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# Ethiopian Construction Project Management Maturity Model Determination and Correlational Prediction of Project Success

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This is to certify that the doctoral dissertation by

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Abstract

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Management

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Abstract

In Ethiopia, although the construction industry is booming, the practice of effective project delivery in time, cost, and quality remains a challenge. Construction project success comes through the application of knowledge-based, critically essential factors. The industry's effectiveness is dictated by the level of project management knowledge built in each company. The purpose of this quantitative, correlational study was to evaluate project management maturity level of construction industry and the predictability of project success from project management knowledge maturity of 193 project managers working in contractors, consultants, and clients. The study, which was informed by the project management body of knowledge and stakeholder theory, used 2 existing valid and reliable survey instruments, the Construction Project Success Factors, and Kerzner Project Management Maturity Measurement questionnaire, to collect the data. The correlation between project success rate and maturity level of group sample was checked by Pearson correlation. Statistically significant ($p < .001$) and strong positive correlation (Pearson's ranging from .502 to .677) were found for all measures of project success and project management maturity score of Level-1 and Level-2. The study provides strong evidence that construction project management maturity level is correlated and predicts the project success rate. These findings may help improve the project management knowledge, organization, and delivery system for a positive social change. The results may help policymakers and professionals encounter successful projects derived from the improvement of construction project management knowledge.

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Dedication

First, I dedicate this precious dissertation to my beloved country Ethiopia, the reasons of who I am today. Second, I dedicate this to my friends the former prime minister of Ethiopia H.E Hailemariam Desalegn, minister, H.E Muferiyat Kamil, for inducing the passion of organizational leadership, development, peace, professional integrity, and giving the opportunity seeing the bigger picture beyond the complexities of leadership. Third, I dedicate this to my wife, Hewan, for unflattering support and patience while avoiding completing this dissertation. I could not have completed without her love, support, and understanding. Fourth, I dedicate this to my son Bemnet, daughters, Tsion, Sina, and Elbetel. I hope they understood one day why daddy spent so much time on the computer. And over time I hope they see me spend less time on the computer and more time with them. Fifth, I dedicate to my Dad (Gashye) and Mom (Emiye) for raising me in those unforgettable hard times. Last but not least , I dedicate this to, Samrawit & Miniyiluh, Seblewongel & Dr. Henok, Mihret & Dr. Tadese, Yetnayet & Solomon for supporting with your finances.

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# Chapter 1: Introduction to the Study

Ethiopian public construction projects were critically affected by factors owner's competence, conflict among project participants, poor human resource management, and project managers' ignorance and the lack of knowledge (Sinesilassie, Tabish, & Jha, 2017). Currently, most mega public construction projects suffered from unmanaged project planning, operation, and function. Construction projects schedule slippage reaches up to 80%, and the rise of cost than planned ranges up to 40% (Ayalew, Dakhli, & Lafhaj, 2016). Project quality, time overrun, and cost rise is challenging the economic and construction industry development of the country.

People's competency is given less attention to the Ethiopian construction project management environment (Sinesilassie, Tabish, & Jha, 2017). The critical success and failure factors were related to people's knowledge. Ayalew, Dakhli, and Lafhaj (2016) asserted the level of construction project management practice in the Ethiopian construction industry in terms of adapting the standard project management procedure, tools, and techniques to be unsatisfactory. Safety, risk, and time management were found at the low stage and key challenging issues for project managers.

Chapter 1 introduces the topic of research and the background of crucial research variables, construction projects success stories, and state of construction project management knowledge related to Ethiopian construction industry practices. The problem statement, the purpose of study, research questions and hypotheses,

theoretical foundation, nature of the study, definitions of the key terms, assumptions, limitations, delimitations, and significance of the study to theory, practice, and social change, and summary.

## Background

Ethiopia is recognized as one of the most impoverished nations on earth, where robust economic change is needed (Economics, 2018). According to the International Monetary Fund (IMF, 2018), the Ethiopian economy had shown a continuous growth driven by major public construction and infrastructural investment for the last 2 decades, with increasing demand for development. The economy showed an annual GDP growth rate of 7.7% in year 2017/2018 (IMF Report, 2018). The federal government of Ethiopia is prioritizing the allocation of public funds to the infrastructure investment to achieve the national economic development goal of middle-income status by 2025 (Sinesilassie, Tabish, & Jha, 2017). Middle-income countries, defined as those with GDP per capita yearly incomes in a range of $2,585 to $17,600 (Eichengreen, Park, & Shin, 2018). MoC (2015) indicated that the commitment of the government is being demonstrated by mobilization of actual funds to the construction industry, as compared to other economic sectors.

The Ethiopian construction industry has shown rapid growth resulting in project success contrasting that of other developing countries. The 10-year forecast of the Ethiopian construction industry of 10.5% is the fastest growth rate in sub-Saharan Africa and the second-fastest industry growth globally (Fitch Solutions,

2019). Ofori (2019) found that developing countries' construction performance has declined in progress in the past decades. In the developing country construction industry, Ofori (2015) highlighted the need to improve construction performance. This research will play a pivotal role in transforming developing country socioeconomic status through increased project productivity.

Over the past 20 years, rapid construction projects have been implemented across Ethiopia. The government was the key player in the public investment project process. Shiferaw, Klakegg, and Haavaldsen (2012) argued the project success is not a success story as it faced many critics challenging the success of projects. Roads constructed in remote parts of the country were below the accepted daily traffic flow, the government was unable to create revenue, and failed to cover maintenance and operation costs. Similarly, public-funded housing development projects, universities, and hydropower generation projects were among the projects that cost the government an enormous amount. Shiferaw et al. affirmed the government of Ethiopia was overambitious in planning mega projects and did not allocate sufficient time for the front-end project development phases critically crucial to the success of projects.

It is expensive to improve the delivery scheme and construction project management process at any organizational level, with many factors to attain project success (Tripathi & Jha, 2018). Ofori-Kuragu, Baiden, and Badu (2016) explored the critical success factors (CSF) for the success of the Ghanaian contractor's organization. Gunduz and Yahya (2015) studied the CSFs of the construction

industry in Dubai and the middle east region. Experience indicated it is necessary to focus on country-specific CSFs leading to organizational and project success.

Abdul Rasid, Wan Ismail, Mohammad, and Long, (2014) employed the criteria of the project management body of knowledge, project integration management, scope management, time management, quality management, human resource management, communication management, risk management, and procurement management to assesses one Malaysian public agency project management maturity. Crawford (2006) proposed PM solutions as the underlying platform to define the project management maturity model initially developed for software industry and was later expanded to other industries. Lack of sufficient construction project management knowledge and skills in the construction project implementation process of key actors is a challenge.

Kerzner (2003) believed the project management model (PMM) takes into consideration of high chance of repeated success as an outcome of following standard work procedures. Kerzner's project management maturity model (KPMM), after checking for the alignment to capability project maturity model (CPMM), contains five levels: Embryonic, Executive Management Acceptance, Line Management Acceptance, Growth, and Maturity (Souza, Salomon, Silva, & Aguiar, 2012). Most researchers used questionnaires to estimate the level of PMM in the company where it is classified. PMM measurement and the KPMM model are efficient to handle because they contain only 20 questions. The other model suggested by Ibbs and Kwak (2000) contains 148 questions that are used to estimate

project management maturity. Nine project management body of knowledge areas and organizational perspectives are the basis for project management maturity measurement.

