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An Analysis of the Project Management Maturity Level in the Construction Industry of Developing Countries

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Abstract

This study assesses the project management maturity levels within the construction industries of selected developing countries, with a focus on identifying strengths, weaknesses, and critical gaps across key areas of project management knowledge. Utilising a mixed-methods approach, which included surveys, structured interviews, and maturity assessments, data were collected from 21 local contractors and 15 practitioners. The findings reveal that the majority of construction firms operate at low levels of both process and practice maturity, particularly in areas such as risk, safety, communication, and quality management. Conversely, comparatively higher maturity was recorded in cost, time, and human resource management. ISO-certified contractors and those participating in capacity-building programs demonstrated significantly higher maturity levels than their counterparts, highlighting the positive impact of formal training and a process-oriented approach. Road contractors exhibited higher maturity scores than building contractors, a difference attributed to stricter client requirements and larger project scopes. The study concludes that construction project success in developing countries is hampered by the inconsistent application of standardised project management practices. It recommends targeted interventions, including regulatory reforms, professional development, and context-specific maturity models to enhance project delivery performance across the sector.

Keywords: *Project Management Maturity, Construction Industry, Developing Countries, Process Maturity, Practice Maturity, ISO Certification, Capacity Building, Project Performance, Risk Management, Project Governance*

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1.0 INTRODUCTION

The construction industry plays a pivotal role in the socio-economic development of nations, particularly in developing countries where infrastructure gaps are significant and rapidly growing populations demand increased investment in buildings, roads, housing, energy, and water facilities. However, despite the strategic importance of the construction sector, many projects in developing countries continue to be plagued by inefficiencies, delays, cost overruns, and quality issues. These persistent challenges are often attributed to weak project management practices and the absence of standardised systems to evaluate and improve project execution processes (Marcelino-Sádaba et al., 2019).

Project management maturity refers to the extent to which an organisation or sector has developed and institutionalised its project management practices, processes, and systems. It reflects the ability of organisations to consistently deliver successful projects through structured methodologies, governance, and continuous improvement (Sánchez et al., 2017). Mature project management environments are typically associated with better resource utilisation, improved stakeholder engagement, and higher project success rates (Ofori, 2017). Conversely, in many developing countries, the project management function remains underdeveloped, lacking

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systematic approaches to planning, risk management, performance measurement, and knowledge transfer (Mir & Pinnington, 2019).

In the construction sector of developing nations, the level of project management maturity tends to be low due to several interrelated factors. These include limited institutional capacity, poor regulatory frameworks, insufficient training and professional development, and the dominance of informal procurement practices (Agyekum et al., 2018). The lack of structured maturity models and benchmarking mechanisms further complicates efforts to assess and improve project delivery capabilities. While various project management maturity models (PMMMs) such as CMMI, OPM3, and P3M3 have been adopted globally, their application in developing country contexts remains limited and often poorly aligned with local industry realities (Too & Weaver, 2017).

Recent research has emphasised the need for construction firms and policymakers in developing countries to understand and assess their project management maturity levels, identifying gaps and designing targeted interventions (Bofinger et al., 2019). Such assessments can enable more strategic investments in capacity building, standardisation of processes, and the adoption of best practices tailored to local conditions. Moreover, with the increasing complexity of construction projects and the growing emphasis on sustainability, digitalisation, and stakeholder collaboration, raising the maturity level of project management is becoming an essential prerequisite for national development goals (Alotaibi et al., 2020).

Given the importance of improving project delivery outcomes in the construction industry, this study aims to analyse the project management maturity levels within construction sectors in selected developing countries. By identifying prevailing maturity levels, strengths, and deficiencies, the study aims to contribute to the ongoing discourse on project management capacity building and inform the design of more effective project governance structures in resource-constrained environments.

2.0 MATERIALS AND METHODS

2.1 Concept of Project Management Maturity

Project management maturity refers to the extent to which an organisation consistently applies standardised project management processes, tools, and techniques to achieve predictable and successful outcomes. Maturity models are used to assess organisational capability and guide continuous improvement in project delivery. These models generally comprise multiple levels, ranging from ad hoc and unstructured practices to optimised and continuously improving project systems (Sánchez et al., 2017).

One of the most recognised maturity frameworks is the Organisational Project Management Maturity Model (OPM3) developed by the Project Management Institute (PMI), which integrates best practices across project, program, and portfolio levels. Similarly, the Capability Maturity Model Integration (CMMI) and P3M3 (Portfolio, Programme, and Project Management Maturity Model) provide systematic assessment frameworks, particularly for complex and technology-driven projects (Too & Weaver, 2017). These models facilitate benchmarking and enable performance tracking across various industries and countries.

2.2. Project Management Maturity in the Construction Industry

The construction industry is inherently project-based, complex, and resource-intensive, making effective project management critical to success. Despite this, construction projects in many developing countries continue to underperform in terms of cost, schedule, and quality, partly due to low levels of project management maturity (Ofori, 2017). This lack of maturity is often reflected in weak risk management practices, poor stakeholder engagement, ineffective planning, and insufficient post-project evaluations (Mir & Pinnington, 2019).

Bofinger et al. (2019) highlight that construction firms in developing economies, particularly in Sub-Saharan Africa, often operate at the lower levels of maturity, characterised by ad hoc practices and a lack of formal project governance. These organisations often lack defined roles, standardised methodologies, and performance measurement mechanisms. Capacity constraints, corruption, and regulatory weaknesses further compound this immaturity.

In contrast, organisations that have adopted maturity models in their project management processes have reported improved outcomes. For instance, Alotaibi et al. (2020)

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found that applying maturity frameworks in the construction industry in Saudi Arabia resulted in increased alignment between project goals and organisational strategy, ultimately enhancing project success rates.

2.3. Challenges to Achieving Higher Maturity Levels in Developing Countries

Numerous structural and contextual challenges hinder the development of project management maturity in the construction sectors of developing countries. These include limited investment in project management education, a shortage of qualified professionals, resistance to organisational change, and the absence of national standards (Agyekum et al., 2018). Additionally, cultural factors such as hierarchical decision-making and limited stakeholder empowerment often impede the implementation of structured project practices (Too & Weaver, 2017). Furthermore, Marcelino-Sádaba et al. (2019) note that while many construction firms acknowledge the benefits of maturity models, they frequently lack the strategic vision and resources necessary to implement them. The cost of assessment, lack of localised models, and insufficient awareness of maturity frameworks pose additional barriers. For these reasons, researchers argue for the adaptation of international maturity models to local contexts, emphasising flexibility, cultural alignment, and incremental implementation (Bofinger et al., 2019).

2.4. Benefits of Improved Project Management Maturity

Improving project management maturity levels offers substantial benefits. Organisations with higher maturity are more likely to deliver projects on time and within budget, improve stakeholder satisfaction, and reduce project risks (Sánchez et al., 2017). Higher maturity also contributes to institutional learning, better integration of sustainability principles, and enhanced innovation capabilities within construction projects (Marcelino-Sádaba et al., 2019).

Moreover, as digital transformation and sustainability become increasingly prominent in construction practices, maturity models provide a strategic tool to guide technological adoption and organisational resilience. Alotaibi et al. (2020) emphasise that maturity assessments can help firms navigate complex environments, align project outcomes with long-term development goals, and enhance competitiveness in global markets.

3.0 METHODOLOGY

Some scholars have concentrated on the various functions of the PMO, while some have concentrated on the complexity of the PMO and its processes and team leaders, and all have demonstrated differences in positions due to organisational requirements. The purpose of this research is to propose that the implementation of a PMO enhances project success in Trinidad and Tobago Consulting Limited by achieving the following objectives:

- To provide specific insights and guidelines on the implementation or enhancement of the use of PMO to maximise successful project results.
- To define and analyse the specific functions of the PMOs discussed in relevant current literature and how they may be applied to the essence of project success
- To generate strategic recommendations to the PMO on how to boost their performance.

Saunders (2021) indicated that research methodology is the strategy used to obtain information and expertise, to develop and evaluate hypotheses and the interaction between the theoretical context and the research issue. It is necessary to recognise the various study theories and methods that are possible while conducting a study. The overarching aim of this chapter is to explain the research design, data collection, and data review techniques that have been used to answer the research questions posed. This research was conducted in keeping with the honeycomb technique. The mechanism consists of 6 components (Wilson, 2008), shown in Figure 10 below.

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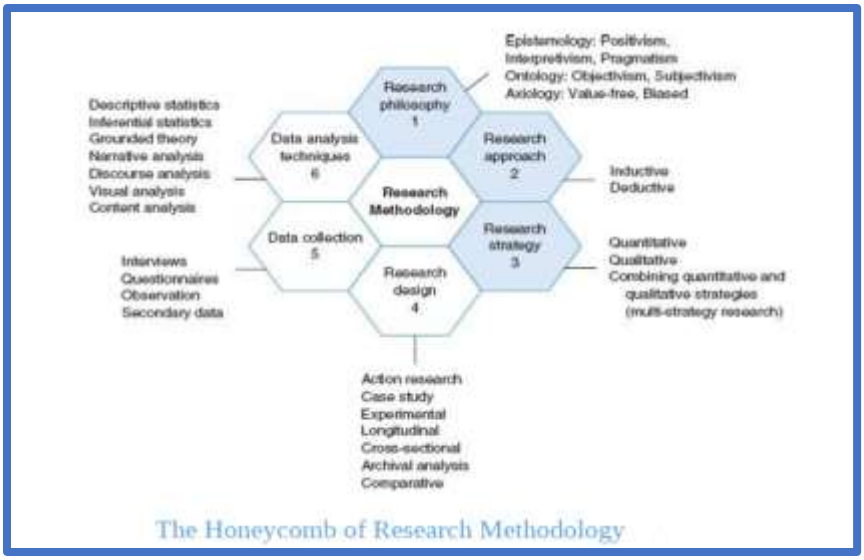

Figure 1: Honeycomb Research Methodology

3.2 Research Design

A case study is the research design used in the present analysis. It is a testing methodology in which data is obtained from a single place or entity that has characteristics correlated with the study topic. A case study can be either explanatory, exploratory, or descriptive. The purpose of an explanatory case study is to have the answers: why or how? (Silva and Ramos 2013). It included researching the theory by reflecting on the real-life case. The exploratory case studies aim to provide answers to the questions: what? And who? Other data collection techniques, such as questionnaires and interviews, typically follow the data collection process. The objective of a descriptive case study is to analyse the sequence of interpersonal events after a specific duration of time (Tjora 2018). A concise case study aims to identify a trend, such as a society or subculture.

This research implemented an exploratory methodology as it would require the response to the question, 'What is the role of the PMO in the progress of projects inside organisations? The study cycle took place between March 2020 and September 2020, and the total analysis period was six months. The thesis would be a quantitative analysis to be performed in a single institution that offers insight into the research subject. The research will employ a cross-sectional research design to ensure that the participants have equal interaction in the study without controlling them (Roni, Merga & Morris, 2020).

3.3 Ethical Considerations

Research ethics is the examination of the opinions of the community as to what is correct or wrong during the data collection process. Ethics advises that the method of data gathering will be carried out on the grounds of society's moral views as to what is good or wrong (Ketefian 2015). The data collection process was carried out ethically by ensuring that permission was obtained for the need to survey the company in which the survey is being conducted. The ethical considerations that were included in the current research: ensuring the privacy of respondents by not disclosing their names when reporting the research; ensuring that they were not subjected to an environment where they may be at risk; and preventing their likelihood of using the respondent to harm them. Table 12 offers a description of ethical issues to be addressed and the steps to be implemented to minimise them.

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Table 1: The ethical considerations for the research

Stage of the research	Ethical Risks	Mitigation
Preparation	Failure to seek authorization to carry out research	Seeking prior permission before the actual research
Data Collection	Disclosing the names of respondents who provided specific responses.	Avoiding direct naming of responses
Data presentation	Presenting the findings to people who are not concerned with the research.	Only sharing the research results with the relevant parties.

4.4 Research Methods

Research methods are how data about a topic should be obtained, processed, and used. Epistemology is a theory of market science that claims that information can be gained by studying nature and classifying observations as to how it represents the facts regarding itself. Knowledge can be intuitive, hierarchical, rational, or scientific. (Dana and Dumez 2015). This research was largely focused on a positivist model approach. According to positivism, information is extracted from quantifiable findings that can be evaluated and interpreted to contribute to concrete outcomes. Awareness of positivism theory is a discreetly measurable human behaviour and experiences that are made using conventional approaches (Taylor and Medina 2011). Ontology focuses on the theory of being and the perception of truth. Therefore, all assumptions or conclusions taken by a person must be focused on evidence that can be witnessed or confirmed (Silva and Ramos 2013). In this research, there is a significant relationship between the input variables and the outcome of the project management as stipulated. The study was focused on an objective stance in which the evidence gathered and the researcher's findings were interpreted to provide an understanding of the research subject and the formulation of the hypothesis.

The objectivity of science includes ontological viewpoints such as the belief that social events and their implications are focused on the truth that is autonomous of social actors. The researcher acknowledges that project management involves analysing people's opinions in a project to understand the underlying problems that limit their performance. Therefore, a subjective stance in this category will not be useful as it works with a particular set of individuals, such as nurses in a hospital, whereas project management has a wide set of individuals involved who are not subject to the topic of study.

Hennink, Hutter, and Bailey (2020) assert that the research approach is a chronological format that the researcher seeks to use in the study. Scientific research can take a deductive or an inductive approach. The rationale for deductive research uses the hypothesis as the basis for research to gather data that is analysed to establish a link between variables (Dana and Dumez 2015). The findings of the study were used to establish a framework that can be applied to explain related topics. Inductive reasoning is a method in which a researcher takes concrete assumptions and analyses hypotheses that are used to generalise a group with identical characteristics. It does not carry out a literature review or establish theories that can be checked.

This research used a deductive approach to the research because it involved collecting data from real-life situations, analysing findings from several sources of information, and comparing them to allow the assumption to be accepted or rejected. The use of a deductive analysis method has allowed the researcher to gather evidence from a variety of outlets, viewing observations as simple facts that reinforce the hypotheses and theories that will be established on the subject of study (Tjora 2018). It will be useful in ensuring that the findings are based on facts rather than perceptions. Therefore, the inductive approach will not be appropriate for this

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study as it seeks to add to the theory. The research has chosen the deductive approach because it will investigate the practicality of the application of project management theories in modern business ecosystems.

Analysis approaches can be in the context of qualitative, quantitative, or mixed methods. Throughout the qualitative analysis, the data collection method includes the gathering of people's views, experiences, and observations on the phenomena or topic of study (Barnham 2015). This is distinguished by the usage of concise knowledge in the form of comments and narratives of the respondents. A quantitative analysis approach employs a data collection method that is delivered in subtle formats that can be quantified or recorded (Bryman 2007). Throughout the quantitative study method, the interpretation of data is defined by mathematical measures such as means, standard deviations, and concise statistics. In the framework of mixed-method research, the analysis instrument is structured in such a manner that both qualitative and quantitative data are obtained. Respondents are presented with situations where they are expected to offer objective details and areas where they are permitted to give specific viewpoints and views, as in the case of open-ended queries. The researcher used a mixed-method, both qualitative and quantitative, to review current literature and to evaluate new knowledge results.

3.4.1 Research Samples

It was not economically feasible, among other constraints, to contact all the people; hence, a sample size of seventy (70) was included in the study. This sample size was chosen because there is little variation in the target population; hence, the outcome from this sample will be representative. This sample was also taken because of the amount of data that needed to be collected. The employees were selected using convenience sampling (haphazard sampling) techniques. The data collection process included methods that would allow both primary and secondary data to be collected. Primary data collection included informal interactions with respondents and analysts, whilst secondary data collection would rely on the usage of knowledge from electronic sources to gain more insight into the topic. The table below shows a summary of the data collection methods used.

Table 2: Summary of sources of information for the research

Objective	Who/Where? **Source**	Data Needed **Themes/Constructs**	How will the Data be collected? **Method**
To collect views and opinions of experts	Respondents from Company X	Survey questions, Concepts of PMO and project success	Surveys and interviews
To find data and figures related to the research topic	Databases within the project management organizations	Project management, PMO functions, Project Success	Organizational database search
To find experts opinions regarding the research topic	Views of scholars in published materials.	Project Management, Project management Office, Project Success	Website searches

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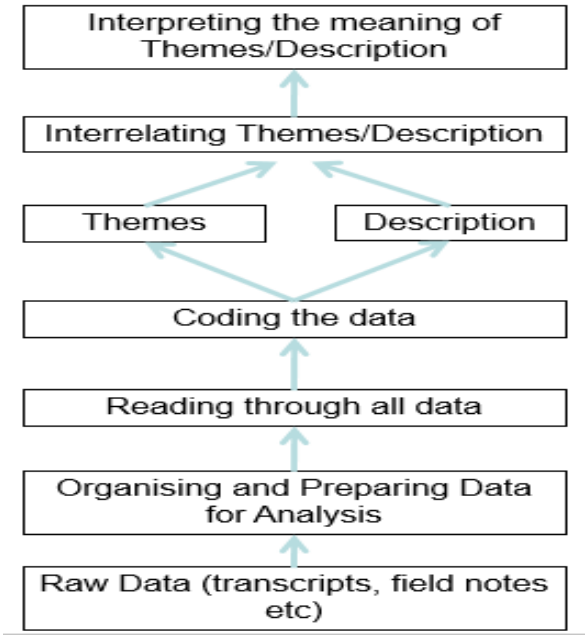
3.4.2 Research Result

Since the questionnaire required the collection of quantitative data, while the interview incorporated the collection of qualitative data, both types of data analysis were used. Quantitative data was managed by data entry, sorting, and encoding. Data entry is the method of documenting study observations in a book, a device, or other knowledge-storing medium that can be retrieved in the future (Garner and Scott 2013). Sorting of data refers to the act of arranging the data collected according to specific criteria, such as questions relating to specific data themes that can be used to analyse the data (Seale and Kelly 2004). Coding is a systematic method of data processing where basic principles and areas of concern are defined for use in the interpretation of study results. Descriptive Statistics; data was evaluated through descriptive data processing to define key patterns such as mean, median, spectrum, and style (Simonsohn, Simmons, and Nelson 2019). Descriptive research can include an interpretation of the subjective features of the demographic profiles of the respondents (Van Elst 2013). Descriptive statistics will be presented in graphic formats using graphs and pie charts.

