction industry so that each particular sectorial category of contractor can be assessed and measured.

d) Conduct continuous yearly research to measure the increment and improvement of the PM Maturity of the construction industry as a whole and the contractors in particular.

e) Conduct PM Maturity of key construction stakeholders like consultants, project management agents and clients to enhance the development of project management in the construction industry of Ethiopia.

f) Contractors are recommended to self-assess or let assessed by professional their organization PM Maturity level, so they check regularly to improvement their capability.

g) Sectorial and professional associations should research PM Maturity of contractors, consultants and clients and publish the result regularly to enhance the project management awareness sin the industry

h) Rather adapting from other countries experience, it is recommended to research and develop construction industry-based performance measurement framework, key performance indicators and modelling system in order to measure performance of construction organizations and projects.

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ANNEXES

Annex 1 – Questionnaire

Dear Respondent,

My name is Addisalem Nega and i am conducting a research on the effect and relation of project management maturity on the performance of contractors at Addis Ababa University, College of Business and Economics

You are invited to participate in this research which will contribute to the development and improvement of Project Management in the construction industry of Ethiopia. Thus, you are kindly invited to fill out the questionnaire and return it to the researcher within 5 days of the receipt of the questionnaire.

Information collected through this questionnaire will be used only for research purposes and will not be shared with other business entities. Personal and contact information provided by participants will be kept confidential and may only be used for research purposes or future communication with the research participants.

Please call to Addisalem at 0911 43 86 02 for pickup of the completed questionnaire or send via email to addisalem.nega@gmail.com

Thank you for your interest in participating in the research.

Researcher:

Addisalem Nega

Advisor:

Dr. Lakew Alemu, Addis Ababa University, College of Business and Economics, Department of Management, Executive MBA Program, Email: lakealem@yahoo.com, Tel: 01122961l

Part I – General Information	
Direction: Please provide the requested information on the space provided	
1. Position/role in the company :_____	
2. Your qualification?	
Diploma/Cerificate	
1st Degree	
2nd Dgree and more	
Other (please specify)	
3. Respondent's Work experiance:	
0-5 years	
6-10 years	
11-15 years	
16-20 years	
more than 20 years	
other (please specify)	
4. Experience of your organization, as organization or firm (in years)	
0-5 years	
6-10 years	
11-15 years	
16-20 years	
more than 20 years	
other (please specify)	
5. What is the category of your organization?	
A. General contractor (GC)	
B. Building contractor (BC)	
C. Road contractor (RC)	
D. Specialized Contractor (SC)	
E. Other (please specify)	
6. Has your company participated on any of Capacity Building Program?	
A. Yes	
B. No	
C. I do not know	
7. Have you participated and acquired project management certification (like PMP, PMS etc?	
A. Yes	
B. No	
C. I do not know	
8. Your company is	
A. ISO certified	
B . In a process to get the certification Neither	
C. ISO certified nor in a process to be certified	
D. Other (please specify)	

Part II - Project management maturity self assessment questionnaire (Survey)

General Direction:

Answer all the questions that follow based on your knowledge of practice of Project Management in the project you are participating or in the organization you are working.

Please Choose:

1 for Very low: If the description does not come close to the condition in you project (organization). PIM

2 for Low: if the description come at the minimum level to the project (organization).

3 for Medium: if the description come at average level to the project (organization).

4 for High: If the description approximates meets the condition in your project (organization).

5 for Very High: If the description fully meets (100%) the condition in your project (organization).

How do you rate the project management maturity of your organization/project with respect to the following project management competences?