## Problem Statement

The 5-year term national growth and transformation plan GTP II (2015) performance report revealed a decline of the poverty level from 26.9% in 2011 to 23.4% in 2015; however, the problem of poverty in Ethiopia remains. Large construction projects played a significant role in reducing poverty by creating a job for unemployed youths. According to NBE (2018), the construction industry contribution covers 71.4% of the economic growth in industrial output. Unlike other economic sectors, the construction industry's influence on socioeconomic transformation is recognized through its direct, indirect, and spillover effects. Strengthening organizational project implementation performance capability of contractors and consultants in Ethiopia is needed to build the competitive construction industry.

Gomes and Romao (2016) identified project success criteria like time, cost, technical requirement, customer satisfaction, and objective achievement and CSF (scope control, team engagement, top management support, resource availability, risk management, business opportunity, market impact, and financial resource). The failure to meet construction contract time and work within the budget limit in the construction industry drove countries to look for new opportunities (Gunduz &

Yahya, 2015). These factors are essential to improve the project management effectiveness of stakeholders involving in the construction implementation process.

The construction time management failure among stakeholders during construction contract execution remained the deep-rooted problem of the industry. The fact that the United Arab Emirates' construction industry suffered to meet deadlines and budgets necessitated great attention to identify CSFs to maintain improved competitive construction industry that contributes to economic development (Faridi & El Sayegh, 2006). The finding revealed that the construction project failure in developing countries is often higher than in their developed counterparts. Sinesilassie et al. (2017) indicated that Ethiopian public construction project management issues of people's competency are founded on knowledge of project management are given less attention. GTP (2015) explained that the poor project management of the country's construction industry was identified as a challenge of project success. Despite the construction boom currently occurring, no critical research has been conducted targeting Ethiopia that relates to construction project schedule performance (Sinesilassie et al., 2017).

The GTP (2015) characterized management problems issues such as capacity limitation, lack of integration, finance shortage, lack of good governance, technology gaps, lack of monitoring, and implementation as a problem to be addressed in the national development plan. I analyzed the construction project management knowledge maturity and suggest the CSF at the organizational level to increase project success.

The general problem of this quantitative study focused on the lack of consensus to measure the effectiveness of Ethiopian construction project management as they apply to CSF and gaps in the project management body of knowledge. The specific problem of the study is poor construction implementation caused from the absence of known critical success factors that apply to Ethiopian contractor's and consultant's construction and weakness in project management capability.

## Purpose of the Study

The purpose of this quantitative, correlational study was to examine the CSF and construction project management knowledge maturity level of contractors, consultants, and clients engaged in active project sites of building construction industry. The construction project management maturity level helps to identify the gaps in project management knowledge for future improvement. The CSF will serve as management decision making focus on resource allocation due to the extensive influence towards organizational project success. The study findings may enhance the understandings of CSF by project owners, project managers, engineers, and architects for the success of projects in the Ethiopian context. Results of this study may inform the state of the project management maturity level of the construction industry and indicate the future areas of improvement.

**Research Questions and Hypotheses**

1. To what extent, if any, do project management body of knowledge (PMBoK), as measured by KPMMA of contractor's, significantly predict the project success, as measured by CPSFA?

$H_0$1: The collective effect of the project management body of knowledge of contractor's, as measured by KPMMA, does not significantly predict the project success, as measured by CPSFA.

$H_A$1: The collective effect of the project management body of knowledge of contractor's, as measured by KPMMA, significantly predicts the project success, as measured by CPSFA.

2. To what extent, if any, do project management body of knowledge (PMBoK), as measured by KPMMA of consultant's, significantly predict project success, as measured by CPSFA?

$H_0$2: The collective effect of the project management body of knowledge of consultants, as measured by KPMMA, does not significantly predict the project success.

$H_A$2: The collective effect of the project management body of knowledge of consultants, as measured by KPMMA, significantly predicts the project success.

3. To what extent, if any, do project management body of knowledge (PMBoK), as measured by KPMMA of client's, significantly predict project success, as measured by CPSFA?

$H_0$3*:* The collective effect of the project management body of knowledge of clients, as measured by KPMMA, does not significantly predict the project success.

$H_A$3: The collective effect of the project management body of knowledge of client's, as measured by KPMMA, significantly predicts the project success.

4. What is the level of construction project management body of knowledge of the construction industry, as measured by the KPMMA?

## Theoretical Foundation

The appropriate project management theories, project management models and tools, CSF theory, and stakeholder theory practiced in the construction project management process were used as a foundational theoretical framework of the study. The Project Management Institute (PMI) lead project management body of knowledge derived methodologies, procedures, competencies, and tools used in management application (Kostalova & Tetrevova, 2018). The project management maturity model is used to assess and mark the enterprise level. Researchers provided various types of Project Management Maturity Model (PMMMS) that established on the nature of the organization and the underlying theoretical foundation.

According to Kostalova and Tetrevova (2018), 43 project management maturity models were identified. Understanding project management maturity and applying the right type of model impacts the success rate of the project execution process (Kostalova, & Tetrevova, 2018). The project management body of knowledge has been used as theoretical base for multiple types of PMMM,

including: Fincher and Levin (1997), PMMM (Lubianiker, 2000), Project Management assessment 2000 (PMA 2000 Model), PMI (2001), Organizational Project Management Maturity Model (OPM3; Kwak & Ibbs,2002), Project Management Process Maturity (PM2; Kerzner, 2014, 2001), Kerzner Project Management Maturity Model (KPM3; Crawford, 2015), PM Solution (2013), Project Management Solution or PMMM, and ESI international, 2016 ESI's Project Maturity Model–Project Framework.

Project success related research grew in the early 1960s, and most researchers concluded that not all project factors made an equal contribution to final project success (Alvarenga, Branco, Bittencourt, & Pereira, 2018). Organizations apply CSFs theory to keep their advantage over their competitor. Kannan (2018) highlighted that CSFs became an analytical tool to evaluate any type of organization. The complexity of decision making arising from the presence of several factors in organizational goal accomplishment is reduced by applying critical success theory. The CSF approach in the construction management field is used to identify essential factors that simplify the management challenges. CSFs are key success variables to meet project goals and planning processes (Adnan, Yusuwan, Yusof, & Bachik, 2014).

The framework uses two distinct stakeholder management approaches the management of stakeholders and management for stakeholders (Eskerod, Huemann, & Ringhofer, 2018). The diversity in stakeholders yields specific interest that does not align with the firm interest calls the theory for more work to analyses the

combined and diverging interest and the influence have on stakeholder's relationship (Harrison et al., 2015). Stakeholder theory assumes an equal level of treatment to all stakeholders with fairness, honesty, generosity, and that it is useful in a turbulent and complex environment (Harrison, Freeman, & de Abreu, 2015). The objective of employing theories of the PMI is to facilitate the quantitative data analysis and apply to identify the critical success factors and to assess the project management knowledge maturity level of the construction industry of Addis Ababa, Ethiopia.

## Nature of the Study

In this quantitative, correlational study, a survey technique was employed to examine the relationship between construction industry stakeholders' organizational project management knowledge of level aspects of project management knowledge maturity (i.e., the independent variable) and the company's technical capabilities, control system, effective site management, top management support, political condition, and corruption aspects of project success (dependent variable).