Thematic research is a methodological data processing approach that focuses on defining the subjects, ideas, and subtopics that arise from the report. Thematic analysis was relevant to the identification of the themes and concepts in the responses provided by the participants in the survey. Thematic research was based on the Creswell model as seen in Figure 11.

Table 3: Thematic analysis framework



The transcription was carried out during the thematic review by translating the audio representation of the data into a written form (Davidson 2009). Making notes required the use of a pen and paper to document the audio replies of the research participants. Categorising themes is a thematic research technique that allows for the grouping of answers due to the resemblance of the themes in qualitative findings (Garner and Scott 2013). Interlinking themes is done by defining the degree to which various themes display overlap in explaining a research topic or addressing a research query.

3.4.3 Research Questionnaires

Surveys are commonly utilised in management analysis by utilising a questionnaire that gathers data from respondents, which is then systematically evaluated (Saunders, Lewis & Thornhill, 2007). The reason for using a survey is the quantification of evidence by evaluating, reviewing, interpreting, and generalising results (McDaniel & Gates, 2006). This segment deals with the quantitative dimension of discussing the problem of PMO characteristics inside project-

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based organisations. The purpose of the questionnaire was to determine whether there is a relationship between the existence of PMO and the success of projects in organisations that manage projects.

In addition, questionnaires are based on the characteristics of the PMO as described by roles, activities, and structure. The questionnaire used by the researcher was a guide to the aspects of the research topic for which data collection was done. The respondents were project management professionals from around the globe. The sample size to improve the reliability of the research outcomes was 63 respondents. The respondents were subjected to equal treatment: asked the same questions and prevented from bias in presenting their responses.

A purposive sampling procedure was used where the respondents were selected to achieve particular outcomes targeted by the researcher. In this case, purposive sampling ensured the selection of only the respondents who have an understanding of the research topic and can provide appropriate responses. Measurement of variables was achieved by using a Five-Point Likert scale to establish the perspectives of the respondents regarding their level of agreement with specific propositions or claims, for which 1= “strongly disagree” to 5= “strongly agree”. As a consequence, the questionnaire provided useful evidence required to accomplish the goals of the dissertation. The questionnaires are included in Appendix A.

3.4.4 Research Interviews

Tansey (2007) claimed that the interview was described as a convincing way to collect useful data for process-based analysis. This enables data to be obtained from individuals via conversations. According to Kvale (1996) regarded interviews are regarded as “…an interchange of views between two or more people on a topic of mutual interest, see the centrality of human interaction for knowledge production and emphasises the social situatedness of research data”. Interviews were the primary method of data collection in this research process. In this analysis, the researcher prefers to use a formal interview to elicit knowledge from academic professionals that may be positive or contrary to practitioners' opinions via a series of structured questions about the exploratory issue of PMO's position in fostering project success through the governance system prism.

To gather data from appropriate databases, the researcher questioned staff in the engineering department of a Company specialised in project management in Trinidad and Tobago. Before beginning the interviews, an introduction was created for the interviewees, clarifying the intent of the study and its objectives specifically for senior staff. Interviews were open-ended to gain specific viewpoints and insights from the respondents. Interviews were performed face-to-face with the respondents by visiting their workplace and inviting them to engage in an informal interview with the interviewer. In addition, interviews were conducted by making notes, filling in the right choices in the prescribed queries, and documenting the respondent's verbatim as a tool for developing a database of primary data collected. The interview session was, however, focused on an interview-survey with some formal governance questions to suggest the context for the research analysis.

3.4.5 Research Validity

The main qualitative drawback associated with the report was that it was focused on a case study, and the results may only affect the company examined rather than other organisations in a related sector. The act of generalising the study subject based on the results can affect the reliability of the findings. The thesis is often constrained in terms of the reality that it is quantitative work and may involve planning, the potential to pay extra expenses, and often obstacles that render it impossible for the research goals to be accomplished. In addition, the researcher expects some non-avoidable list of restrictions to occur while conducting the study. The limitations are natural in any research study, and some are defined by the scope and strictness of the scope of the study. This research will be limited to data reliability. Since the survey is about project management, participants may be exposed to external influence to answer the research questions in a particular way. This limitation is beyond the reach of the researcher and may harm the reliability of the data collected, thereby causing a skewed analysis.

3.5 Chapter Summary

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Chapter three explains the procedure for gathering data and the approach for evaluating the research question identified in chapter one. A case study concept is expressed through several methods of data collection. Semi-structured interviews, record review, assessment, and systematic research were the core techniques of data collection. Triangulation of evidence to strengthen the quality of the results was available across a variety of data channels, such as a review of interview transcripts and cross-checking of the data observed/interviewed with high-level executives in the organisation. Keeping this approach in mind, chapter four presents the findings collected from each event and analyses cross-case models.

Aubry, Hobbs and Thuillier (2018) propose that the Project Management Office is a dynamic topic that should be interpreted as a part of a systemic cycle within an operational sense since it is rooted in the host entity and both evolve concurrently. The case study approach is thus known to be more suitable for this analysis, as it enables the gathering of very comprehensive details on procedures and events. In addition, a benefit of this case study approach, working with recent issues helps researchers to utilise a broad variety of evidence: documentation, archival reports, findings, interactions with the individuals concerned, and artefacts. The usage of several data points mitigates the possible question of construct validity.

4.0 RESULTS AND DISCUSSIONS

4.1 Data and Information Description

The research questionnaire was initially delivered to 40 contractors, of which 32 are local contractors and eight are international contractors (seven Chinese and one Indian contractor doing business in Ethiopia). Twenty-six of the 32 local contractors returned the questionnaire, and unfortunately, none of the eight international contractors returned the maturity assessment questionnaire. Of those 26 which returned the survey, a response from five was rejected as the responses were not complete or properly completed. Hence, only the response from the 21st contractor was used in performing the maturity analysis. This chapter presents only the result of the maturity assessment of the 21 organisations and the practice rating of the PM practices by 15 Practitioners.

Table 4: Summary of the demographics of practising contractors

Contractor 's Category	**Number of contractors in the category**
Based on Ownership Type	
Public Construction Companies	3
Private Construction Companies	18
Non-Identified	0
Based on the contractor's major work	
General Contractors (both road and building works)	7
Building Contractors	9
Road Contractors	5
Based on Participation in Capacity Building Program	
Capacity Building Program	10
Participant	
Non-Capacity Building Program Participant	8
Unidentified	3
Based on ISO-Certification	
ISO-Certified	5
In process for ISO certification	6
Neither certified nor in Process	9
Unidentified	1

5.2 Context of Research Sites

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Practitioners Interviewed

In order to develop the proposed model, two additional questionnaires were prepared distributed to a total of 18 selected Practitioners and Academicians in areas of construction Project Management. Fifteen of the respondents have returned the first questionnaire (Survey-questionnaire II) of which the result of one was rejected due to incompletes. For the third questionnaire (survey –Questionnaire III), 12 respondents have returned the questionnaire of which the result of three respondents were rejected due to incompleteness. Generally, Nine of the 15 practitioners that have returned the questioners have PM training at master's level (Construction management program) one of the respondents has PhD level training and the remaining five have short term PM training. Two respondents have less than two years of experience as PM, four of them have experience between two to four years, six respondents have 5 to 10 years' experience working as PM and the remaining three have indicated working as PM above 10 years. The respondents have an average of seven years of PM experience.

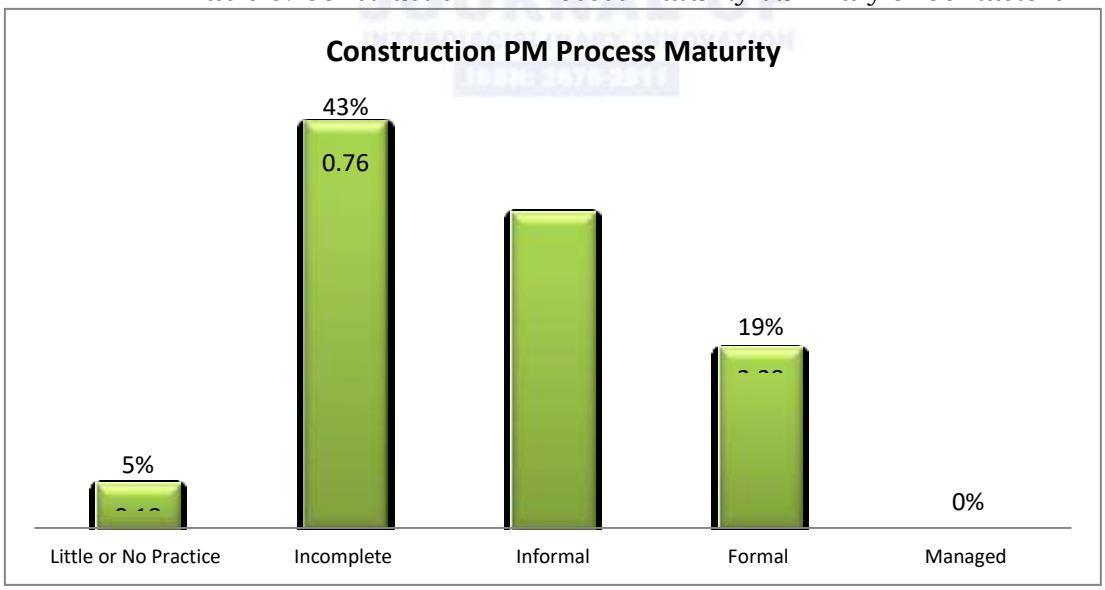
Maturity Assessment Result and Discussion

The maturity assessment has been performed for the 12 construction PM knowledge areas covered by the research. The assessment is performed in two dimension of Practice maturity dimension and Process maturity dimension. Subsequent parts provide assessment summary result and discussion.

Maturity Assessment Result- Process maturity Dimension

As can be seen in Figure 9, approximately 50% of the contractors are found to be at incomplete level of PM process maturity (that is on average 50% of the contractors do not perform all the necessary processes that are required to manage construction projects successfully). On average these contractors do not perform 1 in 4 of processes or practices that are expected to be performed to achieve knowledge area goals. Further, 1/3 of the contractors perform the majority of necessary PM processes informally, and only 20% perform the majority of the PM processes formally. There was no single contractor which has attained the managed level process maturity. This result supports the research assumption to use maturity level up to defined level only. Moreover, the result is indicative of the low level of PM development in the country's construction industry.

Table 5: Construction PM Process Maturity summary of Contactors



The research finding indicates that overall, the maturity of the process dimension of construction project management is found to be at informal process maturity level (1.30-see Figure 10). As seen in Figure 10 the knowledge areas of material, procurement, cost, time, financial and human resource management have shown comparatively higher level of maturity compared with other

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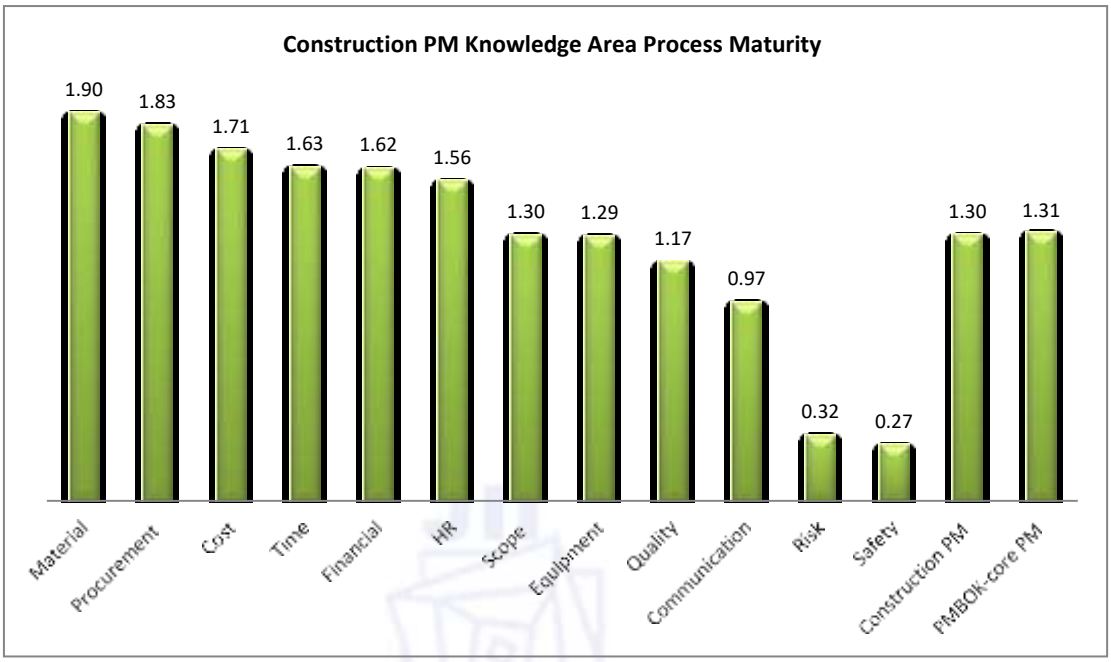
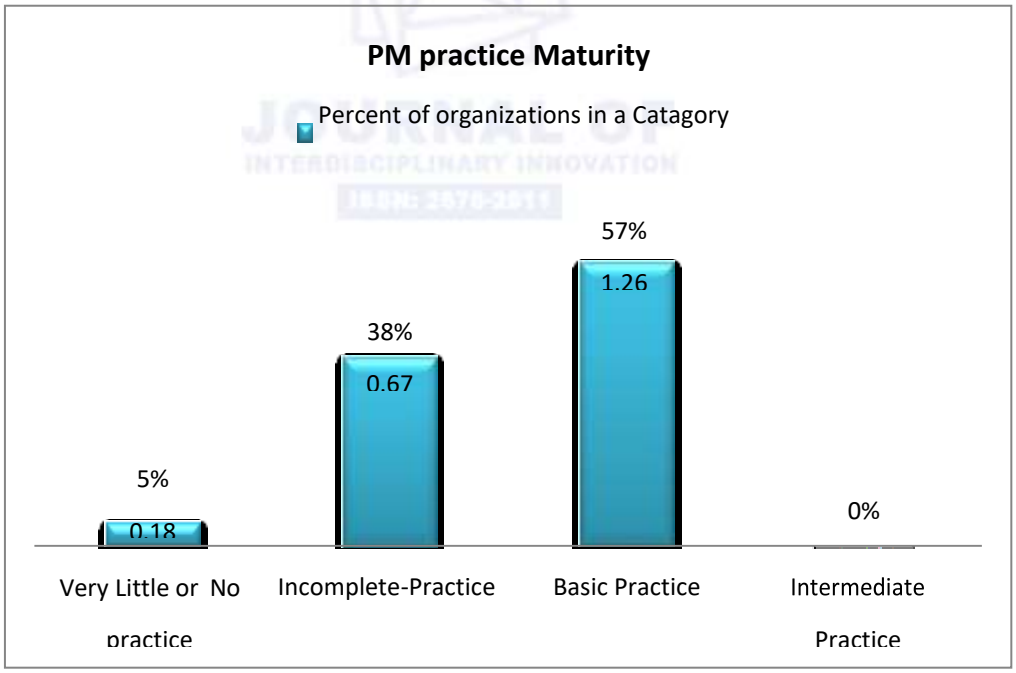
PM knowledge areas. These knowledge areas are more or less being performed formally by the majorities of the contractors. Whereas the knowledge areas of scope, equipment, quality and communication management are comparatively at lower level and could be considered to be performed informally by the majorities of the contractors. The remaining two knowledge areas of risk and safety management are the least mature knowledge areas. For practical purposes, one can consider these two to be unknown or practised by very few in the industry.





Maturity Assessment Result- Practice Maturity Dimension

The assessment results show that almost 40% of the contractors are at an incomplete level of practice maturity. That means, on average, 40% of the contractors do not perform all the practices considered basic. In fact, on average, 40% of contractors perform only two-thirds of the PM practices considered basic in managing construction projects. This is indicative of the very

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low level of PM maturity in the country's construction industry. The rest 60% of the contractors are at basic level of practice maturity. Not a single contractor has managed to achieve even intermediate level of PM practice maturity. The assessment result also indicates that on average about 60% of the contractors perform all the practices which are considered to be basic in managing construction projects and they also perform approximately 1 in 4 of the practices that are considered to be of intermediate or average importance in managing construction projects.