Project Management Knowledge Area		**Project Management**				
1. Project Integration Management						
1	Project Charter Development	1	2	3	4	5
2	Project Management Plan Development	1	2	3	4	5
3	Project Execution	1	2	3	4	5
4	Monitoring and Controlling Project Work	1	2	3	4	5
5	Integrated Change Control	1	2	3	4	5
6	Project or Phase Closure	1	2	3	4	5
7	Project Management Office (PMO)	1	2	3	4	5
2. Project Scope Management						
1	Scope Management Planning	1	2	3	4	5
2	Requirements Collection	1	2	3	4	5
3	Scope Definition	1	2	3	4	5
4	Work Breakdown Structure	1	2	3	4	5
5	Scope Validation	1	2	3	4	5
6	Scope Change Control	1	2	3	4	5
3. Project Schedule Management						
1	Time Management Planning	1	2	3	4	5
2	Activity Definition	1	2	3	4	5
3	Activity Sequencing	1	2	3	4	5
4	Activity Resource Estimating	1	2	3	4	5
5	Activity Duration Estimating	1	2	3	4	5
6	Schedule Development	1	2	3	4	5
7	Schedule Control	1	2	3	4	5
8	Schedule Integration	1	2	3	4	5
4. Project Cost Management						
1	Cost Management Planning	1	2	3	4	5
2	Cost Estimating	1	2	3	4	5
3	Budget Determination	1	2	3	4	5
4	Cost Control	1	2	3	4	5
5. Project Quality Management						
1	Quality Management Planning	1	2	3	4	5
2	Quality Assurance	1	2	3	4	5
3	Quality Control	1	2	3	4	5
4	Management Oversight	1	2	3	4	5
6. Project Resource Management (HR, Equipment, Material)						
1	Plan resource management	1	2	3	4	5
2	Estimate activity resources	1	2	3	4	5
3	Acquire resources	1	2	3	4	5
4	Develop team	1	2	3	4	5
5	Manage team	1	2	3	4	5
6	Control resources	1	2	3	4	5

7. Project Communications Management						
1	Communications Management Planning	1	2	3	4	5
2	Communications Management (Information Distribution)	1	2	3	4	5
3	Communications Control	1	2	3	4	5
4	Issues Tracking and Management	1	2	3	4	5
8. Project Risk Management						
1	Risk Management Planning	1	2	3	4	5
2	Risk Identification	1	2	3	4	5
3	Qualitative Risk Analysis	1	2	3	4	5
4	Quantitative Risk Analysis	1	2	3	4	5
5	Risk Response Planning	1	2	3	4	5
6	Risk Control	1	2	3	4	5
7	Risk Documentation	1	2	3	4	5
9. Project Procurement Management						
1	Procurement Management Planning	1	2	3	4	5
2	Procurements Requisition and Solicitation	1	2	3	4	5
3	Procurement Control and Vendor Management	1	2	3	4	5
4	Procurement Closure	1	2	3	4	5
10. Project Stakeholder Management						
1	Stakeholder Identification	1	2	3	4	5
2	Stakeholder Management Planning	1	2	3	4	5
3	Managing Stakeholder Engagement	1	2	3	4	5
4	Controlling Stakeholder Engagement	1	2	3	4	5
5	strategy to deal with the stakeholder claims	1	2	3	4	5
11. Project Health, Safety, Security, and Environmental Management (P-HSSE-M)						
1	HSSE Management Planning	1	2	3	4	5
2	HSSE Management Executing	1	2	3	4	5
3	HSSE Management Monitoring and Controlling	1	2	3	4	5
12. Project Financial Management						
1	Financial Management Planning	1	2	3	4	5
2	Budget monitoring and Control	1	2	3	4	5
3	Financial management procedure	1	2	3	4	5
4	Budget planning	1	2	3	4	5
5	Application of standardized process, format and tools	1	2	3	4	5

13. Please rate the overall project management maturity level of your organization for the following Project Management Knowledge Areas

	13. Project Management Knowledge Area					
1	Integration Management	1	2	3	4	5
2	Scope Management	1	2	3	4	5
3	Schedule Management	1	2	3	4	5
4	Cost Management	1	2	3	4	5
5	Quality Management	1	2	3	4	5
6	Resource Management	1	2	3	4	5
7	Communications Management	1	2	3	4	5
8	Risk Management	1	2	3	4	5
9	Procurement Management	1	2	3	4	5
10	Stakeholder Management	1	2	3	4	5
11	Health, Safety, Security, and Environmental Mgmt.	1	2	3	4	5
12	Financial Management	1	2	3	4	5

Part III: Assessment of performance of an organization

Answer with right sign (√) if it fits to your answer for question 1

For the questions from 2-9, select as per the guideline of Part II

1 Does your company use any performance measurement systems (e.g., Key Performance Indicators [KPIs])? (if Yes, please specify.)