The sample of the study was 100 registered Category 1 and 2 contractors, 48 Category 1 and 2 consulting companies, and 45 major client organizations that allocate a substantial amount of finances for the construction projects considered. The participants in the study were members of the construction industry representing contractors, consultants, and clients involved design, construction, and project management roles and responsibilities.

A one point in time approach was applied in data collection. The participants in the study were contractors, consultants, and project managers of clients involving

in building construction projects site located in Addis Ababa. The outcome of data collection and analysis used to enhance the understanding of existing construction industry project management knowledge level and PSF influencing the success of projects was understood by studying the perception of project managers participated in the construction project management process of the industry.

The data were collected through two existing valid and reliable survey instruments. The KPMMA, originally designed by Kerzner (2001) and modified Souza, Salomon, Silva, and Aguiar (2012), was used to measure the independent variable of project management knowledge maturity level. The CPSFA, originally designed by Gunduz and Yahya (2015), was used to measure the dependent variable of project success for contractor, consultant, and client.

KPMMA uses Kerzner's PMMM original scale ranging from -3 to +3. Souza et al. (2012) explained that the scale has no scientific basis and is used instead of a Likert scale. The project management knowledge of respondents is assessed on scale -3 (*Strongly disagree*), -2 (*Disagree*), -1 (*Slightly disagree*), 0 (*No Opinion*), 1 (*Slightly agree*), +2 (*Agree*), +3 (*Strongly agree*). The instrument is an accepted measurement tool by PMI to collect data and conduct subsequent analysis (Souza et al., 2012). The model classification is presented in five levels, 1(*for lowest*) and 5 (*for the highest*). CPSFA applied a 5-point Likert scale containing importance scale and the second the frequency scale. The factors importance scale designates 1 (*Very Low*), 2 (*Low*), 3 (*Average*), 4 (*High*), 5 (*Very High*) and for the frequency section 1 (*Never*), 2 (*Rarely*), 3 (*Sometimes*), 4 (*Often*), 5 (*Always*). Correlation coefficients

were used to analyze the level of strength between the project management maturity to project success.

## Definitions

*Architects- Engineers:* In most construction industry settings, the architect-engineer is an independent professional or company organized to design and supervision services. The owner of projects hires architect-engineer through the contractual process to design service (Sears et al., 2015).

*Construction Project Management*: Walker (2015) defined construction project management as the planning, coordination and control of a project from conception to completion (including commissioning) on behalf of a client, requiring the identification of client's objectives in terms of utility function, quality, time, and cost; the establishment of relationships between resources, integrating, monitoring, and controlling, the contributors to the project and their output; and evaluations and selecting alternatives in pursuit of the client's satisfaction with the project outcome.

*Criteria of Project Success*: The definition of project success is dependent on the size, complexity, experience of owner, project stakeholders, and type of projects. Criteria of project success is defined as the set of principles or standards by which favorable outcomes can be completed within a set of specifications (Chan & Chan, 2004). Contractors, clients, designers, and consultants do have their project success criteria because the project objectives of each entity vary.

*Critical Success Factor (CSFs):* Critical success factors are few factors among which the project manager should give due attention to bring the successful

accomplishment of projects and critical concepts pertinent to induce effective organizational change (Ofori-Kuragu et al. 2016). Zuo, Zhao, Nguyen, Ma, and Gao (2018) put critical success factors as unique areas where the management should focus on the project implementation process to benefit maximum outcome.

*Project Management Body of Knowledge (PMBOK):* The PMI PMBOK guide defined a series of project management knowledge areas; Project Integration Management, Project Scope Management, Project Schedule Management, Project Cost Management, Project Quality Management, Project Resource Management, Project Communication Management, Project Risk Management, Project Procurement Management, Project Stakeholder Management as generally accepted knowledge (PMI 2017, Pretorius, Steyn, & Jordaan, 2012). Construction Extension to the PMBOK guide encompasses the construction industry-specific knowledge areas and process groups (PMI,2016). Construction extension to PMBOK guide aims to advance construction project management effectiveness and efficiency, tools, procedures, techniques, processes that apply to the construction industry. Construction extension to PMBOK guide added Project Health, Safety, and environment Management, and Project Financial Management is added knowledge to address construction industry-specific management issues.

*Project Management Maturity (PMM):* "A well-defined level of sophistication that assesses an organization's current project management practices and processes" (Kwak & Ibbs, 2002,PP 150).

*Project Owners:* The owner, whether public or private, is the instigating party that gets the project financed, designed, and built. Private owners may be individuals, partnerships, various corporation combinations thereof. Public, private partnership is another mode of ownership that might be seen in project management undertakings. Defining the project work is the responsibility of the owner technically assisted by design professionals (Sears et al., 2015).

*Successful project management:* Achieved the project objectives within time, within the cost, at the desired performance/technology level, while utilizing the assigned resources effectively and efficiently, accepted by the customer (Kerzner,2001).

## Assumptions, Limitations, and Delimitations

### Assumptions

Assumptions are the enablers to carry out a proposed study (Simon & Goes, 2013). The first assumption in this study is honest, and accurate responses were expected from each participant. Each participant in the study was assured that their response kept secure and confidential to increase the likelihood of meeting an honest and factual response. The assumptions of honesty and trust during data collection from participants are among the expectations of the study.

Respondents carefully examined and completed the questioner responsibly; however, participants had the right to withdraw from the survey at any time without notice. All responses are assumed to be the reflection of construction project management knowledge application. The study maintains the principle of

confidentiality and anonymity. The quantitative research approach was suitable for the project management knowledge application maturity assessment and identification of critical success factors of the construction industry in Addis Ababa, Ethiopia.

**Limitations**

Limitations are an imposed restriction beyond the control of the researcher (Theofanidis & Fountouki, 2018). It is a potential weakness related to the chosen research design, statistical model constraints, or other factors. Limitations affect the study design, results, and conclusion. In this regard, the acknowledged limitations of the study are getting competent project management experienced participants to respond to questions in spite of language barriers. The popular national language spoken is Amharic; as a result, people may not want to participate in the study. Expert knowledge was needed in collecting data from four points. Participants in the study, at an individual or organizational level, may not be interested or willing to cooperate in supplying data on time. The finding of the study may not be scalable to other regions due to the limited scope of study covering the Addis Ababa area.

**Delimitations**

Delimitations of the study are deliberate limitations or set of boundaries established by the researcher (Simon & Goes, 2013). The conscious inclusion and exclusion actions made by the researcher are the known cause for delimitation. Delimitations are linked with the study's theoretical background, objectives, research questions, variables under the study, and study sample. I proposed to

exclude locally unregistered construction project professional's participation in the study sample. However, there exist several project success factors that were studied. I decided to use the construction extension project management body of knowledge as success factors of the study.

## Significance of the Study

### Significance to Theory

The findings of the study may be significant to stakeholders' understanding of CSF's project management body of knowledge as applied to the construction project success. The findings identify individual and collective construction project management knowledge-based CSF for contractors, consultants, and owners to facilitate project success. The Ethiopian construction industry project management benefits from the study in two ways. First, findings may enhance further development of weak project management knowledge after becoming familiar with the 14 project success factors. To date, no other study has used these factors to identify the CSF for project success. Results may contribute to the knowledge of construction project management for the Ethiopian construction industry. Second, the study could help policymakers and stakeholders understand the domestic construction industry's organizational project management knowledge level for effective decision-making.