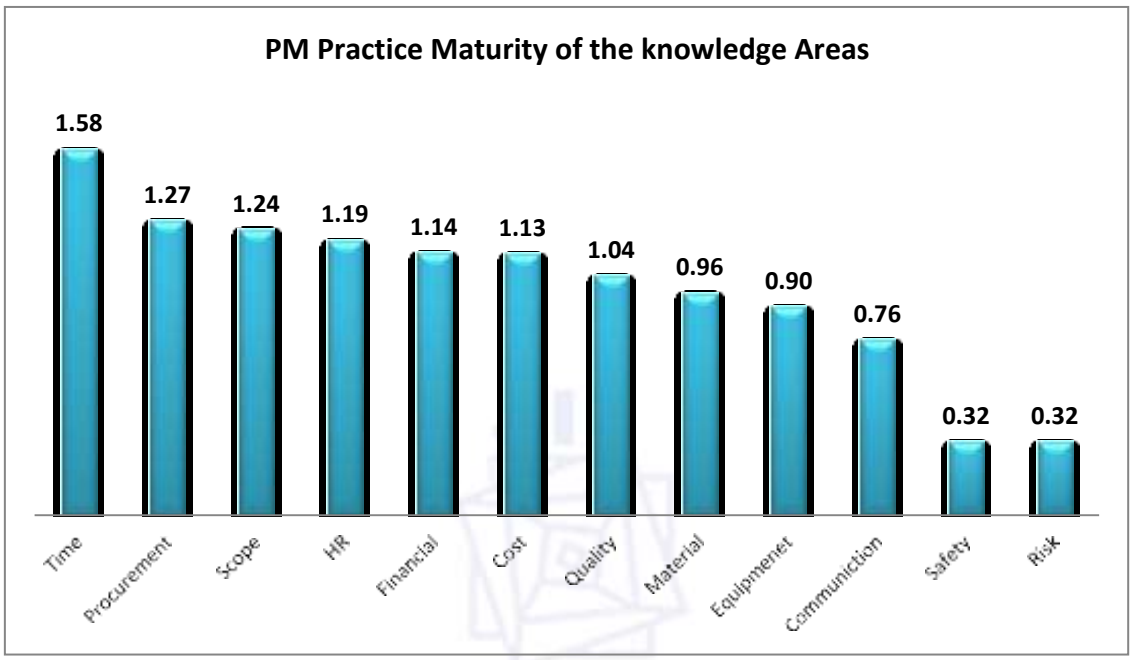

Table 6: Construction PM Practice Maturity of Knowledge Areas

The research finding also indicates that safety and risk management are totally neglected in managing construction projects in the industry. On average only 1/3 of the basic practices in the two knowledge areas were being performed. Next to the above two, communication management is another knowledge area which is comparatively at lower level of practice maturity. Here also contractors on average do not perform one in four of the practices that are considered basic in managing communication in construction projects.

The comparatively lower level of practice maturity of equipment management and material management could be because of the common practice in the industry to treat them as tasks to be managed by functional departments and are not usually considered to be the PM function. It seems there is similar understanding in the developed world. For example, even though HR is taken as one of the core functions or knowledge areas of PMBOK, equipment management and material management are not considered, even in the construction extension to PMBOK. Two major factors may have contributed to the low importance given to the two knowledge areas. The first is that the procurement dimension of both material and equipment have already been considered in procurement management and the second is the lower importance given to these two knowledge areas in the developed world compared to HR in controlling cost.

In the developed world, human resource cost is expensive than material and equipment. Whereas, in many projects in developing countries, the two accounts for about 75% of the project cost and thus it means their consideration should be of high importance. Further, in developing countries due to scarcity of resources, managing these two important resources is critical for success of construction projects. Because of their importance in developing countries construction PM, the two knowledge areas have been considered as additional construction PM

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knowledge areas in this research. There is generally a direct relationship between process maturity and practice maturity with coefficient of correlation of 0.936, which means, more matured processes are associated with more matured or advanced practices. Test of significance has been undertaken and it was found to be significant even at 1%. (see Appendix-I: Hypothesis Test Result)

4.3.1 Analysis of The Questionnaires
ISO vs. Non-ISO Contractors" PM Maturity
The research findings show a significant difference in maturity among different categories of contractors. Figure 14 shows the process maturity assessment results for contractors that are ISO certified in a certification process and those that are neither ISO certified nor in a certification process.

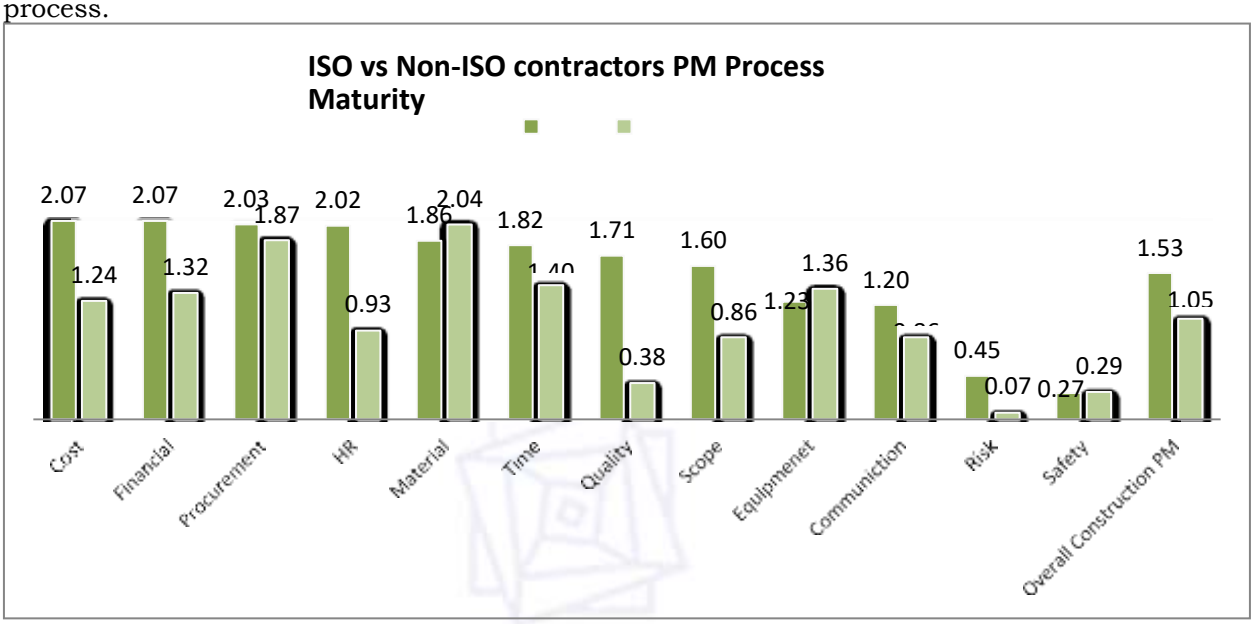
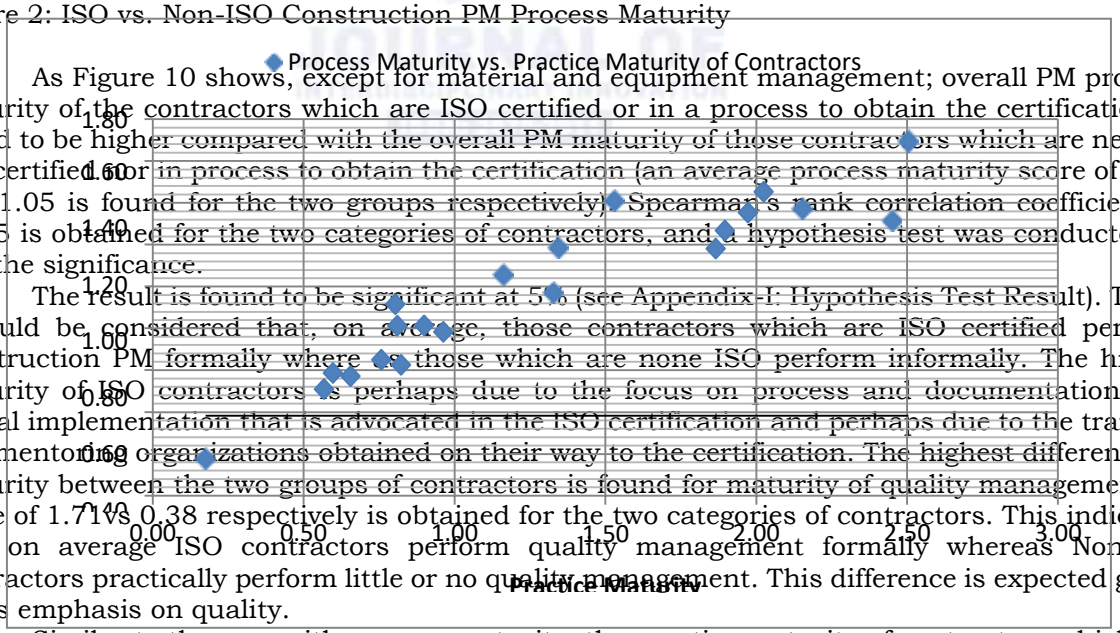


Figure 2: ISO vs. Non-ISO Construction PM Process Maturity

As Figure 10 shows, except for material and equipment management; overall PM process maturity of the contractors which are ISO certified or in a process to obtain the certification is found to be higher compared with the overall PM maturity of those contractors which are neither ISO certified nor in process to obtain the certification (an average process maturity score of 1.53 and 1.05 is found for the two groups respectively). Spearman's rank correlation coefficient of 0.575 is obtained for the two categories of contractors, and a hypothesis test was conducted to test the significance.

The result is found to be significant at 5% (see Appendix-I: Hypothesis Test Result). Thus, it could be considered that, on average, those contractors which are ISO certified perform construction PM formally where as those which are none ISO perform informally. The higher maturity of ISO contractors is perhaps due to the focus on process and documentation and formal implementation that is advocated in the ISO certification and perhaps due to the training and mentoring organizations obtained on their way to the certification. The highest difference in maturity between the two groups of contractors is found for maturity of quality management. A value of 1.71 vs 0.38 respectively is obtained for the two categories of contractors. This indicates that on average ISO contractors perform quality management formally whereas Non-ISO contractors practically perform little or no quality management. This difference is expected given ISO"s emphasis on quality.



Similar to the case with process maturity, the practice maturity of contractors which are ISO c

Table 7: Process Maturity vs. Practice Maturity of Constructors

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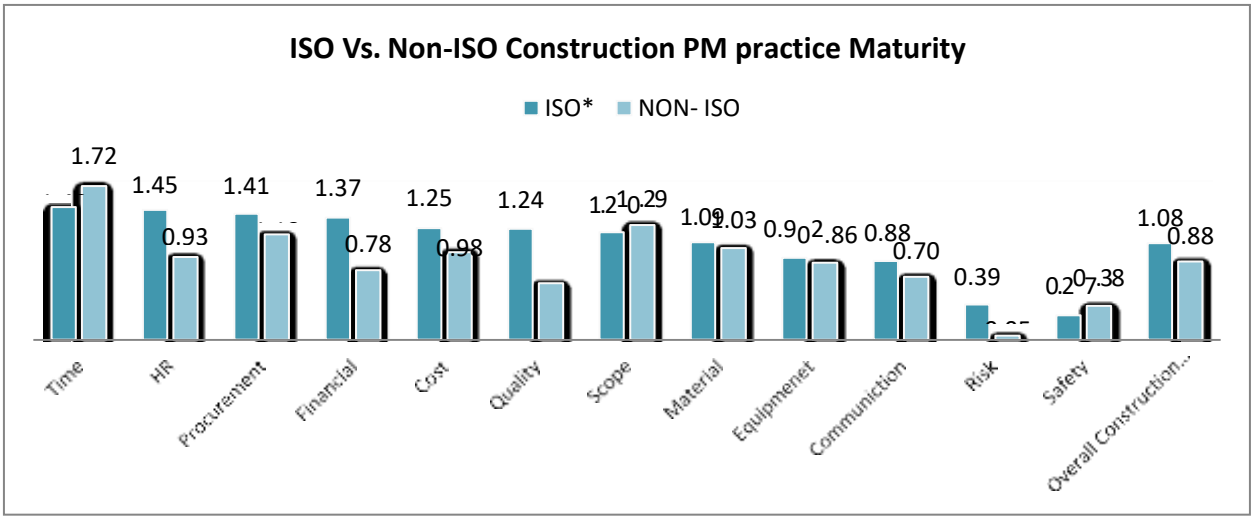

Figure 3: ISO vs. Non-ISO Contractors Practice Maturity
(An average practice maturity score of 1.08 and 0.88 is found for the two groups respectively). Spearman's rank correlation coefficient of 0.755 is obtained for the two categories of contractors, and a hypothesis test was conducted to test the significance. The result is found to be significant at 1% (see Appendix-I: Hypothesis Test Result)

4.2.2 Conclusions from Questionnaires
Capacity Building Program (CBP) Vs (Non-CBP) Contractors PM Maturity

Figure 16, shows the process maturity assessment result for contractors which have participated in Capacity Building Program (CBP) and those which did not participate (Non-CBP). The maturity assessment result shows that, contractors which participate in capacity building program have shown consistently higher maturity in all knowledge areas of construction management except for that of material management. An average maturity of 1.52 is recorded for contractors which participate whereas; an average maturity of 1.11 is recorded for those which did not participate. That is, on average contractors which participate in capacity building program perform construction PM formally, whereas, those contractors which did not participate perform construction PM informally. This finding indicates the potential high improvement that could be achieved through training and mentoring at lower maturity levels. Spearman's rank correlation coefficient of 0.771 is obtained for the two categories of contractors, and a hypothesis test was conducted to test the significance. The result is found to be significant at 1% (see Appendix-I: Hypothesis Test Result). The highest difference in maturity is recorded in this category in the HR knowledge area. (1.52 for CBP vs. 1.11 for Non-CBP). Material management knowledge area maturity of the Non-CBP contractors is found to be slightly higher than the CBP contractors.

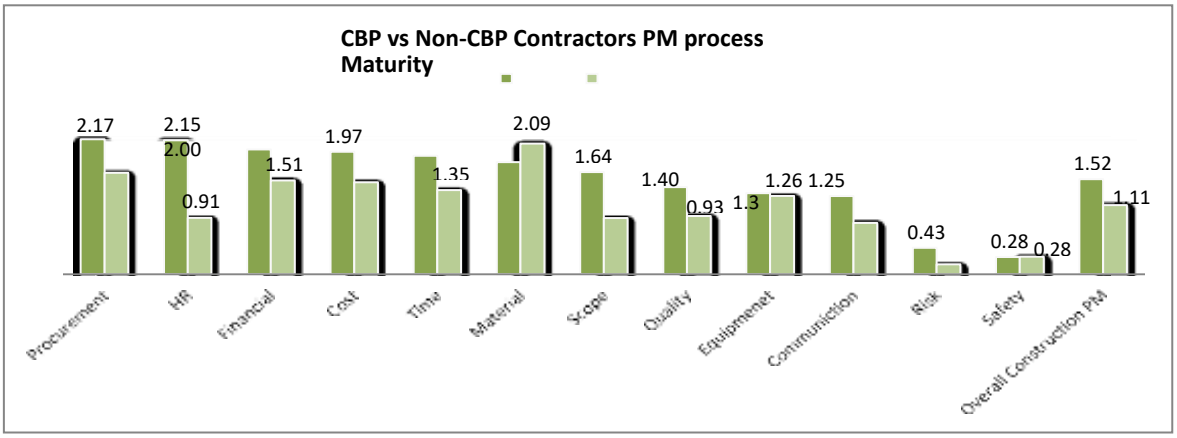

Figure 4: CBP vs. Non CBP Constructors PM Process Maturity

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The maturity of contractors participating in a capacity-building program has also shown higher maturity compared to those who did not. (1.08 for CBP vs. 0.93 for Non-CBP) Similar significance tests have been conducted, and the result is found to be significant at the 5% level (see Appendix I: Hypothesis Test Result).

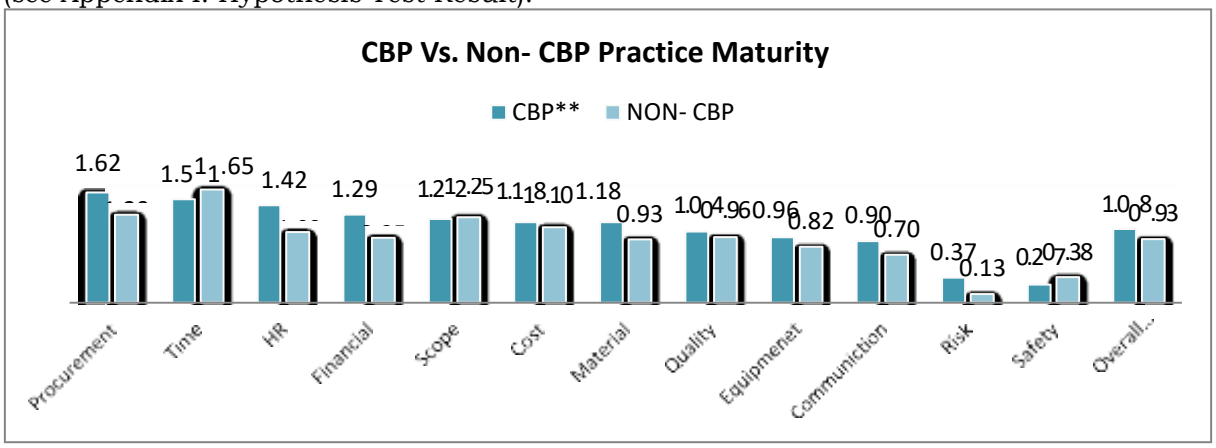

Figure 5: CBP vs. Non-CBP Contractors Practice Maturity

Road Contractors vs. Building Contractors PM Maturity

Figure 18 shows the process maturity assessment result for Road contractors and Building contractors.