No	
Yes	

if yest please specify_____

2 How do you rate the performance of your organization/firm with respect to the following parameters?

	Very Low	Low	Medium	High	Very High
General Construction Project Management Practices – Extent of Application of Project Management Functions, Tools, Techniques and Systems.	1	2	3	4	5
General Construction Project Management Practices – State of Adoption and Implementation of Construction Project Management Procedures	1	2	3	4	5
Risks Management Performance – Stake Holders Perception, Trend, Identification of Causes of Risks and their Responsibility Allocation	1	2	3	4	5
Delay Management Practices – Identifying/Understanding Causes of Delays and Delay Responsibility Allocation	1	2	3	4	5
Safety Culture – Perceptions and Practices	1	2	3	4	5
Quality Culture – Perceptions and Practices	1	2	3	4	5
Constructability Practices	1	2	3	4	5
Contract Management Practices	1	2	3	4	5
Bid Procurement Practices	1	2	3	4	5
Addressing Client Satisfaction	1	2	3	4	5

3 Over all, how do you rate the overall performance of your organization in practicing the above construction project management practices?	1	2	3	4	5

4 Please rate the application of project management knowledge areas in your organization?

Integration Management	1	2	3	4	5
Scope Management	1	2	3	4	5
Schedule Management	1	2	3	4	5
Cost Management	1	2	3	4	5
Quality Management	1	2	3	4	5
Resource Management	1	2	3	4	5
Communications Management	1	2	3	4	5
Risk Management	1	2	3	4	5
Procurement Management	1	2	3	4	5
Stakeholder Management	1	2	3	4	5
Health, Safety, Security, and Environmental Management	1	2	3	4	5
Financial Management	1	2	3	4	5

5	**Please rate the extent of potential challenges on your organization or firm of the following project management knowledge areas?**					
	Integration Management	1	2	3	4	5
	Scope Management	1	2	3	4	5
	Schedule Management	1	2	3	4	5
	Cost Management	1	2	3	4	5
	Quality Management	1	2	3	4	5
	Resource Management	1	2	3	4	5
	Communications Management	1	2	3	4	5
	Risk Management	1	2	3	4	5
	Procurement Management	1	2	3	4	5
	Stakeholder Management	1	2	3	4	5
	Health, Safety, Security, and Environmental Management	1	2	3	4	5
	Financial Management	1	2	3	4	5
6	**Please rate the extent of deviation for the following issues in terms of % by comparing planed (at the beginning) and actual (at completion stage)**					
	Wastage (Time, Space, Materials, Manpower, Money and Machine etc)	1	2	3	4	5
	Time Over run (Delay)	1	2	3	4	5
	Cost Over run (Increase in Cost)	1	2	3	4	5
	Quality Deviation	1	2	3	4	5
	Safety	1	2	3	4	5
	Risk and uncertainty	1	2	3	4	5
7	**How do you rate the overall performance of your organization/firm with respect to the following KPI parameters?**					
	Quality (Impact of the defects of the final product)	1	2	3	4	5
	Construction Time (Improvement of time year on year)	1	2	3	4	5
	Construction Cost (Improvement of capital cost year on year with	1	2	3	4	5
	Predictability Cost (Actual cost against the cost predicted at tender)	1	2	3	4	5
	Predictability Time (Actual time against the time predicted at tender)	1	2	3	4	5
	Client Satisfaction- Service/Product (Client satisfaction with the delivered product and project team)	1	2	3	4	5
	Productivity (Value added per person working on the project)	1	2	3	4	5
	Profitability (Profitability of the Construction Company)	1	2	3	4	5
	Safety (Accident Incident Rate for the Company)	1	2	3	4	5
8	**How do you rate the performance of your organization on the specific project with respect to the following KPI parameters? (You may consider the average of your three recent completed**					
	Quality (Impact of the defects of the final product)	1	2	3	4	5
	Construction Time (Improvement of time year on year)	1	2	3	4	5
	Construction Cost (Improvement of capital cost year on year with regard to contract and industry bench mark)	1	2	3	4	5
	Predictability Cost (Actual cost against the cost predicted at tender)	1	2	3	4	5
	Predictability Time (Actual time against the time predicted at tender)	1	2	3	4	5
	Client Satisfaction- Service/Product (Client satisfaction with the delivered product and project team)	1	2	3	4	5
	Productivity (Value added per person working on the project)	1	2	3	4	5
	Profitability (Profitability of the Construction Company)	1	2	3	4	5
	Safety (Accident Incident Rate for the Company)	1	2	3	4	5