The findings of the construction project management CSF and project management maturity knowledge level research may be translated into policies, capability building programs, decisions, and initiatives to build skills of project

management knowledge of consultants, contractors, and clients (Ofori, 2015). The study finding could also enhance the knowledge of project managers, project management regulatory institution's understanding of project management process, organizational maturity level, and associated gaps for future intervention.

**Significance to Practice**

Project management companies, owners, contractors, and consultants could be informed about the gaps in the construction project implementation process, impeding factors from achieving project success. The study finding of maturity level may further help project management companies improve their project management knowledge at an organizational level and help them to stay competitive in the construction industry. The booming construction industry development in Ethiopia resulted in huge construction success (GTP, 2015). The achievements are not well supported with adequate research works because most construction project management performance studies were done for developed countries (Sinesilassie et al., 2017).

The findings of the study may support the perceived achievements through quantitative analysis and provide critical success factors leading to Addis Ababa, Ethiopian construction project successes. The findings of the study may provide a practical basis for project management professionals and high-level decision-makers to utilize critical success factors. Demirkesen and Ozorhon (2017) highlighted the significance of understanding the leadership, project management, and construction industry challenges to bring a recommendation to policymakers, stakeholders,

practitioners, and academia to improve the social and economic development of a country. The findings of a study conducted in Addis Ababa; Ethiopia could motivate other regions to focus on building the organizational project management knowledge capability.

**Significance to Social Change**

The study findings contribute to positive social change through improved Ethiopian construction project management and integrated project delivery that yields sustainable infrastructure and a residential environment for societal use and continuous economic transformation. In conventional construction project management, time, cost, and quality management were commonly known criteria used to measure the success of projects. Improved productivity of the construction project process help stakeholders' profitability and the benefits of society.

## Summary and Transition

The objective of this study was to evaluate the relationship between project management maturity and project success for contractors, consultants, and clients. The maturity level of each organization and at the industry level will be known. This chapter of the study included the introduction to the study, the background of the study, problem statement, purpose of study, research question and hypothesis, theoretical foundation, nature of the study, definition of terms, and significance of the study. In Chapter 2, the theoretical framework grounding the study and reviewed the literature described.

# Chapter 2: Literature Review

## Introduction

The objective of this study was to examine the current construction project management practices in order to understand the CSFs and project management maturity level of companies and how that is linked to project success. The literature review includes theoretical framework PMI (2016), construction extension PMBoK, Kerzner's (2006) project management maturity model and theory of stakeholder as studied by Mok et al. (2015) on megaproject management, and Uribe et al.'s (2018) studies on project success. The objectives of this literature review was (a) to integrate the findings to these theorists to the current trends of project success; (b) to differentiate suitable project success factors and project management maturity variables matching to Ethiopian construction industry that will increase the quality, reliability, and validity of survey instruments; (c) identify specific operational terms to be defined and used in the study; and (d) analyze how this theory has helped contractors, consultants, and client organizations applying project success factors and project management knowledge maturity level contribution to project success.

## Literature Search Strategy

I used different procedures to identify relevant literature. The search was bound to the last 5 years of recent literature. The literature search included peer-reviewed journals, articles, books, and encyclopedias from Google Scholar, ABI/Informa Collection, Academic Search Complete, Business Source Complete, EBSCO eBooks, Emerald Insight, Taylor and Francis Online, IEEE Xplore Digital

Library, ProQuest Central and SAGE journals database. Other project works of authors reflecting the project success, National Construction Industry Policy, the Growth and Transformation Plan (GTP I, and GTP II), World Bank, and IMF reports on construction industry performance reports were also included. The keywords searched *were construction industry development, stakeholder theory, project success factor, critical success, construction management, construction project performance, project management maturity, organizational maturity, project management body of knowledge,* and *project management theory.* This chapter is organized and divided into three major parts: (a) construction management theoretical perspective, (b) construction industry project success factors, and (c) project success from project management knowledge maturity dimension. Construction project success measurement variables are discussed in this chapter.

## Theoretical Foundation

### Project Management Body of Knowledge Construction Extension

PMBoK applies to construction project management because most of the practices and knowledge were originated from the PMI (2016). PMI confirmed that knowledge built through time impacted the convergence of world construction industry practice. The impacts included rapid advancement in technology, application of new project management tools and techniques, modern method of construction, alternative project delivery mode, and societal influence visibly affecting the performance of projects.

According to PMI (2016), contractors, consultants, architectural, or engineering designers are seen as the core stakeholder in the construction management process. Lack of planning, poor preconstruction preparation, poor communication, and weak construction contract administration were identified as core construction problems. In order to ensure successful organization and project success, PMI advised the construction project management process established on fundamental theories and concepts following 12 PMBoK founding the construction management process.

- Project integration management
- Project scope management
- Project schedule management
- Project cost management
- Project quality management
- Project resources management
- Project communication management
- Project risk management
- Project procurement management
- Project stakeholder management
- Project health, safety, security, and Environmental management
- Project financial management

Applying the skills, knowledge, techniques, and tools of project management are necessary, but not the only thing to affect project success. Understanding the

fundamental knowledge of project management to address the challenges encountering in the project process effectively is needed for project success. PMI (2016) recommended project managers working at any organizational setting of contractor, consultant, and the client advised to have adequate knowledge, experience, and competence for the project management process.

**Stakeholder Theory**

An effective stakeholder management process is a crucial task of the project manager in the construction industry environment. The very nature of construction brings together different professionals of various backgrounds with unique but essential knowledge and skills. Chan and Oppong (2017) concluded the criticality of external stakeholders at the earliest stage of projects, like the design and planning phase, rather than internal stakeholders.

The project management process ensures meeting the vested expectations of the stakeholders throughout the project life cycle to bring project success. Stakeholder theory is then selected as an established theoretical framework (Uribe, Ortiz-Marcos, & Uruburu, 2018). Uribe et al. (2018) found the impact of stakeholder theory visible on the four-project management knowledge: project stakeholders, project risk, project communications, and integration management. Asserting stakeholder theory is still a critical approach to address the needs related to project management.

The PMBoK guide parts of construction extension discussed the significance of construction management roles as discharged by construction managers,

consultants, insurance companies, banking construction specialists, architects, designers, engineers, regulatory agencies, governments, subcontractors, and financial institutions as the familiar stakeholders on the construction industry. The construction project management knowledge and competence available to the management process are critical to project success. The project management body of knowledge, as related to construction management, the theory of stakeholder, and the significance of project success factors application impact go beyond project success to organizational success.

**Project Success Criteria and Project Success Factors**

Abdul et al. (2014) summarized time, cost, quality, and stakeholder appreciation as project success criteria. Human management, process, and organization, contractual and technical, team and leadership, project manager, stakeholder management, planning, scheduling, organization, control and monitoring, financial resources, and quality management were identified as success factors. The study population should be experienced project managers or experts with 6 years of experience who are capable of managing projects from planning to completion phase (Abdul et al. 2014). The population was from the business sector of the agency (Abdul et al. 2014). Project managers, project team members, resident engineers, locally certified engineers, and architects with experience of project management.