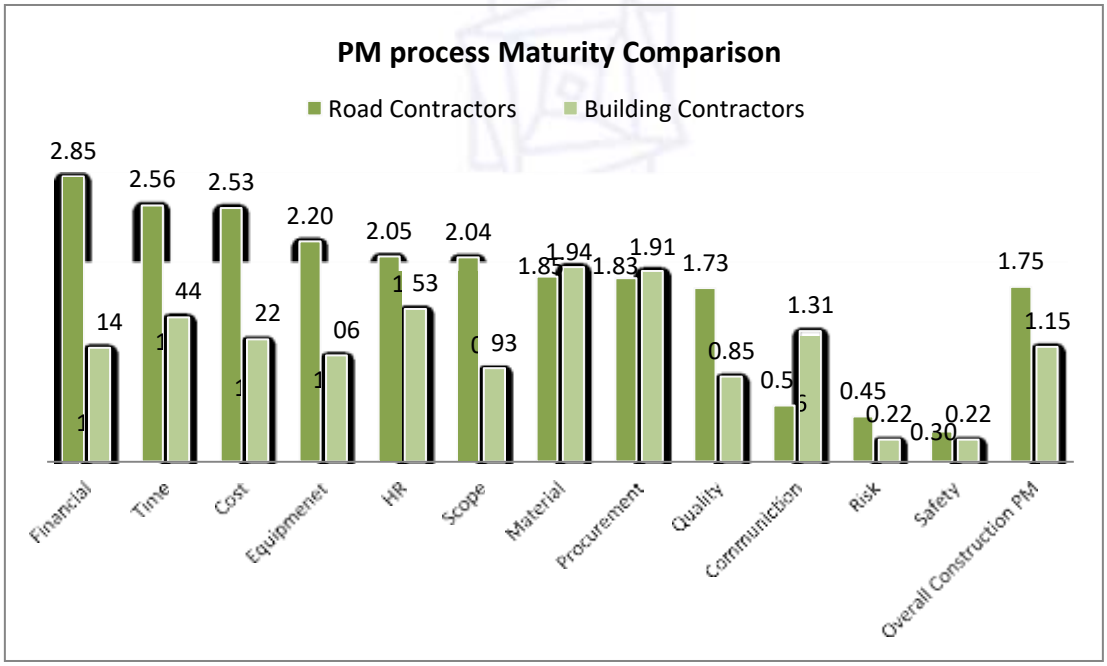

Figure 6: Road Contractors vs. Building Contractors Process Maturity

Generally, construction PM Maturity of Road contractors is found to be higher than that of Building contractors' construction PM process Maturity (1.75 vs 1.15). A Spearman's rank correlation coefficient of 0.593 was obtained for the two categories of contractors, and a hypothesis test was conducted to determine its significance. The result is found to be significant at 5% (see Appendix-I: Hypothesis Test Result). The maturity score shows that on average road contractors are managing their projects formally whereas, building contractors manage informally. The main reason for higher maturity of road contractors could be the fact that road

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contractors are usually large companies that perform large works and operate with comparatively huge capital and large number of employees.

Thus, it becomes challenging for such contractors to manage informally, and hence they are forced to use a formal approach. In such cases, companies will have the capacity to install the required system and recruit relatively more experienced and trained professionals for management. On the other hand, building contractors typically operate with relatively lower capital and perform a lower volume of work in terms of scope and capital; this implies a lower degree of necessity to use a more formal approach, such as road contractors do. These may be the primary reasons for the comparatively higher maturity of road contractors compared to building contractors. The other major factor that could explain the difference is the impact of clients, donors, or financiers. In the case of road contractors, the majority of the time, the client is the Ethiopian Road Authority (ERA), which has been managing road projects for decades.

Due to its long-standing experience in managing projects, the standards set by ERA and its controlling capability are expected to be higher for contractors working for it compared to those working for building contractors' clients, which include the private sector and various public institutions that have limited experience in managing construction projects. In addition, as most road projects are financed by foreign organisations, in such cases, those financiers impose higher requirements that force contractors to develop comparatively higher capabilities. This is not the case for most building contractors, whose clients are primarily the private sector and various government organisations that often lack organisational capability and experience in managing such projects. Thus, the standard that would be set in such cases is most likely to be lower.

The higher maturity of road contractors may be more closely associated with the nature of their projects rather than other factors, such as being ISO certified or participating in a capacity-building program. Out of the 5 road contractors, only 2 are ISO certified, whereas among the 9 building contractors, 6 are ISO certified or in the process of obtaining certification. The same holds true for the effect of participating in the capacity building program. Similar to the case of process maturity, road contractors have also shown higher level of practice maturity compared with building contractors.

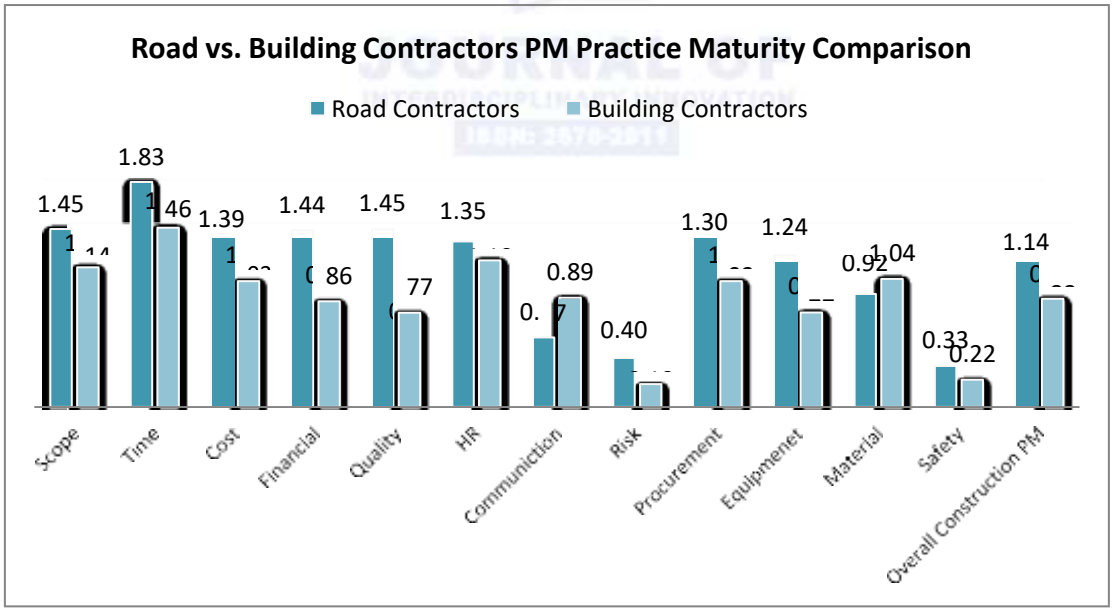

Figure 7: Road vs. Building Contractors Construction PM Practice Maturity

Road contractors showed comparatively higher maturity in Quality, Equipment and Financial management compared with the rest. Similar correlation analysis has been performed and spearman rank correlation coefficient of 0.646 is found), further, similar significance tests

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have been done and result is found to be significant at 5% (see Appendix-I: Hypothesis Test Result).

4.2.3 Analysis of The Interviews

Maturity of Project Scope Management

PMBOK (4th edition) defines Project Scope Management as set of processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. The PMBOK‟s project scope management process involves the processes: Identify Requirement, define scope, Create WBS (Work Breakdown Structure), Verify Scope, and Control scope. From contractors‟ perspective scope management is mainly about ensuring that all the works the contractor is doing is what originally agreed on and covered by the contract documents. According to (Sarshar, et al., 2000) “During the construction phase, (Scope management) has no specific meaning, as the (scope) has already been defined by this phase. Thus, at this stage scope management for a contractor is mainly concerned with scope control”.

Scope Management Process Maturity Figure 20 shows the scope management process maturity result of participating contractors. The overall scope management process maturity is found to be 1.30. Generally, the scope management could be considered to be at informal level. According to the result of the research about 20% of the contractors practice little or no scope management (performing only 1 in 5 of the practices expected to be performed in scope management). Approximately, 30% contractor’s scope management practice is incomplete (performing approximately 3 out of 4 practices expected to be performed in project scope management). About 53 % of the contractors perform scope management fully; however, 20% of the contractors perform scope management informally, the rest 33% practicing formally or at managed level. Not a single contractor is found to perform scope management at a defined level.

Next to change management and risk management (Voropajev, 1998) Study ranks scope management as the second most important knowledge area in managing projects in transition economies (developing countries). However, rating by the practitioners in Ethiopia placed scope management 6th in the ranking of the 12 knowledge areas. The low level of the scope practice maturity and the low value given by the practitioners could be due to the lower importance given by contractors to it as managing scope is mainly the duty and interest of the client (owner). The (Voropajev, 1998) study may be based on the perspective of the entire stakeholders or clients.

Scope Management Practice Maturity

Four of the 5 PMBOK scope management processes were categorized as basic and the other one as intermediate importance practices. The average practice of the PMBOK scope management processes is found to be 77%. That is on average PMBOK‟s scope management practices are performed by 77% of the contractors. Even though it is rated as a basic practice by the practitioners, approximately 1/3 of the contractors do not prepare Work Breakdown structure when defining the project scope.

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The maturity survey indicates that the scope management practice maturity is found to be at basic level (1.24). That means on average contractors are performing basic scope management practices and 1 in four of the intermediate or average scope management practices. Approximately 40 % of the contractors are at incomplete practice level maturity performing only 3 in 5 of the scope management practices that are considered to be basic in managing project scope. The remaining 60% perform all the basic scope management practices with approximately 40% performing also all intermediate or average importance scope management practices.

Maturity of Project Time management

Project time management includes the processes required to ensure timely completion of a project. PMBOK‟s Project time management involves the processes: Define Activity, Sequence activities, Identify and document relationship among project activities, Estimate activity resource, Estimate activity Duration, Develop schedule and Control schedule. PMOBOK‟s construction extension includes three additional processes of Activity Weights Definition, Progress Curves Development, and Progress Monitoring.

Time management Process Maturity

The research finding indicates that Project time management is considered to be more important than managing other knowledge areas. In addition, the maturity of time management practice is higher compared to others. Overall, the time management process maturity of the contractors is found to be somewhat at formally performed level (1.63).

Figure 22 shows the time management process maturity. The maturity assessment result indicates that 33% of the contractors‟ time management process maturity is at incomplete level, this indicates that 1/3 of the contractors do not perform all the practices that are required to attain the time management knowledge area goals. The result indicates that on average 1/3 of the contractors perform only 3 out of 4 PMBOK time management processes that are necessary to achieve the project time management goal. The remaining 2/3 of the contractors perform all processes that are expected in managing project time, however, about 29% of the contractors perform time management informally, only about 40% of the contractors perform time management formally or at higher level.

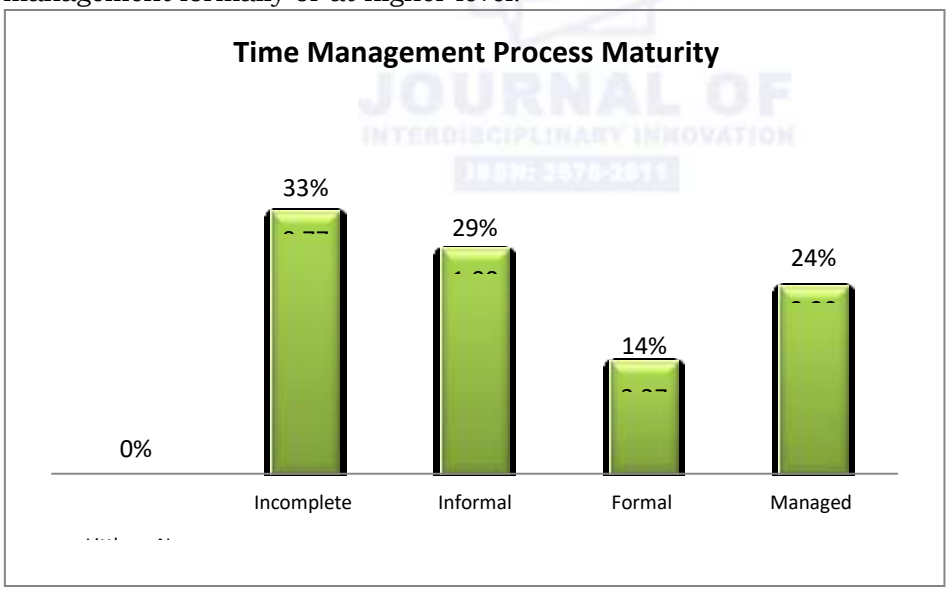

Figure 8: Time Management Process Maturity

Time Management Practice Maturity

Over all the time management practice maturity of the contractors is found to be somewhat at Basic practice maturity level (1.42). This means, on average, contractors are performing all the basic practices under time management and 2 out of 5 intermediate (average) time management practices. All six processes in the PMBOK time management process were rated as basic by the practitioners in the industry. On average PMBOK‟s time management

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process application is found to be 92%. However, about 30% of contractors do not practice monitoring and control of the schedule, which is one of the PMBOK time management process. Approximately about 50% of the contractors reported that they collect actual activity duration data and use it for estimating activity time in schedule preparation. In addition, about 60% of the contractors said they prepare and use network schedule and perform resource levelling. Moreover about 95%of the contractors reported usage of computer tools (at least Excel) in preparing schedule. Further about 50% of the contractors said they prepare S-curve (progress curve) to monitor and control project time. Figure 23 shows the time management practice maturity.

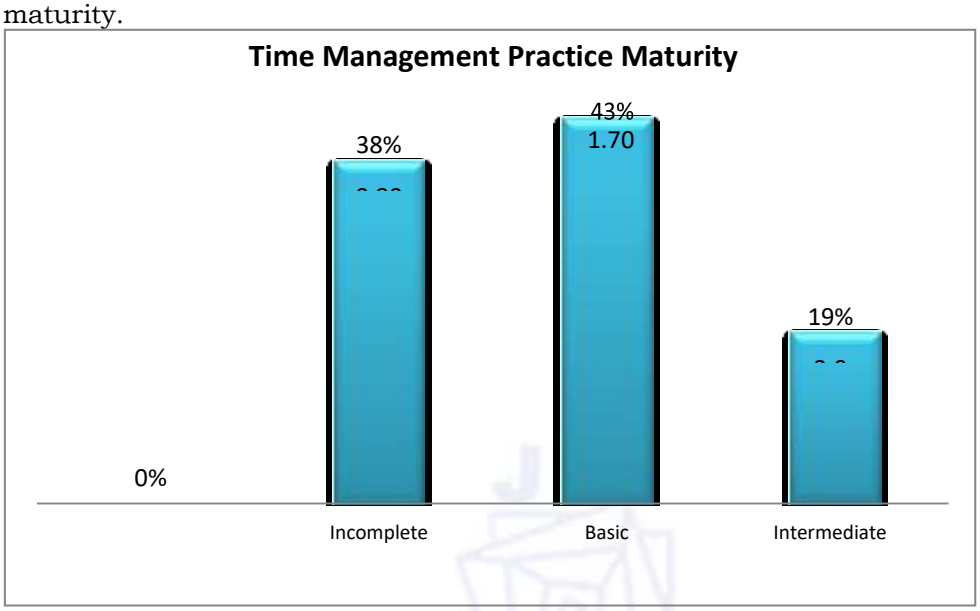

Figure 9: Time Management Maturity Summary

Approximately, 40% of the contractors are found to be at Incomplete Level practice maturity, performing on average 4 out of 5 basic time management practices in the management of project time. The other 40% of the contractors are at Basic Level Practice Maturity performing on average, all the practices that are considered to be basic and performing on average 70% practices that are considered to be of intermediate importance. The rest 20% of the contractors are at intermediate level practice maturity performing all basic and intermediate practices found in project time management. Unlike the process dimension the time management practice maturity dimension

Maturity of Project Cost Management

Project cost management includes the processes involved in estimating, budgeting and controlling costs so that the project can be completed within the approved budget. Project cost management includes the processes of: Estimate costs, Determine Budget and Control Cost.

Cost Management process Maturity

The overall cost management process maturity of the contractors is found to be 1.70, which means on average the contractors perform cost management formally.