9	How do you rate the impact of projet management competences or knowledge areas of your organization on the specific key performance indicators?					
9.1	**List of project management body of knowledge that affects performance in construction projects**	**Degree of Impact on Quality**				
		Very Low	Low	Medium	High	Very High
1	Integration Management	1	2	3	4	5
2	Scope Management	1	2	3	4	5
3	Schedule Management	1	2	3	4	5
4	Cost Management	1	2	3	4	5
5	Quality Management	1	2	3	4	5
6	Resource Management	1	2	3	4	5
7	Communications Management	1	2	3	4	5
8	Risk Management	1	2	3	4	5
9	Procurement Management	1	2	3	4	5
10	Stakeholder Management	1	2	3	4	5
11	Health, Safety, Security, and Environmental Management	1	2	3	4	5
12	Financial Management	1	2	3	4	5
9.2	**List of project management body of knowledge that affects performance in construction projects**	**Degree of Impact on Time**				
		Very Low	Low	Medium	High	Very High
1	Integration Management	1	2	3	4	5
2	Scope Management	1	2	3	4	5
3	Schedule Management	1	2	3	4	5
4	Cost Management	1	2	3	4	5
5	Quality Management	1	2	3	4	5
6	Resource Management	1	2	3	4	5
7	Communications Management	1	2	3	4	5
8	Risk Management	1	2	3	4	5
9	Procurement Management	1	2	3	4	5
10	Stakeholder Management	1	2	3	4	5
11	Health, Safety, Security, and Environmental Management	1	2	3	4	5
12	Financial Management	1	2	3	4	5
9.3	**List of project management body of knowledge that affects performance in construction projects**	**Degree of Impact on Cost**				
		Very Low	Low	Medium	High	Very High
1	Integration Management	1	2	3	4	5
2	Scope Management	1	2	3	4	5
3	Schedule Management	1	2	3	4	5
4	Cost Management	1	2	3	4	5
5	Quality Management	1	2	3	4	5
6	Resource Management	1	2	3	4	5
7	Communications Management	1	2	3	4	5
8	Risk Management	1	2	3	4	5
9	Procurement Management	1	2	3	4	5
10	Stakeholder Management	1	2	3	4	5
11	Health, Safety, Security, and Environmental Management	1	2	3	4	5
12	Financial Management	1	2	3	4	5
9.4	**List of project management body of knowledge that affects performance in construction projects**	**Degree of Impact on Predictability Cost**				
		Very Low	Low	Medium	High	Very High
1	Integration Management	1	2	3	4	5
2	Scope Management	1	2	3	4	5
3	Schedule Management	1	2	3	4	5
4	Cost Management	1	2	3	4	5
5	Quality Management	1	2	3	4	5
6	Resource Management	1	2	3	4	5
7	Communications Management	1	2	3	4	5
8	Risk Management	1	2	3	4	5
9	Procurement Management	1	2	3	4	5
10	Stakeholder Management	1	2	3	4	5
11	Health, Safety, Security, and Environmental Management	1	2	3	4	5
12	Financial Management	1	2	3	4	5