**Critical Success Factor**

Sinesilassie et al. (2017) examined the critical success and failure factors of Ethiopian construction project management schedules performance of government projects. Sinesilassie et al. used a quantitative design method of a statistical analysis based on 35 project performance factors identified from the literature review included in the survey. Sinesilassie et al. revealed that the owner's competence among all other factors found critical to the success of schedule management. The six categories of project success factors with their corresponding attributes could be taken as a resource to the current project success factors study.

Banihashemi et al. (2017) examined the CSFs impacting the integration of construction project management and sustainability. A mixed research methodology with a structural equation model application was used to analyses the data collected through interviews. A developing country project managers' experience was utilized as the basis of participants. Project managers were the participants from a respective developing country. The findings of the study as proposed lists of CSFs for construction project management practices of a developing country can be used as a benchmark to Ethiopian condition.

Ramlee et al. (2016) researched the CSFs specific to construction project management. The research design of the factor analysis method was used to identify the critical factors among known project success factors. Ramlee et al. found cost, time, quality, satisfaction, management, safety, technology, organization, environment, and resource CSFs are pertinent to construction project success.

Demirkesen and Ozorhon (2017) examined and recommended the key performance measure of construction project success factors based on the 14-PMBoK developed by the PMI (2013). The researchers applied a quantitative research methodology of correlational study among the body of knowledge yielding project success for 121 construction projects. The data were analyzed with a structural equation model. Banihashemi et al. (2017) revealed that the effects of factors were classified as direct and indirect to the success of projects. This study can be adopted as a reference to current construction project management success factors study.

Ofori-Kuragu et al. (2016) presented the first set of eight critical success factors: quality and zero defects culture, organizational design, work culture and work environment, client satisfaction, strategy, leadership, measurement, analysis of information and knowledge management, and implementation of lean principle for Ghanaian contractor's project organizational competitiveness. The research finding is useful for contractors to plan for improvements in a highly competitive environment. A quantitative research design approach was employed through a factorial analysis application.

As Ethiopia and Ghana share a similar level of economic development, the approach and experience can be adopted. Nethathe, Van Waveren, and Chan (2011) studied South African context CSFs of projects after recognizing the delay problems seen in the different project execution processes. The country's project management CSFs are linked with people. Delay in delivery of projects, poor quality, cost escalation are the few problems observed in construction project management

organizations. CSFs are essential to finding a model that helps to make the right allocation of scarce resources. The instrument and approach used in the study can be adapted to the Ethiopian context. South Africa and Ethiopia share common characteristics of the economic and political context. Alvarenga et al. (2018) affirmed that the role of project manager and his leadership is a hypercritical factor to project success, amongst 35 crucial CSFs were identified as essential to project success.

**Characteristics Construction Industry**

The knowledge and background of construction industry attributes help construction project managers' capability to achieve a successful project (Sears et al., 2015). The construction industry is a complex system composed of many actors that require adequate knowledge to stay competitive. Similarly, the construction projects' process needs different specialized services, complex and consumes time to meet the objectives. Ofori (2019) emphasized that developing countries should enhance their construction project management and economics knowledge base through mainstream capacity and capability development. Ofori emphasized the importance of a more vibrant and complex knowledge base to effect success in the construction industry.

The problem of law enforcement and the absence of regulation is the common problem seen in developing countries, as caused by immature construction project management. To mitigate such challenges, Ofori (2019) advised maximizing the benefits of technical competence, experience, professionalism, and ethical

behaviour. The construction industry, as it involves several stakeholders and its overarching impact, it is known as the cornerstone of the socioeconomic development (Arain, 2012). The level of construction industry development indicates the nation's development.

**Construction Project Management**

Management of construction projects, unlike managing a single company, differs by its far-reaching coverage to coordinate and regulate all the project process critical to the successful accomplishment of the projects. There are no two projects that are the same. The project managers working under construction project management mandated to deliver his responsibility working with organizations beyond his own (Sears et al., 2015). Construction projects embrace a variety of entities, from project initiation to completion. As the project process flows from one end to another, construction project management demands resources from financial organizations, agencies, engineers, architects, lawyers, insurances, contractors, material and equipment manufacturers, construction craft workers. Construction projects are differentiated by their uniqueness (Sears et al., 2015).

## Construction Project Success Factors Countries Practice

**Malaysian Construction Industry**

Yong and Mustaffa (2012) investigated the CSFs leading construction project success to the Malaysian construction industry. A relatively important technique was used to identify the critical factors out of 37 lists of project success factors found from a review of previous literature. Contractors, consultants, and clients in the

Malaysian construction industry were the major participants in the survey. Yong and Mustaffa (2012) stated CSF are not a standard set of measurements and differs from country to country and over time. CSFs were the few among many vital matters to meet the desired goal. Project success understood by measuring the overall objective of the project; project management success is perceived through a measure of time, cost, and quality factors.

The 37 project success factors of the Malaysian construction industry are categorically grouped into seven classes: project-related factors, project stakeholder factors client team leaders, consultants, consultants, project procurement factors, and external factors (Yong & Mustaffa, 2012). A mean value analysis used to identify the ranks of each factor to compute the relative level of importance. The mean score (MS) result was used to identify the critical success factors of the response degree of importance to construction project success on a Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*).

**Kenyan Construction Industry**

CSFs for Kenyan project performance were studied by Das and Ngacho (2017). Das and Ngacho focused on the critical performance indicators to figure out the critical success factors out of 30 project success factors after the response of contractors, consultants, and clients. Das and Ngacho identified six CSFs best explaining the Kenyan construction project management. The CSFs were project-related, consultant related, client-related, contractor related, supply chain-related, and external environment-related factors.

Construction industry development projects play significant roles in the redistribution of resources to the community, reducing poverty, creating employment opportunities, ultimately raising the standard of living through improved health care service, education, and access (Das & Ngacho, 2017). The CSFs were facilitating factors for the success of a project (Das & Ngacho, 2017).

**Ghanaian Construction Industry**

Ofori-Kuragu, Baiden, and Badu (2016) explored eight CSFs: quality and zero defects culture, organizational design, work culture, and work environment, client satisfaction, strategy, leadership, measurement, analysis of information and knowledge management, and implementation of lean principles for the success of Ghanaian contractors' organization. A factor analysis was used to differentiate the most critical factors from the questioner survey conducted on contractor perception of essential factors (Ofori-Kuragu et al., 2016). Yang, Shen, Drew, and Ho (2010) revealed CSFs for stakeholder management engaged in Hongkong construction project undertakings. Project management professionals from clients, contractors, and consultants were the respondents of the questioner survey. Yang et al. employed 15 CSFs: managing stakeholder with social responsibility, formulating clear mission statement, identifying stakeholder, understanding stakeholder interests, exploring stakeholder needs and constraints, assessing stakeholder behaviours, predicting the influence of stakeholder, assessing the attributes of power, urgency, and proximity of stakeholders, analysing conflicts, compromising conflicts, keeping good relationship, formulating appropriate strategies to manage stakeholder, analysing the

change of stakeholders influence and relationship, communicating and engaging stakeholders frequently (Yang et al., 2010).

A descriptive statistics tool of mean score value calculated to identify the CSFs based on ranking. The relative importance of CSF between groups was analyzed. The study result informed weak positive and negative correlation existed between groups.