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The result shows that approximately 30% of the contractors‟ cost management process is

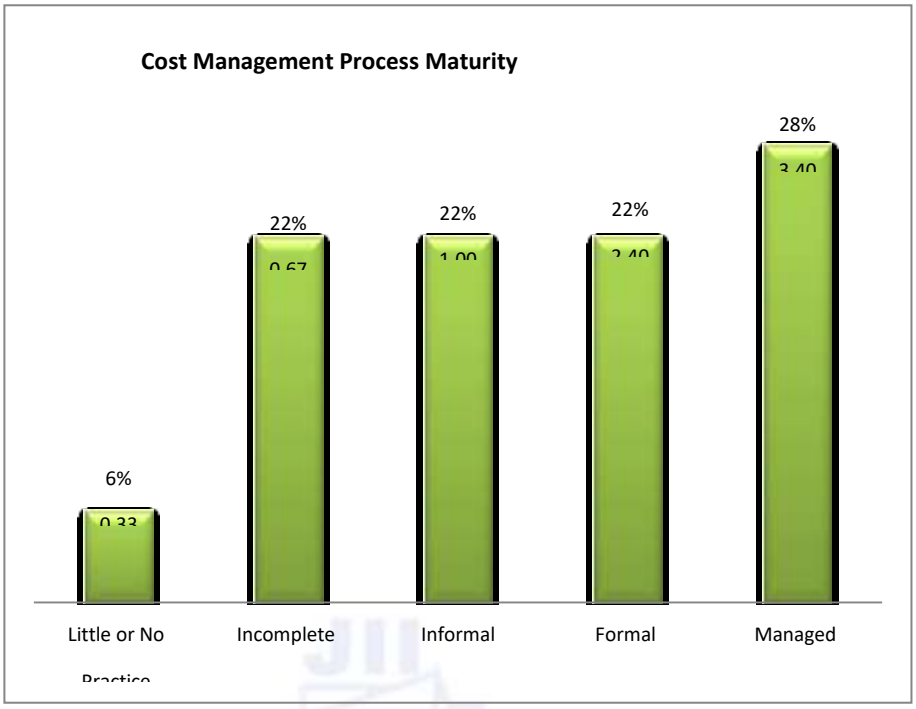

Figure 10: Project Cost Management Process Maturity Summary

incomplete, on average performing only 2 of 3 processes that are to be performed to achieve the goal of project cost management. About 20% of the contractors perform on average all the processes that are expected to be performed in managing project cost informally; and only about 50% of the contractors are performing cost management formally or at higher level.

Cost Management Practice Maturity

The overall cost management practice maturity of the contractors is found to be 1.13, which means on average the cost management practice of the contractors is somehow at basic level practice maturity. Those contractors perform on average only 13% of the intermediate or average practices. All the three PMBOK cost management processes of prepare estimate, prepare budget and control budget are considered to be basic practices. The average PMBOK cost management process application is found to be 87%. Generally, about 90% of the contractors reported that they prepare detailed estimate of cost of labor, material and machinery, however, only 75% of the contractors reported that they prepare detailed budget. About 70 % said they track cost of labor, material and machinery separately. About 67% have also reported that they collect and use company‟s historical data for preparation of cost estimate. However, only 1/3 of the contractors indicated that they use computer tools for cost estimate preparation. Further, about 2/3 of the contractors have reported that they update their budget regularly at least once in a month.

Figure 25 shows the cost management practice maturity. About 60% of the contractors are at incomplete practice maturity level performing on average 3 out of 4 practices expected to be performed in cost management. The rest 40% are at basic level of maturity performing on average all the basic practices and 70% of the intermediate or average practices. Of the 21 contractors, only one contractor has achieved the intermediate level cost management practice maturity performing all the basic and intermediate practices.

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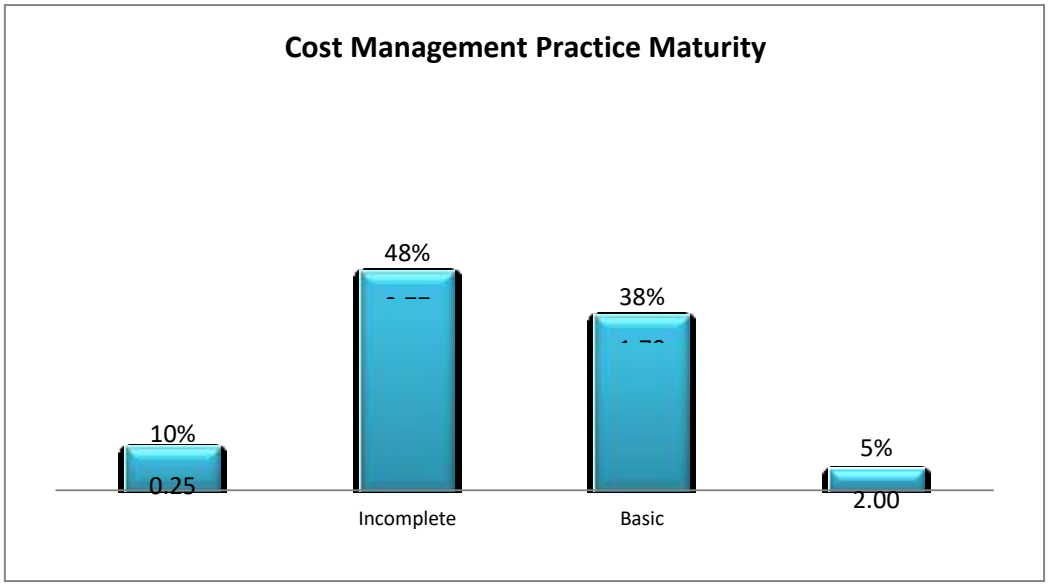

Figure 11: Project Cost Management Practice Maturity

Maturity of Project Financial Management

Financial management includes the processes of acquiring and managing the financial resources for the project. Compared to project cost management, project financial management is more concerned with revenue sources and monitoring net cash flows for the construction project than with managing day-to-day costs. The primary processes involved in financial management are Financial Planning, Financial Control, Administration and Records.

Financial Management Process Maturity

The overall financial management process maturity of the contractors is found to be 1.62 that means on average the contractors perform financial management formally. Figure 26 shows the financial management process maturity

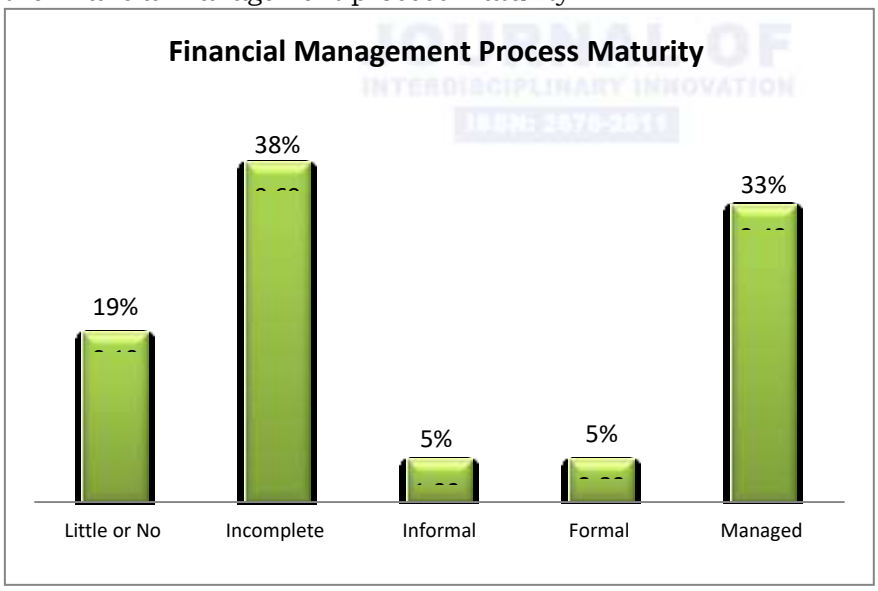

Figure 12: Financial Management Process Maturity Summary

The result shows that approximately 60% of the contractors‟ financial management process is incomplete, about a third of the contractors perform little or no financial management, performing on average only 3 out of 5 processes that are to be performed to achieve the goal of project financial management. The rest 40% of the contractors perform on average all the

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processes that are expected to be performed in managing project financial management formally or at higher level.

4.2.4 Conclusions from Interview

Financial Management Practice Maturity

Over all the financial management practice maturity of the contractors is found to be somewhat at Basic practice maturity level (0.96). This means, on average contractors are performing all the basic practices under financial management. All of the four processes in PMBOK financial management process were rated as basic. On average PMBOK‟s financial management process application is found to be 73%. The maturity of financial control practice is found to be higher than that of financial planning (81% vs. 67%).

This is perhaps due to the common misunderstanding in the contractors to equate informal control of finance with financial management. The reported maturity of financial administration and records is also higher than financial planning. Only 2/3 of contractors reported that they perform financial planning. Ninety percent of the contractors have also responded that they perform project cash flow analysis. This higher-level maturity may be b/se of the common contractual requirements to prepare project cash flow analysis. About 75% of the contractors have reported that they perform project financial audit. However, despite frequent price fluctuations only 43 % of the contractors reported that they consider effects of change in exchange rate, escalation of labour and material price etc in their financial planning.

Approximately 20% of the contractors perform little or no financial management; the other 50%

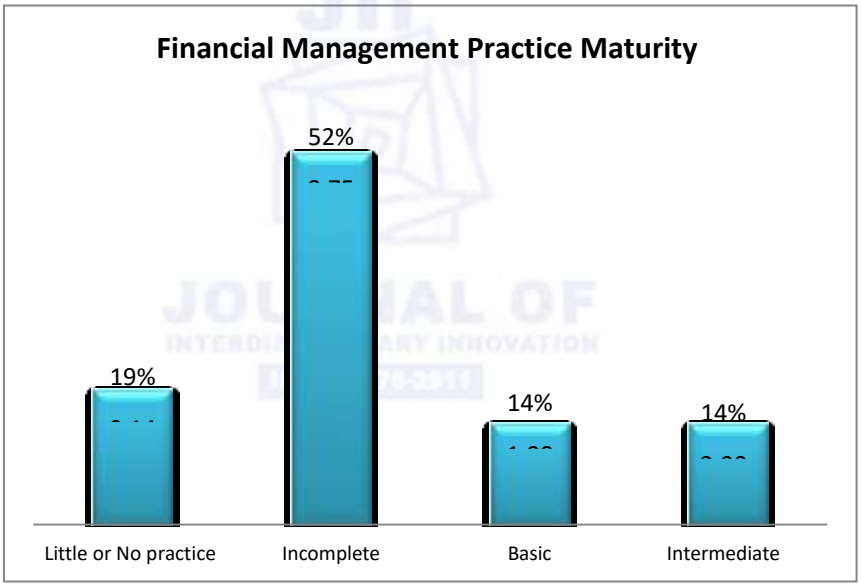

Figure 13: Financial Management Practice Maturity

of the contractors perform incomplete financial management practices, performing on average 3 out of 4 basic financial management practices. The other 15% of the contractors are at Basic Level Practice Maturity performing on average, all the practices that are considered to be basic. The rest 15% of the contractors are at intermediate level practice maturity level performing all basic and intermediate practices found in project financial management.

Maturity of Project Quality Management

Project Quality Management includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. PMBOK‟s Project quality management includes the processes: Plan Quality, Perform Quality Assurance and Perform Quality control.

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Quality Management Process Maturity

Overall, the quality management process maturity of the contractors is found to be somewhat at an informally performed level (1.17). Figure 28 illustrates the maturity of the quality management process. The research findings show that approximately 43% of contractors perform little to no quality management, while the other 24% perform only two out of three quality management processes expected to achieve the goal of project quality management. The remaining 33% of the contractors perform quality management formally or at a higher process maturity level.

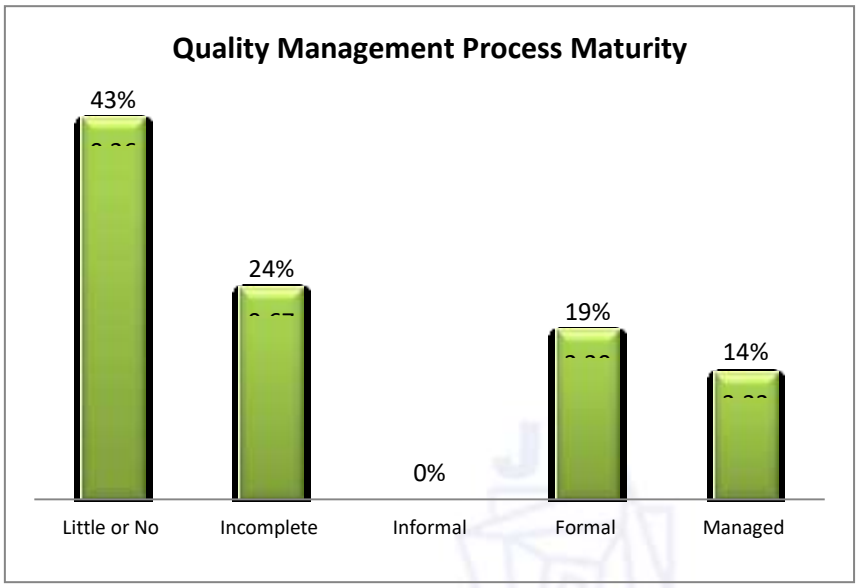

Figure 14: Quality Management Process Maturity

Almost all the PMBOK quality management practices and the lists of practices identified by the research under this knowledge area were rated as intermediate level of importance by the practitioners. This could explain why maturity of quality management (1.17) is low compared to others such as financial management (1.62) and cost management (1.71). (Practitioners consider it somehow second in importance).

Quality Management Practice Maturity

Twenty out of the 21 contractors indicated that there is awareness about the importance of quality management in their organization. Also, about 85% of the contractors said there is some effort of managing quality in their organizations. The overall quality management practice maturity of the contractors is found to be 1.04, which means on average the contractors are performing all the basic quality management practices. The average PMBOK quality management process implementation of the contractors is found to be 60%. Fifty-seven percent7% of the contractors have reported that they have quality management policies, procedures and guidelines, however, only 24% said they have department or employees specializing in quality management. Similar to the case with that of financial management the maturity of quality monitoring and control practice is found to be higher than quality planning (81% vs. 48%). This is perhaps due to the attitude of equating quality management with quality control. Further, the emphasis and requirement of quality control in contract may have contributed for the higher maturity level of quality control.

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About 20% of the contractors perform little or no quality management practices; the other 40%

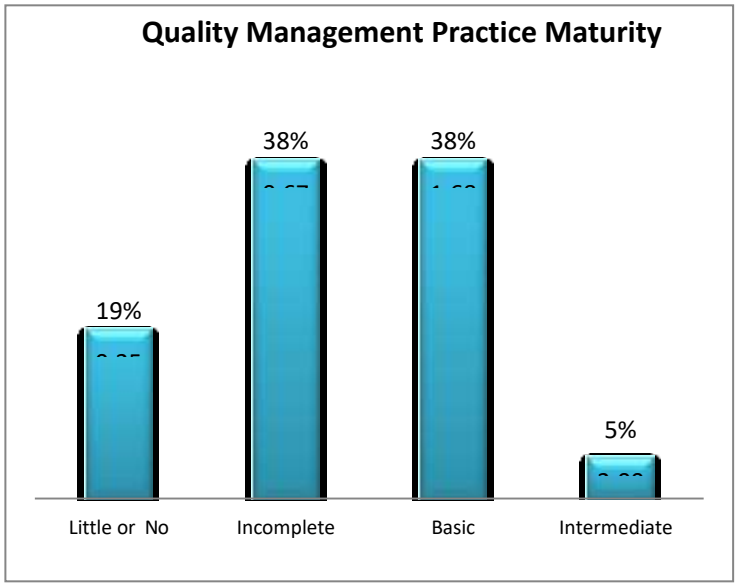

Figure 15: Quality Management Practice Maturity

of the contractors‟ quality management practices is at incomplete practice maturity level, performing only 2 out of 3 basic quality management practices. The remaining about 40% of the contractors are at basic practice maturity level (1.68) performing all the basic practices and 68% of the intermediate practices. Only 1 of the 21 contractors has

achieved intermediate level of practice maturity, performing all practices that are considered basic and all those which are considered average in construction project quality management.

Maturity of Project Human Resource Management

Project Human Resource Management includes the processes that organize, manage, and lead the project team. The project human resource management involves the processes: Develop Human Resource Plan, Acquire Project Team, Develop Project Team and Manage Project Team. The Construction extension to PMBOK 3rd edition includes a Fifth construction-related process, of Close Project Team.

Human Resource Management Process Maturity

Overall, the human resource management process maturity of the contractors is found to be somewhat at formally performed level (1.56). Figure 30 shows the Human resource management process maturity. The research finding shows that about 62% of the contractors HR management process is incomplete. On average these contractors perform only 3 out of 5 HR management processes that are expected to be performed to achieve the goal of project HR management. The rest 38% of the contractors perform HR management formally or at higher process maturity level.