9.5	**List of project management body of knowledge that affects performance in construction projects**	**Degree of Impact on Predictability Time**				
		Very Low	Low	Medium	High	Very High
1	Integration Management	1	2	3	4	5
2	Scope Management	1	2	3	4	5
3	Schedule Management	1	2	3	4	5
4	Cost Management	1	2	3	4	5
5	Quality Management	1	2	3	4	5
6	Resource Management	1	2	3	4	5
7	Communications Management	1	2	3	4	5
8	Risk Management	1	2	3	4	5
9	Procurement Management	1	2	3	4	5
10	Stakeholder Management	1	2	3	4	5
11	Health, Safety, Security, and Environmental Management	1	2	3	4	5
12	Financial Management	1	2	3	4	5

9.6	**List of project management body of knowledge that affects performance in construction projects**	**Degree of Impact on Client satisfaction**				
		Very Low	Low	Medium	High	Very High
1	Integration Management	1	2	3	4	5
2	Scope Management	1	2	3	4	5
3	Schedule Management	1	2	3	4	5
4	Cost Management	1	2	3	4	5
5	Quality Management	1	2	3	4	5
6	Resource Management	1	2	3	4	5
7	Communications Management	1	2	3	4	5
8	Risk Management	1	2	3	4	5
9	Procurement Management	1	2	3	4	5
10	Stakeholder Management	1	2	3	4	5
11	Health, Safety, Security, and Environmental Management	1	2	3	4	5
12	Financial Management	1	2	3	4	5

9.7	**List of project management body of knowledge that affects performance in construction projects**	**Degree of Impact on productivity**				
		Very Low	Low	Medium	High	Very High
1	Integration Management	1	2	3	4	5
2	Scope Management	1	2	3	4	5
3	Schedule Management	1	2	3	4	5
4	Cost Management	1	2	3	4	5
5	Quality Management	1	2	3	4	5
6	Resource Management	1	2	3	4	5
7	Communications Management	1	2	3	4	5
8	Risk Management	1	2	3	4	5
9	Procurement Management	1	2	3	4	5
10	Stakeholder Management	1	2	3	4	5
11	Health, Safety, Security, and Environmental Management	1	2	3	4	5
12	Financial Management	1	2	3	4	5

9.8	**List of project management body of knowledge that affects performance in construction projects**	**Degree of Impact on profitability**				
		Very Low	Low	Medium	High	Very High
1	Integration Management	1	2	3	4	5
2	Scope Management	1	2	3	4	5
3	Schedule Management	1	2	3	4	5
4	Cost Management	1	2	3	4	5
5	Quality Management	1	2	3	4	5
6	Resource Management	1	2	3	4	5
7	Communications Management	1	2	3	4	5
8	Risk Management	1	2	3	4	5
9	Procurement Management	1	2	3	4	5
10	Stakeholder Management	1	2	3	4	5
11	Health, Safety, Security, and Environmental Management	1	2	3	4	5
12	Financial Management	1	2	3	4	5

9.9	**List of project management body of knowledge that affects performance in construction projects**	**Degree of Impact on health and safety**				
		Very Low	Low	Medium	High	Very High
1	Integration Management	1	2	3	4	5
2	Scope Management	1	2	3	4	5
3	Schedule Management	1	2	3	4	5
4	Cost Management	1	2	3	4	5
5	Quality Management	1	2	3	4	5
6	Resource Management	1	2	3	4	5
7	Communications Management	1	2	3	4	5
8	Risk Management	1	2	3	4	5
9	Procurement Management	1	2	3	4	5
10	Stakeholder Management	1	2	3	4	5
11	Health, Safety, Security, and Environmental Management	1	2	3	4	5
12	Financial Management	1	2	3	4	5