**Indian Construction Industry**

Tripathi and Jha (2018) studied the relative weights of success attributes and success factors leading Indian construction organizations' success, applying a factor analysis and fuzzy preference relation (FPR) statistical tool. The analysis used 30 success attributes collected from previous research condensed into eight success factors assumed success of organizational goals. A questioner survey was conducted to collect data from the target group.

Tripathi and Jha (2018) studied Indian construction organization success; results revealed success factors ranked from one to eight based on the relative weights; experience and performance, top management competence, project factor, supply chain and leadership, availability of resources and information flow, effective cost control measures, favourable market, and marketing team, and availability of qualified staff. It is expensive to deal with many factors to attain success, improving construction project management, and delivery process at any organization level (Tripathi & Jha, 2018). It needs to focus on a few crucial critical success factors to the success of the organization.

### Dubai Construction Industry

Gunduz and Yahya (2015) studied the critical success factors of the construction industry in Dubai and the middle east region. The study analysed 25 project success factors identified in the literature review. The criteria of time, cost, and quality are considered to identify the CSFs. A statistical technique employed to compute the Relative Importance Index (RII) and frequency index (FE). Project management experience and project implementation knowledge of respondent is very crucial in this particular study.

Gunduz and Yahya (2015) used a Likert scale measurement divided into two scale RII, and the FE was used to measure the which factor is critical than others. A Spearman correlation was used to check the accurateness of data, a *t*-test was used to check how close or related to two groups, and a *p*-value was used to analyse the significant difference between the means between groups.

## Project Success in Construction Industry

Hughes, Tippett, and Thomas (2004) introduced an assessment of construction project success factors. The model used to understand the critical attributes contributing to project success and metrics to analyse the behaviours of project success factors at any point and time. The survey was designed to accommodate experienced project management professional knowledge to objective and subjective measurement. The tool supports to capture the opinion of all stakeholders influencing construction project success and help the planning process.

The success attributes are categorized into six areas: costs, schedule, performance, quality, safety, and operating environment latent variables (Hughes et al. 2004). The flexibility of the model increases its adaptability to the current study. The unique feature of CPSS is its measurement and scoring the known attributes of the construction industry project success factors, helps as a planning tool for contractors, consultants, clients, engineers, and project managers to evaluate individual evaluation of the project (Hughes et al. 2004). The model is applicable at planning to identify the potential factors to meet the success and provides management, both subjective and objective success factors. Hughes et al. (2004) suggested six project success perspectives and 32 variables as project success factor assessment.

**Project Scope Definition**

Defining the scope of projects in precise terms at preconstruction phases will determine effective implementation in the construction phase. Projects tend to fail because of a poor scope definition. Project scope management has become one of the fundamental project management body knowledge (PMI 2013). Dumont, Gibson, and Fish (1997) highlighted that well-defined project yields affect success both at the starting phases of design and construction. Their study argued that poorly defined project scopes are responsible for causes of cost overrun, unexpected delay, and dispute.

**Technical Capability**

The soft skills of construction management professional and project success, as studied by Jian, Xianbo, Nguyen Quan, Ma, and Shang (2018), affect the soft skills of project managers and significantly contributed to the success of projects. As technological advancement and the increasing level of project management complexities, project management professionals require a broad knowledge of project management technical capability to meet their project successfully. They further pointed out the nature of skills into two category-specific and general skills. The specific skills are related to the kind of knowledge related to the construction management process while the general skills are necessary management skills like leadership, communication, and problem-solving skills. Regardless of the company type, project management companies should embrace construction project management technical capability to achieve their organizational and project success.

**Planning Efforts**

Project planning is an essential task that dictates the overall project management process. Adequately prepared project plans utilize resources allocated to meet the project goals. The growing demand for project management services in the construction industry requires improved management capabilities of project managers, planners, and estimators (Zwikael, 2009). Educational institutes gave due attention to knowledge and skill-building of project planning. The government of Ethiopia established the Ethiopian Construction Project Management Institute (ECPMI) to develop the construction project management capabilities of contractors,

consultants, and project owners. The emphasis on construction planning knowledge, skill, and practice results in project success.

Zwikael (2009) suggested the need for higher efforts to key planning processes: cost estimation, budgeting, communication, risk, and procurement planning. According to Al Nasseri, Widen, and Aulin (2016), widely used project management tools and methods in managing construction projects process are grounded on and connected with planning and scheduling. The presence of planning knowledge in construction project management process yields a successful project.

**Personnel Selection and Training**

Sinesilassie et al. (2017) studied schedule performance management in Ethiopian public construction project management. Findings showed owner competence, conflict among project participants, inadequate human resources management, and project manager's ignorance and lack of knowledge are the critical factors affecting the schedule performance. Regardless of the position where the personnel positioned human resource, competence is the critical factor for project success.

**Political Conflicts and Corruption**

Damoah, Kumi, and Damoah (2018) found developing countries' politics, administrative systems, partisan politics, culture, and corruption were the influencing factors in the Ghanaian construction industry. Corruption and administrative bureaucracies were identified as factors of failure to government construction projects. Corruption is a critical failure factor for most developing countries in

construction industries. According to the study findings on the Afghanistan construction industry, Niazi and Painting (2017) identified corruption as a significant factor for cost overrun in addition to delay in payments, financing projects by contractors, and unexpected change orders by clients as the project progresses.

Project management organizational service at all levels needed a project management competency like honesty, enthusiasm, and dedication (Muhammad & Mustafa, 2019). Corruption is one of the significant challenges across the construction industry of Ethiopia. The construction industry is identified among the vulnerable to corrupt practices and perceived as huge finance wasted from public projects through corruption. The presence of honesty in a dimension of project management competence is highly essential to fight malignant corruption in the construction project process. Muhammad and Mustafa (2019) confirmed that dealing with project management of complex engineering projects without the enthusiasm and dedication competencies of the project management team process were a challenge. Muhammad and Mustafa asserted that honesty, enthusiasm, and dedication highly contribute to the success of projects.

**Communication and Project Control**

Elen Nara, de Souza Pinto, and Novaski (2015) discussed the objective of the project, and the project manages influence, the management controls, and previous lessons learned for future applications are decisive for project success. The project communication system throughout the project management process at each stakeholder is a critical element to project success.

**Team Motivation**

Motivation is the process that made individuals or teams stay inspired to fully apply knowledge and skills to the key objectives leading to success (Clark, 2005). Clark (2005) further suggested five motivational goals: fostering mutual respect in team members, support the weak team member whose effort is valuable to team success, respect the value shared at the cooperative level, enhance accountability at a personal level, and being a model for other organizations.

The construction project process nature requires engaging different, coordinated specialized teams. Gilbert's (1978) engineering model used information, instrumentation, and motivation as factors affecting performance (Lee, 2015). The model conceptualizes incentives from the environment and the internal motives of the individuals as driving forces of performance. They managed these teams to meet the desired productivity level, critically influenced by the embodied level of team motivation (Larsson, Eriksson, & Pesamaa, 2018). Larsson et al. (2018) revealed that team motivation has a mediation effect on hard project management. Construction project management should recognize the importance of team dynamics to catalyze team motivation to boost the anticipated performance level and success.