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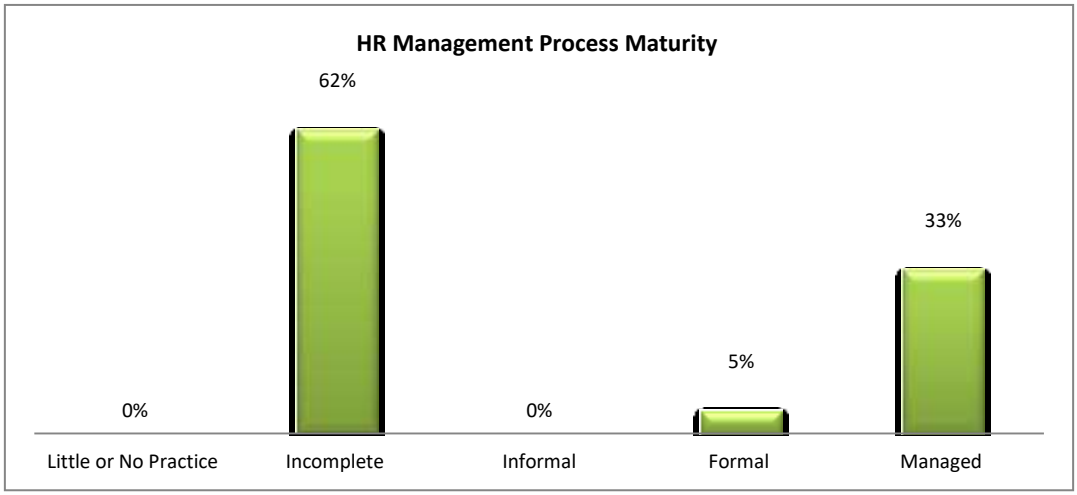

Figure 16: Project Human Resource Management Maturity

HR Management Practice Maturity

Overall, the HR management practice maturity of the contractors is found to be somewhat at the Basic practice maturity level (1.19). This means that, on average, contractors are performing all the basic practices and 1 in 5 of the intermediate practices under HR management. Four of the five HR management processes in PMBOK were rated as basic. On average, PMBOK 's HR management process application is found to be 76%. Even though all contractors have indicated that they perform HR management, only 48% reported tracking the performance of the project team. About 60% of the contractors have indicated that they provide training for their project team.

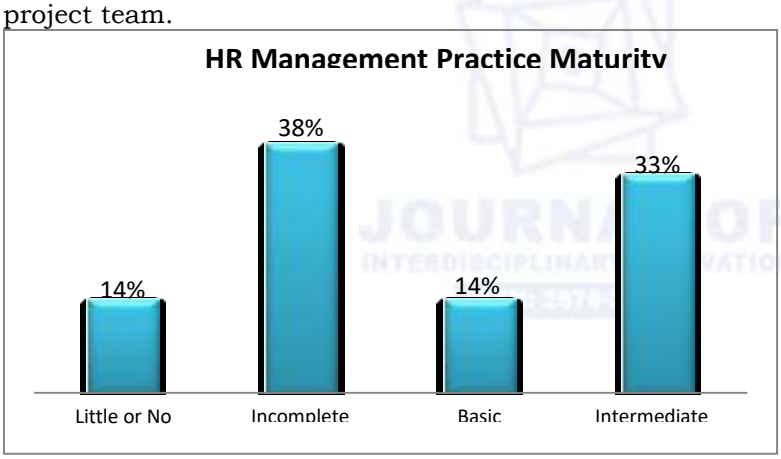

Figure 17: HR Practice Maturity

Approximately, 15% of the contractors perform little or no HR management; the other 40% of the contractors perform incomplete HR management practices, performing on average only 2 out of 3 basic HR management practices in the management of project HR management. The other 15% percent of the contractors are at Basic Level Practice Maturity performing on average; all the practices that are considered to be basic and 2 out of 3 practices that are considered to be average. The rest 30% of the contractors are at intermediate level practice maturity performing all basic and intermediate practices found in project HR management.

Maturity of Project Communication Management

Project Communications Management includes the processes required to ensure timely and appropriate generation, collection, distribution, storage, retrieval, and ultimate disposition of project information. PMBOK"s Project communication management includes the processes: Identify Stakeholders,Plan communications, Distribute Information, Manage Stakeholder Expectations, and Report Performance.

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Communication Management Process Maturity

Overall, the communication management process maturity of the contractors is found to be somewhat at informally performed level (0.97). Figure 32 shows communication management process maturity. The research finding shows that about 43% of the contractors perform little or no communication management; the other 38% of the contractors are at incomplete process maturity level performing only 3 out of 4 communication management processes that are expected to be performed to achieve the goal of project communication management. Only 20% of the contractors perform communication management formally or at higher process maturity level.

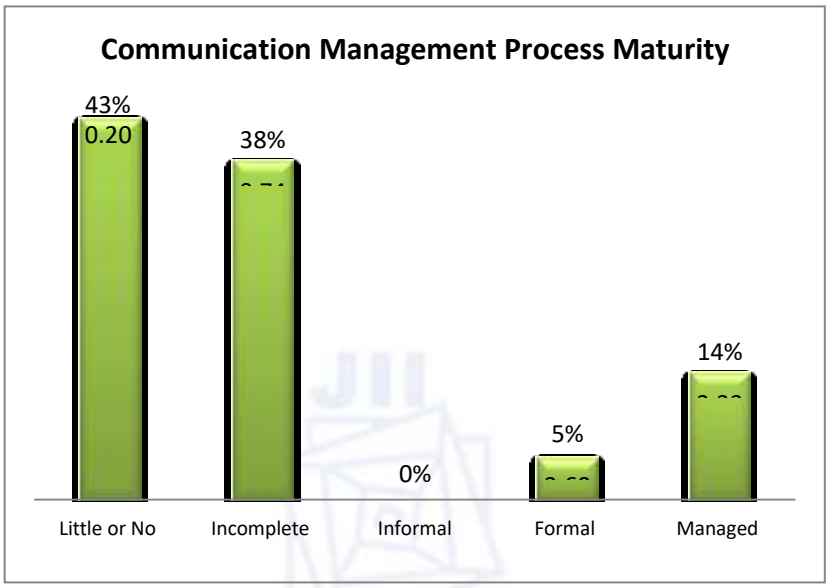

Figure 18: Communication Management Process Maturity

Communication Management Practice Maturity

Overall, the communication management practice maturity of the contractors is found to be somewhat at incomplete practice maturity level (0.76). This means, on average, contractors are performing only 3 out of 4 practices that are considered to be basic in project communication management. Four of the five Communication management processes in PMBOK were rated as basic. On average PMBOK‟s communication management process application is found to be 56%. Comparatively, reporting performance is found to be more practiced by the contractors compared with the other practices in communication management. This can be due to the contractual reporting requirement.

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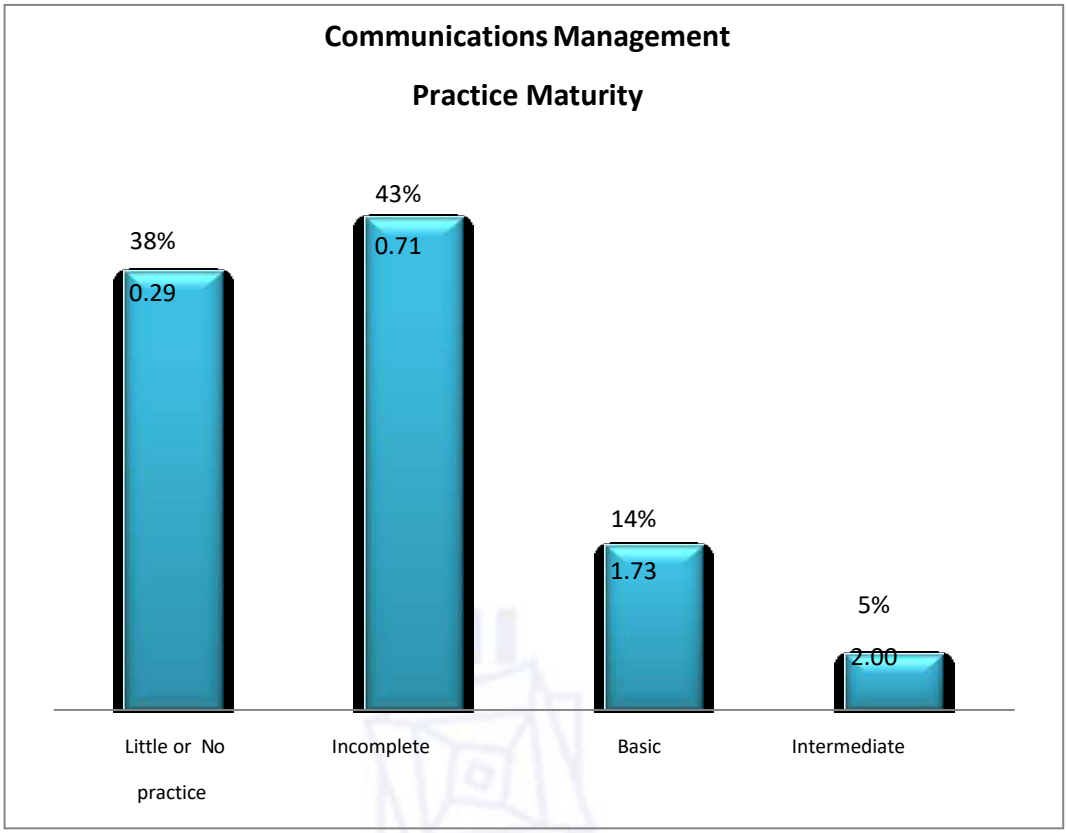

Figure 19: Communication management practice maturity

Approximately 40% of the contractors perform little or no Communication management; the other 40% of the contractors perform incomplete Communication management practices, performing on average only 2 out of 3 basic Communication management practices. The other 15% of contractors are at Basic Level Practice Maturity, performing on average all the practices considered basic and 3 out of 4 practices considered average. Only one of the 21 contractors achieved intermediate-level practice maturity, performing all basic and intermediate practices found in project communication management.

Maturity of Project Risk Management

Project risk management includes the processes of conducting risk management planning, identification, analysis, response planning, and monitoring and control of project risk. The objectives of risk management are to increase the probability and impact of positive events, and decrease the probability and impact of negative events in the project. PMBOK‟s risk management processes are Plan Risk Management36, Identify Risks, Perform Qualitative risk analysis, Perform Quantitative risk analysis, Plan risk Responses, Monitor and Control risks.

Risk Management Process Maturity

Figure 34 shows project risk management process maturity result. The average risk management process maturity is found to be very low 0.32. It could be generalized that there is little or no risk management practice by the contractors.

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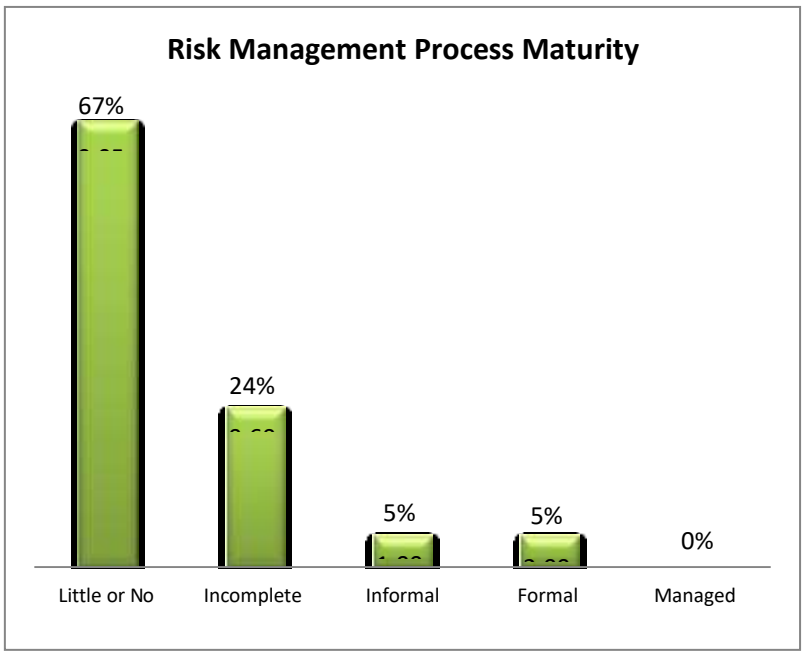

Figure 20: Risk Management Process Maturity

According to the result of the research, about 2/3 of the contractors practice almost no risk management. Approximately, 24% of contractor's risk management practice is incomplete (performing approximately 3 out of 5 practices expected to be performed in project risk management). Only 2 out of the 21 contractors assessed perform risk management fully at informal or formal level. Not a single contractor is found to perform risk management at a managed level. Next to change management (Voropajev, 1998) Study ranks risk management as the second most important knowledge area in managing projects in transition economy (developing countries). However, rating by the practitioners in Ethiopia placed risk management 10th in the ranking of the 12 knowledge areas. This indicates that risk management is known little and given little attention and importance. The very low level of its maturity explains the importance given to it.

Risk Management Practice Maturity

None of the PMBOK risk management processes were categorized as basic, 3 of the 5 processes were rated as advanced and the other two as intermediate processes. The average practice of the PMBOK risk management processes is found to be 27%. That is, on average PMBOKs risk management practices are performed by 27% of the contractors or contractors perform only 1 in 4 of the PMBOKs risk management process. Only 38% indicated that they identify and document risks and 33% said they perform some analysis to the chance and impact. No contractor reported using quantitative risk analysis which is rated by practitioners as an advanced practice. Only one contractor has reported the use of risk register or log. Assigning risk response owner to take responsibility for the management of selected risks was reported by none .Only 2 out of the 21 contractors indicated that they prepare risk response plan.

Figure 35 shows the risk management practice maturity

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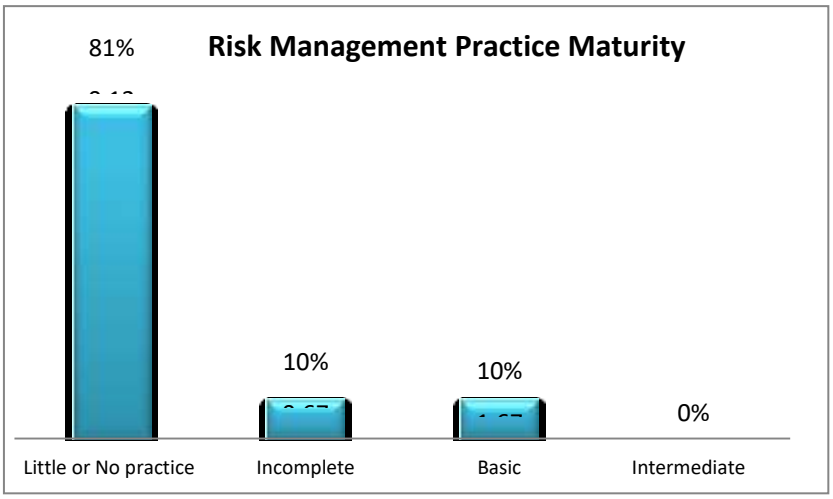

Figure 21: Risk Management Practice Maturity

The maturity survey indicates that, practically, there is little or no risk management (0.32) for 81% of the contractors. This shows that on average contractors perform only 1 in 3 of the basic risk management practices. Only10 % of the contractors are at incomplete practice level maturity performing only 2 in 3 of the risk management practices that are considered to be basic in managing project risk. The remaining 10% perform all the basic risk management practices and 2/3 of the intermediate risk management practices. Not a single contractor attained intermediate level of risk management practice maturity level.

Seventy six percent of the contractors have summarized their risk management practice as "There are no established project risk management practices or standards." And 19% said "There is basic risk management process". This is totally in agreement with the proposed models finding. Other studies done in the country in the areas have also found similar findings. According to (Gessesse, 2009), formal risk management is not instituted and rarely practiced. "In Ethiopian risk analysis is preliminary and undeveloped practice… The use of easy-to-use risk management tools and techniques is not generally known."

The very low level of reported maturity for risk management and the low importance given to it (risk management is ranked to be less important than all the other knowledge areas except safety management and communication management). This may indicate the low level of awareness about the importance of risk management in the construction industry of the country. As developing countries are characterized by very volatile and uncertain environment, management of risk should have been a logical priority. However, the low level of importance and the low maturity recorded for risk management could be due to the inapplicability of current risk management processes. As the PM environment in developing countries is highly uncertain and volatile, the current practices, which were developed in the developed world, may fail to serve when it comes to the developing countries context. Moreover, unavailability of data and the high unpredictability of events in developing countries may make any risk management practice effort futile.

Maturity of Project Procurement Management

Project procurement management includes the processes necessary to purchase or acquire products and services. Procurement management includes the contract management issued by an outside organisation (Buyer) or issued by the performing organisation to an outside organisation (subcontract management) and change control processes required to develop and administer contracts or purchase orders issued by authorised project team members. From the contractor's perspective, procurement management is concerned mainly with subcontract

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management, supply and purchase management and administering the contract that it entered with the client. PMBOK‟s Project procurement management process includes the processes: Plan Procurements, Conduct Procurement, Administer, and Close Procurement.

Procurement Management Process Maturity
The overall procurement management process maturity of the contractors is found to be 1.83, which means on average the contractors perform procurement management formally.

Figure 36 shows the procurement management process maturity.

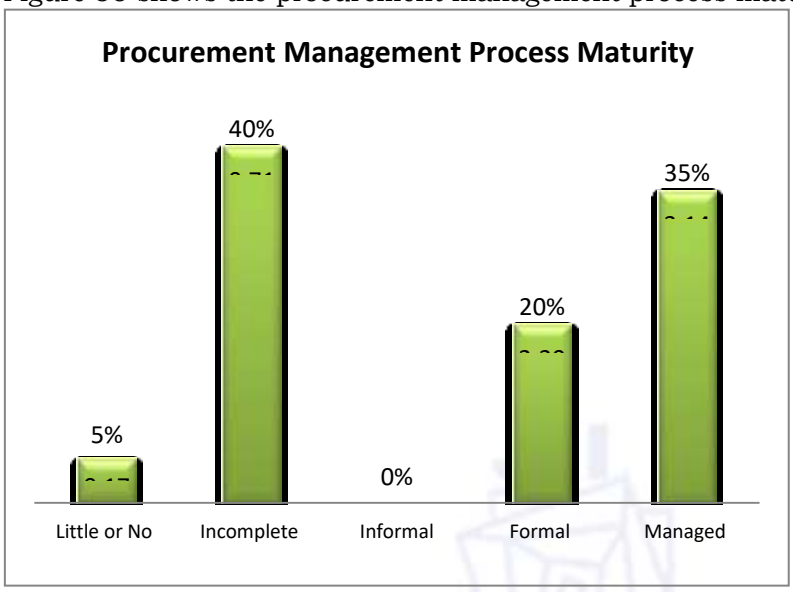

Figure 22: Procurement Management Process Maturity

The result shows that approximately 45% of the contractors‟ procurement management process is incomplete, on average performing roughly only 2 of 3 processes that are expected to be performed to achieve the goal of project procurement management. Approximately 20% of the contractors perform, on average, all the processes expected to be formally managed in project procurement, and the remaining 35% perform procurement management at a managed level.

Procurement Management Practice Maturity
The overall procurement management practice maturity of the contractors is found to be 1.28, which means on average the procurement management practice of the contractors is somehow at basic level; these contractors perform on average all basic practices and 30% of the intermediate or average practices. Only one of the processes in procurement management is rated as a basic practice, while the rest are rated as intermediate practices. The average PMBOK procurement management processes application is found to be 85%. About 85% of the contractors have reported that they prepare a procurement plan , about 75% said they identify major or special supply items and consider them in planning, 80% said they use a preferred supplier/subcontractor or pre-qualify them. Eighty percent of the contractors said they use a documented contract management/administration process. Moreover, 65 % of the contractors said they hire/assign a staff that is trained in contract /procurement management and claim management. About 70% of the contractors reported to have process /procedure for managing claim.

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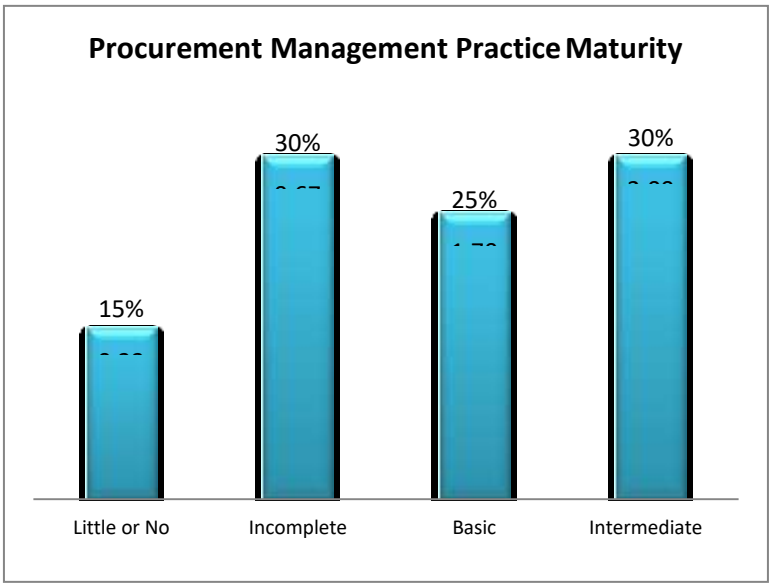

Figure 23: Procurement Management Practice Maturity

About 15 % of contractors perform little or no procurement management, another 30% of the contractors are at an incomplete practice maturity level, performing on average 3 out of 4 practices expected to be performed in procurement management. The other 25% are at a basic level of maturity, performing on average all the basic practices and 70% of the intermediate or average practices. The remaining 30% of the contractors are at an intermediate level procurement management practice maturity, performing all the basic and intermediate practices.

Maturity of Project Equipment Management

Project Equipment Management is not included as a knowledge area of construction project management in either the PMBOK or its construction extension. However, it is considered here in this research as one of the knowledge areas of construction project management due to its relevance for construction projects in general and in developing countries in particular. Many studies, such as [(Jekale, 2004), (Cusworth & Franks, 1993)], indicated that resource scarcity is prevalent and is one of the major causes for the poor performance of projects in developing countries. Thus, the management of resources should be one of the priority areas in managing construction projects in developing countries.

Human resource management and financial management in this regard have already been considered by PMBOK and its construction extension. However, equipment management and material management account for about75% of the project cost in developing countries. Due to their significant impact on project cost and performance, it was decided to include them in the maturity assessment as one of the key knowledge areas of construction project management. The project equipment management process in this research is thought to include, essentially, the processes of equipment acquisition and assignment planning, equipment tracking and monitoring, and maintenance. The overall Equipment management process maturity of the contractors is found to be 1.29 which means on average the contractors perform Equipment management somehow informally.

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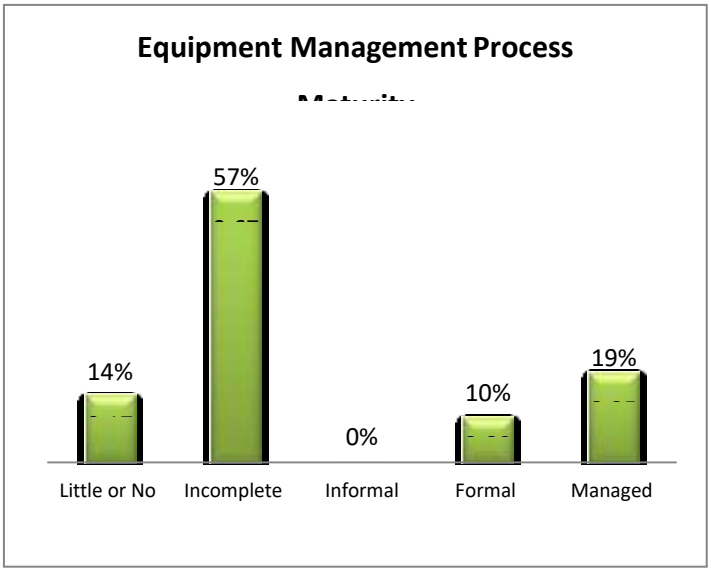

Figure 24: Equipment Management Process Maturity

The maturity assessment result shows that approximately 15% of the contractors perform little or no equipment management. About 57% of the contractors‟ equipment management process is incomplete, on average performing roughly only 2 of 3 processes that are expected to be performed to achieve the goal of project Equipment management. About 30% of the contractors perform on average all the processes that are expected to be performed in managing project equipment formally or at a managed level.

Equipment Management Practice Maturity

The overall equipment management practice maturity of the contractors is found to be 0.90, indicating that, on average, the contractors' equipment management practices are somewhat at a basic level. Only one of the processes in equipment management is rated as a basic practice, the rest being an intermediate practice. Seventy-one per cent of the contractors said they have an equipment policy that guides acquisition, use, and replacement decisions. Sixty per cent of the contractors responded that they prepare all types of equipment plans, including long-term (more than 3 months), medium-term (1 to 3 months), and short-term (weekly and daily) plans. About 42% said they perform formal economic and risk analysis in deciding; buy, lease or rent options for equipment acquisition. Seventy one percent of the contractors said they share equipment among projects and centrally facilitate it. About 83% of the contractors said they have equipment maintenance plan and policy.

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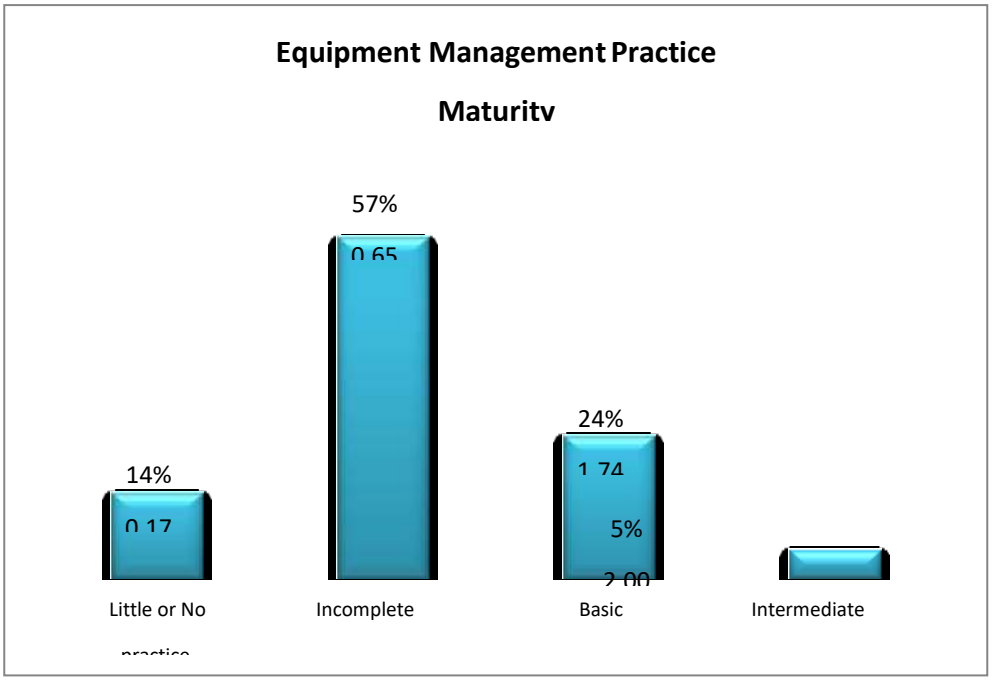

Figure 25: Equipment Management Practice Maturity

Approximately 15% of contractors perform little to no equipment management; another 57% of contractors are at an incomplete practice maturity level, performing on average 2 out of 3 practices considered basic in equipment management. The other 25% are at a basic level of practice maturity, performing on average all the basic practices and 75% of the intermediate or average practices. Only one of the 21 contractors is at an intermediate level of equipment management practice maturity, performing all the basic and intermediate practices.

Maturity of Project Materials Management

Similar to project equipment management, project material management is not included as a knowledge area in construction project management in either the PMBOK or its construction extension. However, as explained in the part dealing with project equipment management, project material management is considered in this research as one of the knowledge areas of construction project management, mainly due to its relevance for construction projects in general and in developing countries in particular. The project material management process in this research is thought to include, essentially, the processes of material planning, managing the material procurement process, monitoring, and controlling material use and availability. The overall material management process maturity of the contractors is found to be 1.90, which means that, on average, the contractors perform material management somewhat formally.

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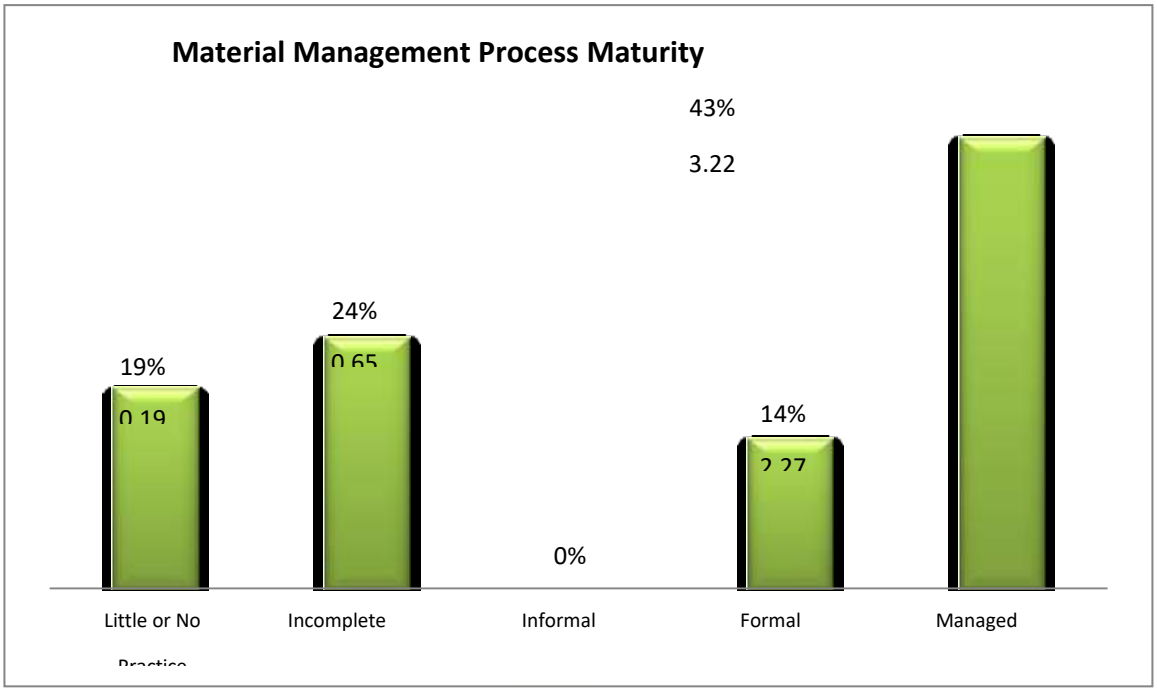

Figure 26: Material Management Process Maturity

The results show that approximately 20% of the contractors perform little to no material management. About 25% of the contractors' material management process is incomplete, on average performing roughly only 2 of 3 processes that are expected to be performed to achieve the goal of project material management. Approximately 55% of contractors perform, on average, all the processes expected to be managed formally or at a managed level in project material management.

Material Management Practice Maturity

The overall material management practice maturity of the contractors is found to be 0.96; which means on average the material management practice of the contractors could considered to be at basic level. Only one of the processes in material management is rated as a basic practice; the rest being an intermediate practice. Fifty four percent of the contractors said they consider risk associated with unavailability, cost increase in material planning and all costs (purchase costs, order cost, holding costs, and unavailability cost) in material planning /management. Sixty seven percent of the contractors said materials requiring long lead-time and critical items are given special consideration in planning and monitoring, eighty eight percent said they have preferred suppliers; ninety six percent of the contractors said their company centrally coordinates material purchase for its different projects.

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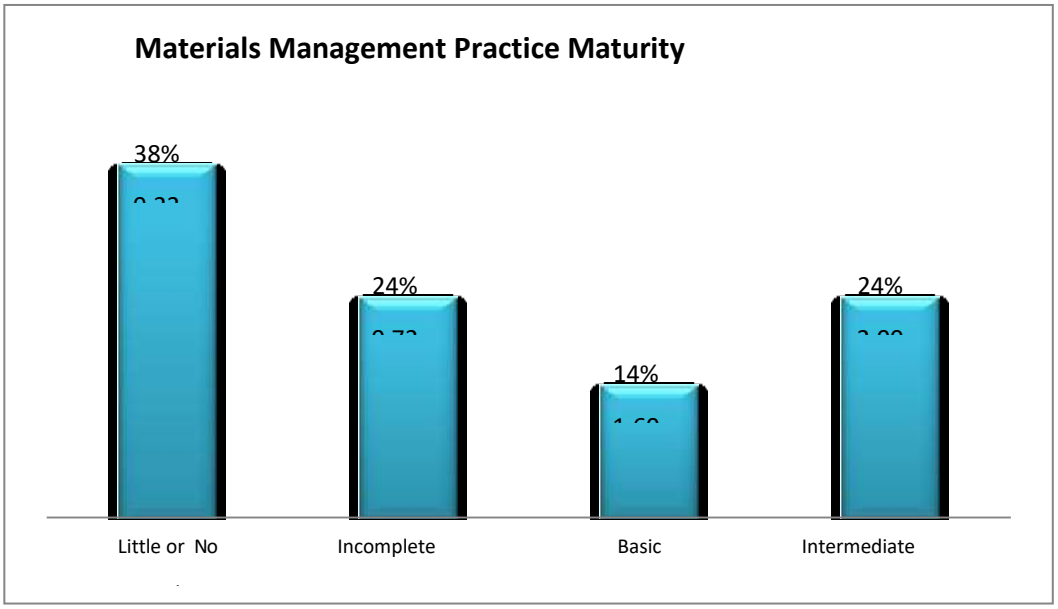

Figure 27: Material Management Practice Maturity

About 38 % of contractors perform little or no material management; another 24% of the contractors are at incomplete practice maturity level performing on average 3 out of 4 practices that are considered to be basic in material management. The other 14% are at basic level of maturity performing on average all the basic practices and 70% of the intermediate or average practices. The rest 24% of the contractors are at intermediate level material management practice maturity performing all the basic and intermediate practices.

Maturity of Project Safety Management

Project Safety Management includes the processes and activities of the performing organization that determine safety policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. PMBOK‟s project safety management includes the processes: Plan Safety, Perform Safety Assurance and Perform Safety Control.

Safety Management Process Maturity

Overall, it could be considered that safety management is performed very little or not at all in the management of construction projects. An average maturity of 0.27 is determined for the contractor's safety management process.