**Adequate Project Management Techniques**

There are different types of project management tools, techniques, and methods applied in the construction project. The popular PM methods are PRINCEW, PRINCE 2W, SSADM, whereas tools are software, Gantt charts and work breakdown structure. Sane (2019) noted that the appropriate application of

project management tools and techniques results in success in project management. The finding of Sengales SMEs revealed that there is a positive contribution of project management tools and techniques to the organizational business performance and social performance. Jugdev, Perkins, Fortune, White, and Walker, (2013) indicated there is a correlation between the use of PM tools, methods, and techniques to the project success.

**Effective Scheduling**

Time and cost overrun in Ethiopian construction project undertakings remained a severe challenge. According to Sinesilassie et al. (2017), the schedule performance of the Ethiopian construction industry is affected by factors such as owner's competence, conflict among project participants, poor human resource management, project manager's ignorance, and lack of knowledge. Schedule performance is found as one of the critical factors of project success.

Project scheduling is among the essential tasks of project management process success factors. It enables resource planning, such as cash, human resources, and materials. Elbeltagi, Ammar, Sanad, and Kassab (2016) asserted that successful construction projects are a result of project activities scheduled for optimally integrated activities. Scheduling in the project management process helps to information that efficiently relates to time. Project management techniques have introduced various tools that enable to track the project progresses.

**Effective Procurement and Tendering Methods**

The procurement and tendering process are critically essential activities in preconstruction and design phases. The effectiveness of managed procurement and the tendering process could be visualized in the construction phase. Eriksson (2017) discussed the importance of different procurement strategies to be followed to explore and exploited the available opportunities for the ultimate success of projects. Projects need to be managed based on the selection of appropriate procurement modalities that matches the complexities of projects. Effective procurement and tendering process management are decisive phases in construction management as it affects the cost of construction.

**Adequate Risk Analysis**

Project risk management is an essential task to be addressed at the planning stage of projects. Identification of risks and their possible sources are the basis for mitigating the likely consequences adversely affecting projects. Ali, Zhu, and Hussain (2018) found risks related to technical or environment critically escalate the transaction costs of construction projects. The internal risks can be controlled by engaging capable project management company while environmental risks are uncontrollable and affect the project during the procurement stage for contractor's opportunity. Mitigating risks in the project is approached through classification and understanding of their possible sources contribute towards successful projects (Ali et al., 2018).

**Project Manager Capability and Commitment**

Burger and Zulch (2018) confirmed that project managers should have adequate project management knowledge to accomplish successful projects. Burger and Zulch further suggested construction project managers' knowledge be categorized into technical knowledge as construction science, finance and cost, construction process, and design process and knowledge nurtured through industry practice and the nine generic project management bodies of knowledge of PMI. Project management capability contains competence, commitment, cooperation, project management methodology, and information communication technology (Jolly, Isa, Othman, & Syazwan, 2016). The capability of project managers and their commitment used to deliver a successful project.

**Effective Project Briefing**

Project briefing is a project management process that builds the knowledge of stakeholders being involved in the project goals. The briefing process is a critical stage in determining client satisfaction and the successful accomplishment of the project (Yu, Shen, Kelly, & Hunter, 2008). Effective communication is a means to all parties in construction project undertakings who are required to identify and explain the scope of projects to the client. It is an active listening platform to learn and understand what precisely the client test is and assure adequately addressed.

The construction project briefing process is also called architectural programming because it communicates the needs of the client in the early design phases of the project (Yu et al., 2006). Managing the briefing process stages of the

project builds awareness to project teams and conveys essential project information to stakeholders.

**Company Financial Strength**

Companies with unhealthy financial capacity will be challenged to sustain in a fiercely competitive environment. In this regard, project management companies must have healthy financial conditions with adequate sources of finance to address the cash flow requirements of project finance demand. Financial strength reflects an organization's financial position by informing their level of profitability and solvency (Bei & Wijewardana, 2012).

**Construction Industry Success Factor Assessment**

A statistical data analysis methodology for both importance and frequency scale will be employed (Gunduz & Yahya, 2015). This model is selected because it enables a researcher to collect the most crucial factors in project success and the corresponding frequency of application in the working world. The model was tested on three group data sets and has brought a meaningful result.

Gunduz and Yahya (2015) used the project success factor assessment questioner survey instrument that was based on the factors found from a literature review, affecting the project performance and success. The instrument was designed to measure on a Likert scale of five-point containing importance scale and the second the frequency scale. The factors importance scale applied 1 (*Very Low*), 2 (*Low*), 3 (*Average*), 4 (*High*), 5 (*Very High*) and for the frequency section 1 (*Never*), 2 (*Rarely*), 3 (*Sometimes*), 4 (*Often*), 5 (*Always*).

The purpose of the survey they developed was to examine the most critical success factors in the UAE and the Middle East construction industry (Gunduz & Yahya, 2015). A total of 25 factors affecting the project success and performance were identified through a literature review in the construction industry.

Table 1

*Project Success Factors*

| | Project Success Factors |
|---|---|
| 1 | Company's technical capabilities |
| 2 | Scope and work definition |
| 3 | Control system |
| 4 | Effective site management |
| 5 | Project manager capabilities and commitment |
| 6 | Company's financial strength |
| 7 | Planning efforts |
| 8 | Effective scheduling |
| 9 | Commitment to the project |
| 10 | Adequate project management technique |
| 11 | Adequacy of plans and specifications |
| 12 | Effective procurement and tendering methods |
| 13 | Client consultation and support |
| 14 | Effective communication between stakeholder |
| 15 | Top management support |
| 16 | Adequate risk analysis |
| 17 | Clarity of project mission |
| 18 | Effective technical review |
| 19 | Personnel selection and training |
| 20 | Completion of design at the construction start |
| 21 | Effective project briefing |
| 22 | Team motivation |
| 23 | Harsh climate conditions and environment |
| 24 | Political conflicts and corruption |
| 25 | Unforeseen conditions |

## Project Management Knowledge, Construction Project Management, and Maturity Level

Project management maturity models are used to assess organizations' capability of project management. The project management maturity model presents organizational management efficiency, state of project delivery practice, and provides information about further performance development (Abdul Rasid et al., 2014).

Abdul et al. (2014) employed the criteria of the project management body of knowledge: project integration management, scope management, time management, quality management, human resource management, communication management, risk management, and procurement management to assess one Malaysian public agency project management maturity. The agency was responsible for the construction of road and building projects. Abdul et al. defined project management maturity level as measures the perceived project management knowledge practiced by project managers reflected in an organizational setting. Abdul et al. further showed that a descriptive study revealed that the agency project management maturity stage is rated at Level 2. Knowing the project management maturity level at the organization level defines what actions are needed to attain the next phase of maturity level. Abdul et al. studied the project manager's knowledge of PM, the practice of the nine knowledge areas in managing projects, and the level of project management maturity.

Construction project management knowledge helps contractors and consultants build effective construction project management processes and enhance the organizational capability of project execution (Abdul et al., 2014). The project management body of knowledge is a generally accepted practice consisting of a series of project management process developed by project management institute (PMI, 2013). Project management maturity is vital to capability is essential to assess the current organizational capability (Abdul et al.,2014). The greater project management maturity revealed higher project management performance (Abdul et al.,2014).