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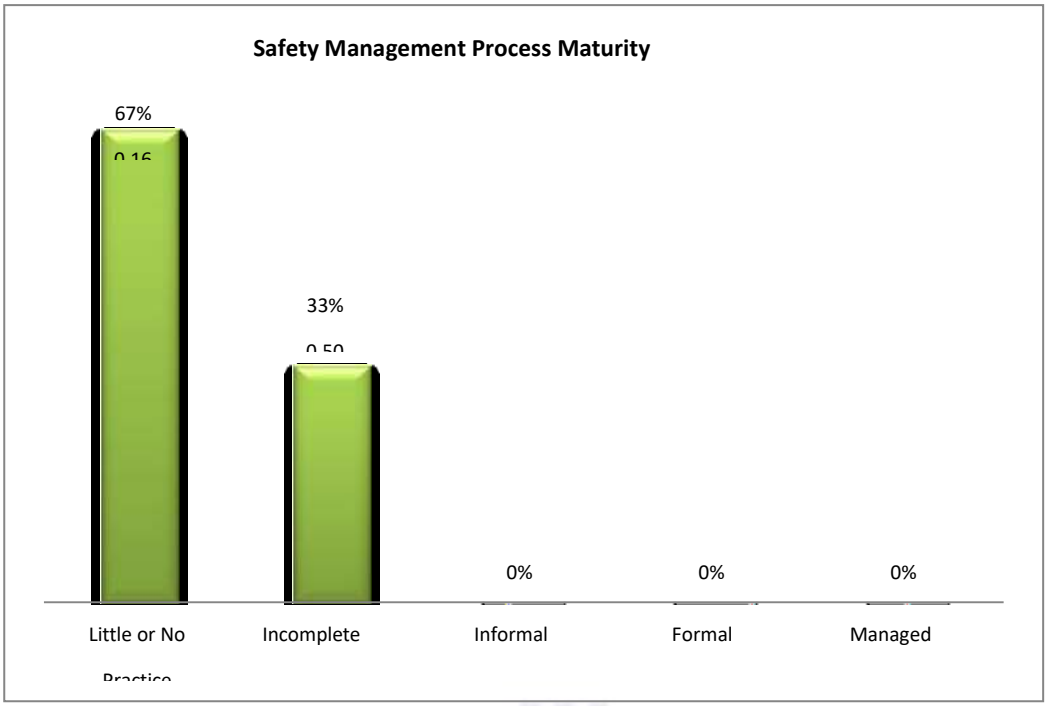

Figure 28: Safety Management Process Maturity

The research finding shows that about 2/3 of the contractors perform little or no safety management, the other 1/3 have incomplete safety management process performing on average 1 out of 2 safety management processes that are expected to be performed to achieve the goal of project safety management.
Only two of the three PMBOKs (construction extension) safety management are considered to be basic in managing safety in projects.

Safety Management Practice Maturity
Twenty out of the 21 contractors indicated that there is awareness about the importance of safety management in their organization; 80% of the contractors said there is some effort of managing safety in their organization. The overall safety management practice maturity of the contractors is found to be 0.32, which means on average the contractors perform little or no safety management in managing their construction projects. The average PMBOK safety management process practice of the contractors is found to be only 33%. Thirty three percent of the contractors said their organizations have organizational policies, procedures and guidelines for safety management, about 21% of the contractors said they perform Site Neighbourhood Safety Characteristics Study for their project, about 42% said their organizations provide safety training for workers; 67% said their project provide Personal Protective Equipment for site employees; 21% said their organizations have safety management personnel/coordinator.

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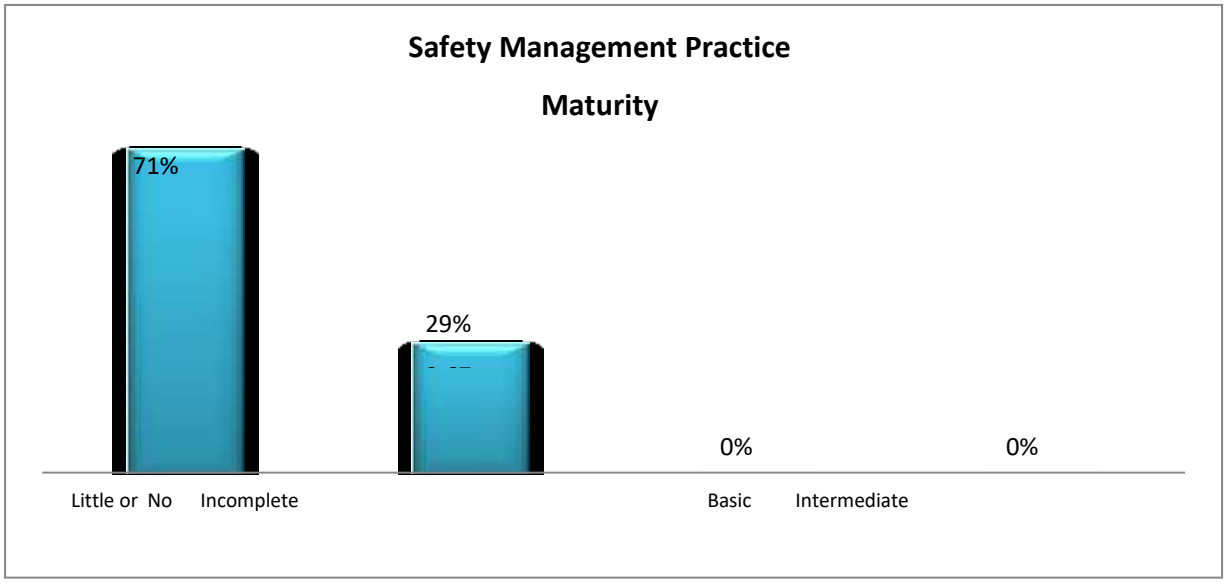

Figure 29: Safety Management Practice Maturity

About 70% of the contractors perform little or no safety management practices; the other 30% of the contractors their safety management practices is incomplete. Those contractors perform only 2 out of 3 basic safety management practices.

4.3 Chapter Summary

The research questionnaire was initially delivered to 40 contractors of which 32 are local contractors and eight international contractors (seven Chinese and one Indian contractor doing business in Ethiopia). 26 of the 32 the local contractors have returned the questionnaire and unfortunately none among the eight international contractors returned the maturity assessment questionnaire. Of those 26 which returned the survey a response from five was rejected as the responses were not complete or properly responded. Hence, only response from the 21 contractor was used in performing the maturity analysis. This chapter presents only the result of maturity assessment of the 21 organizations and the practice rating of the PM practices by 15 Practitioners

In order to develop the proposed model, two additional questionnaires were prepared distributed to a total of 18 selected Practitioners and Academicians in areas of construction Project Management. Fifteen of the respondents have returned the first questionnaire (Survey-questionnaire II) of which the result of one was rejected due to incompletes. For the third questionnaire (survey –Questionnaire III), 12 respondents have returned the questionnaire of which the result of three respondents were rejected due to incompleteness. Generally, Nine of the 15 practitioners that have returned the questioners have PM training at master's level (Construction management program) one of the respondents has PhD level training and the remaining five have short term PM training. Two respondents have less than two years of experience as PM, four of them have experience between two to four years, six respondents have 5 to 10 years' experience working as PM and the remaining three have indicated working as PM above 10 years. The respondents have an average of seven years of PM experience.

5.0 CONCLUSIONS

5.1 Summary

The main goal of this thesis research was to assess the PM maturity of the construction industry in developing countries (Ethiopia) and identify priority and problem area and propose framework for improvement efforts. Additional goal of this research was to propose a maturity model that could be used for the assessment purpose. Further it was the objective of this research to see if there is difference in PM maturity between different categories of contractors. Thus, in this regard this research result has found the following major findings.

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5.2 Findings and Discoveries

Generally, the construction PM process maturity and practices maturity of the contractors (Grade-1 contractors in Ethiopia) is found to be at low level. (Average maturity of 1.30 for the process maturity and 0.99 for practice maturity dimensions). This shows on average the contractors PM process maturity is at informal level and their PM practice maturity is at basic level. This means on average the contractors perform the knowledge areas informally without following structured approach or guide line, relying solely on the knowledge and experience of the project manager or project team, and on average the contractors are performing only the basic practices under each knowledge area. Moreover, about 50% of the contractors are found to be at incomplete level of PM process maturity (that is on average 50% of the contractors do not perform all the necessary processes that are required to manage construction projects successfully).

Further, there was no single contractor which has attained the managed level process maturity. On average 40% of the contractors do not perform all the practices considered to be basic. In fact, on average 40% of the contractors perform only 2/3 of the PM practices that are considered to be basic in managing construction projects. The rest 60% of the contractors are at basic level of practice maturity. Not a single contractor has managed to achieve even intermediate level of PM practice maturity. Given the fact that contractors at lower grade (category-2, 3, 4, 5…) are comparatively less experienced and highly constrained in capacity; the overall PM maturity of the contractors in the country could be worse than what this research found for grade-1 contractors. These findings are indicative of the low level of PM development in the country's construction industry. The findings also support the research assumption that the construction PM maturity of the contractors in Ethiopia will not exceed the defined level (the third Level in CMMI and other maturity models).

Generally, the knowledge areas of material, procurement; cost, time, financial and human resource management have shown comparatively higher maturity compared with other PM knowledge areas. These knowledge areas are more or less being performed formally by the majorities of the contractors. Further, the practitioners in the country consider the above knowledge areas to be more important for success of the construction PM, whereas the knowledge areas of scope, equipment, quality, and communication management are found to be comparatively at lower level of maturity and could be considered generally to be performed informally by the majorities of the contractors.

In addition, the practitioners in the country consider them to be, somehow, less important for success of the construction PM than the former six knowledge areas. The remaining two knowledge areas of risk and safety management are the least matured knowledge areas. On average only 1/3 of the basic practices in the two knowledge areas were being performed. Moreover, the practitioners in the country consider them to be the least important in the management of construction projects. For practical purpose the two knowledge areas could be consider to be totally unknown in the management of construction project in the country or practiced little or by very few in the industry. This is perhaps due to the low level of awareness and the relatively low importance given to these two knowledge areas. Next to the above two knowledge areas, communication management is another knowledge area which is comparatively at lower level of maturity.

Generally, except for Material and Equipment Management knowledge areas, the construction PM maturity of contractors which are ISO certified or in a process to obtain the certification (ISO Contractors) is found to be higher than those which are neither ISO certified nor in a process to obtain the certification (Non-ISO Contractors). Hypothesis test is undertaken and found to be significant at 5%. (Appendix-I: Hypothesis Test Result). On average, it can be considered, that those contractors which are ISO certified perform construction PM formally, whereas those which are Non-ISO perform informally. The higher maturity of ISO contractors is perhaps due to the focus on process and documentation and formal implementation that is advocated in the ISO standards and perhaps due to the training and mentoring organizations obtained on their way to the certification.

The highest difference in maturity between the two groups of contractors is found in the maturity of quality management. A value of 1.71vs 0.38 respectively is obtained for the two categories of contractors. This indicates that on average ISO contractors perform quality

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management formally whereas Non-ISO contractors practically perform little or no quality management. This difference is expected given ISO‟s emphasis on quality. This finding indicates to some extent the potential improvement to be obtained by attaining ISO certification. The fact that maturity model use concept of quality management and the emphasis by ISO to follow structured and documented processes perhaps may have contributed to the improvement in maturity of the contractors in the category compared with those contractors which are Non-ISO.

The PM maturity of the contractors which took part in Capacity Building Program (CBP contractors) is found to be higher than those which did not participate in the capacity building program (Non- CBP Contractors). Hypothesis test at 5% is found to be significant see (Appendix-I: Hypothesis Test Result). Overall, CBP contractors have shown consistently higher maturity in all knowledge areas of construction management except that of material management. An average maturity of 1.52 is recorded for CBP contractors whereas; an average maturity of 1.11 is recorded for the Non-CBP contractors.

Thus, it could be considered that, on average CBP contractors perform construction PM formally, whereas, the Non-CBP contractors perform construction PM informally. This finding to some extent indicates the positive contribution of such improvement effort. The fact that a very low PM maturity is found overall for the contractors; implies that there is a gap in awareness and knowledge in the practice of PM, hence, such efforts as CBP can significantly help filling the gap through the training provided to the contractors. Further, the mentoring given to the contractors by the Capacity Building Program significantly help the contractors easily implement the knowledge they gained through training and bring an improvement in their practice. Overall, the finding indicates the high potential improvement that could be achieved through training and mentoring when the PM maturity is at very low level.

Similar to the case with ISO and CBP contractors, the PM maturity of Road contractors is found to be higher than Building contractors‟ PM maturity (1.75 Vs 1.15). Hypothesis test is undertaken and found to be significant at 5%. (Appendix-I: Hypothesis Test Result). Thus, from the maturity score it could be considered that on average road contractors are managing their projects formally, whereas building contractors are managing informally. The road contractor's higher maturity score could be mainly because of the fact that, road contractors generally are large in size and have higher capital and undertake relatively high volume of work that requires formal management to ensure control of the project. In addition, larger capacity of the road contractors means better capacity to pay and hire more experienced and knowledgeable professionals. Further, comparatively road projects are partially financed by foreign funds that usually demand more formal and better management capacity, forcing the contractors‟ to perform better to meet requirements and win jobs.

The process maturity of contractors is found to be highly correlated with the practice maturity (coefficient of correlation of 0.936). This shows that, more matured processes are associated with more matured or advanced practices. Hypothesis test is undertaken and found to be significant at 5%. (Appendix-I: Hypothesis Test Result). The maturity level determined by proposed model's both process maturity and practice maturity dimensions are found to be highly correlated with maturity levels determined based on the reference model. Hypothesis test is undertaken and found to be significant at 5%. (Appendix-I: Hypothesis Test Result). This is indicative of the validity of the proposed model. Thus, the proposed model could be used in assessment of PM maturity of contractors.

5.3 Limitations

Due to limitation of time and resource, more reliable and informative method such as maturity assessment of organizations based on artifacts and interview, and the use of focus group in developing content of the model were not used. The research used self-administered questionnaires surveys. However, as explained some efforts have been taken to minimize the impact. Due to limitation of time the research adopted only Project Management Standards (PMS). The knowledge area of Environmental management is not covered by this study as there is little or no awareness and practice of the knowledge area in Ghana when this research was started.

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5.4 Recommendations

The low level of construction PM maturity found for the Grade-1 Contractors shows how poor the PM practice in the industry overall is. Thus, improvement efforts need be under taken to improve the current condition. In this regard this research recommends the following specific actions to be undertaken. Providing training and mentoring to the contractors to improve their PM knowledge and practice capacity. In this regard, the higher maturity found among contractors who have participated in the Capacity Building program (CBP) to some extent indicates the potential success that can be gained.

Encouraging contractors to obtain ISO certification as this would help them improve also their PM capability. The high maturity found among ISO contractors in this regard indicates the potential success that can be achieved. Giving special attention to resource, risk and change management. As the review of literature shows, management of projects in developing countries is highly constrained by the scarcity of resources and high uncertainty (a very volatile environment with speedy and less predictable changes). Thus, focusing on the management of resource, risk and change can significantly help lower their negative impact and improve performance of projects through better planning and use of the resources; planning and monitoring of the risks and management of change.

Encouraging contractors to attain at least formal level of process maturity and basic level of practice maturity in order to obtain successful result and ensure control of their projects. As the review of literature showed, the high uncertainty avoidance and power distance common in developing countries mean that workers in these countries tend to avoid risk and prefer clarity and rules, deferring to their superiors. At formal level of process maturity; structured approach, guides and standards are used, and expectations are more or less clarified, thus helping create clarity and lowering risks assumed by subordinates and increase their confidence to make decision.

Further, the use of guides ensures consideration of important aspects, thus significantly contributing to the performance of the knowledge areas. The use of generic guides, such as the PMBOK, in this regard may significantly help. The attainment of basic level of practice maturity means that the organization is performing all the basic practices (must) to attain the goal of the knowledge areas, thus maximizing the chance of attaining knowledge area goals and hence, attainment of project objectives. Conducting continuous assessment of maturity by the contractors to know the success of improvement efforts they undertook and to chart a new action plan for further improvement measures.

5.5 Further Study and Research

This research work is a starting one and needs be followed by several researches to investigate scopes which are not considered in this research and to refine the concepts raised and further enhance our understanding, and contribute to the construction PM knowledge pool. Thus, this research recommends the following for further research and investigation:

- Conducting detailed research to identify the processes and practices to be included under the equipment management and materials management knowledge areas.
- Conduct research to Improve /increase listing of practices under each of the construction PM knowledge areas.
- To determine the overall PM capability of the industry, conducting similar studies by including contractors at different grades or categories and from the perspective of clients and or all stakeholders.
- Conducting further research to improve the proposed model to make it a generic model that could be used for assessment of PM maturity of any organization in any industry.
- Conducting PM maturity of major public clients to determine the PM maturity of the clients and hence contribute to development of PM in the construction industry overall.

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- Conducting in-depth research to determine in detail how each of the construction PM knowledge area is being performed by the contractors so as to be able to prepare a detailed improvement framework. possibly using case study approach to get a deeper insight.

- Extend the proposed maturity model/s process dimension of maturity definition and the assessment tools to the continually improved (optimization) maturity level for possible use in developed countries.

- Extend the proposed model to include other knowledge areas left such as environmental management.

- Conduct further research to refine the model the models and the assessment questionnaire through active involvement of academicians and professionals using focus group and further extensive literatures review

5.6 Conclusions

This master's thesis research aims to assess the extent of use (maturity) of project management processes and practices in the Ethiopian construction industry. Further, the research has provided bench mark data on the current status of PM practice in the industry for use in continuous assessment of future improvement efforts. Moreover, the research has proposed a maturity model that could be used to frame improvement efforts and assess PM maturity of contractors. Contractors can also use the proposed model for self-assessment purpose and to guide their improvement effort. Nevertheless, this thesis research is meant only a starting work towards a long journey to the development of PM practice in the country as a whole and the construction industry specifically. The main goal was to do a starting work and open the door for further refinement and investigation and demonstrate the application of the concepts raised. The research presumed that future works will address the rest and the details.

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