Lopez, Viveros, and Melendez (2017) suggested that identifying a set of best practices in an organization helps to measure the organizational project management maturity model. Groups of processes that evolve successfully affect project and program management. Organizational Project Management Maturity Model (OPM3) is a standard to measure the organizational maturity of project management (Lopez et al., 2017). It usually asks for whether the best practice across the organization is implemented or not.

**Project Management Maturity Model Description**

Crawford (2006) suggested that the PMBOKG is a valuable resource to analyse project management capability. Nine project management body of knowledge and five process maturity levels were used in assessing the project capability. Crawford's organization assessment affirmed project management knowledge and skill lags behind the growth of project management capability.

Crawford proposed PM solutions as the underlying platform to define the project management maturity model initially developed for software industry effective management later expanded to other industries. The organizational project maturity level indicates the capability of completing projects on time and budget.

**Capability Maturity Model Assessment Methodology**

Ibbs and Kwak (2000) suggested that a statistical methodology was developed for the project management maturity assessment of the organization. Assessing project management maturity benefits organizations and helps them to understand their strengths and weaknesses and identify their position compared with other similar organizations. It helps to test the correlation between the organization's project management maturity level and performance (Ibbs & Kwak, 2000). Ibbs and Kwak used the eight-project management body of knowledge scope, time, cost, quality, human resources, communication, risk, and procurement as criteria and six phases of project initiating, planning, executing, controlling, closing, and project organization is driven project environment to assesses the maturity level. The questioner survey encompasses three sections: Appendix A asks for general organizational information, Appendix B assesses the actual project performance, and Appendix C focuses on the assessment of organizational project management maturity (Ibbs & Kwak, 2000).

**Project Management Maturity Model**

Crawford (2006) presented five different maturity levels to investigate the application of nine project management body of knowledge initially for the

information technology industry. Organizations repeatedly used to measure the level of project management knowledge. The model can be used in the Ethiopian Construction Industry Project Management body of knowledge. Vittal, Anantatmula, and Parviz (2018) studied the relationship between project success, project maturity index, and project performance factors. The quantitative research methodology was employed to examine the extent of the relationship between these variables. The findings of the study affirmed the need for assessment of project management maturity level. Yamin and Sim (2016) stated that very little attention had been given to measuring individual and organizational level project management knowledge as gaps in research as compared to the construction project management field.

**Project Management Maturity**

The state of project management knowledge that constituted an organization's systems and project teams decides if the project succeeds or fails. Project management organizations with high maturity levels account for better project performance than the lower levels. Different researchers followed various strategies to construct a model to measure the maturity level quantitively. Regardless of variation among all models were built to measure PMM applying the 9-project management body of knowledge and organizational dimensions (Souza et al., 2012). According to Souza et al. (2012), KPMMM classified the measures into five levels: Embryonic, Executive Management Acceptance, Line Management Acceptance, Growth, and Maturity.

**Project Management Maturity Characterization**

According to Villa (2010), knowledge management is a critical success factor for a project value. The research approached grounded the project management knowledge explained in various project success factors. The easiest way to manage this knowledge across the construction industry is measuring to understand the project management maturity level. Several meanings were given by different researchers about project management maturity level. In this research, in addition to Kerzner's (2003) classification, two interpretations of maturity levels were identified.

**Level-1**

Mullaly and Thomas (2010) described Level-1 as ad hoc, meaning the level is associated with an informal and inconsistent approach to project management. The level was characterized by the absence of structured, organized project management. Instead, the project outcome is the effort of individual's expertise effort. Villa (2010) put maturity Level-1 just as "unknown." He described that knowledge is the unknown dimension of projects. At this level, the project management teams were unaware of the meaning and importance of project management knowledge for project success. The formal process of project management is absent and neglected. This level is characterized by a rare project management knowledge available at an individual level and no clear direction of project knowledge management.

**Level -2**

Mullaly and Thomas (2010) gave clear distinction to Level-2 as stages where organizations experience some degree of incomplete project management practices. This practice is not consistently implemented across the organization or, however, efforts to form some level of organizational formality, not comprehensively applied. Villa (2010) put Level-2 as a new phase where the project management team became aware of the importance of knowledge of project value. At this stage, the project manager and project teams are understood knowledge as a CSF. Knowledge experience evolve from specific projects but are not utilized at an organizational level. In Level-2, If projects are successful, these experiences capture the attention of project owners, senior management, and project team. The knowledge created at this level does not have a chance of cross-fertilization and remains in its boundaries.

**Level-3**

Level-3 is ensured when organizations reached to stage of consistent implementation of project management. A complete project management process in place is one indicator of the organization's maturity Level-3 (Mullaly & Thomas, 2010). The aspiration of many organizations to attain this level. Villa (2010) described this phase as “intended” meaning because the project management team recognized the importance of knowledge for effective project delivery and project management development.

**Level-4**

This level is attained when an organization experience visible cross-fertilization of project management knowledge gained (Mullaly & Thomas, 2010). The level is the result of Integrated practices. When organizations reached this level of maturity, project management becomes the integral management capabilities fully manifested in the project management process.

Villa (2010) called this level as shared. In maturity Level-4, there is a culmination of knowledge recognized in the entire organization as a CSFs of project success. The value of knowledge management well recognized. Stakeholders and project owners support the knowledge management process.

**Level-5**

Maturity Level-5 explains a holistic and fully integrated way of managing knowledge capability (Mullaly & Thomas,2010). This maturity level embraces project practices open for continual improvement. Villa (2010) stated that Level-5 as endless, meaning organizational project management practices move in paths of continual growth and development. Continuous improvement remains the core strategic direction of organizations. Level-5 encompasses knowledge present at individual, group, organization, inter-organizational levels, and project management knowledge follows a pervasive direction

Table 2

*Questions on the PM Maturity by Level*

| Level | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Questions | 1, 3, 14, and 17 | 5, 10, 13, and 20 | 7, 9, 12, and 19 | 4, 6, 8, and 11 | 2, 15, 16, and 18 |
| Kerzner Model Questionnaire | | | | | |
| 1. My company recognizes the need for project management. This need is recognized at all levels of management, including senior management. | | | 2. My company has a system in place to manage both cost and schedule. The project management maturity questionnaire system requires charge numbers and cost account codes. The system reports variances from planned targets. | | |
| 3. My company has recognized the benefits that are possible from implementing project management. These benefits have been recognized at all levels of management, including senior management. | | | 4. My company (or division) has a well-definable project management methodology using life cycle phases. | | |
| 5. Our executives visibly support project management through executive presentations, correspondence, and by occasionally attending project team meetings/briefings. | | | 6. My company is committed to quality up-front planning. We try to do the best we can at planning. | | |
| 7. Our lower and middle-level line managers totally and visibly support the project management process. | | | 8. My company is doing everything possible to minimize "creeping" scope (i.e., scope changes) on our projects | | |
| 9. Our line managers are committed not only to project management, but also to the promises made to project managers for deliverables. | | | 10. The executives in my organization have a good understanding of the principles of project management. | | |
| 11. My company has selected one or more project management software packages to be used as the project tracking system. | | | 12. Our lower and middle-level line managers have been trained and educated in project management. | | |
| 13. Our executives both understand project sponsorship and serve as project sponsors on selected projects. | | | 14. Our executives have recognized or identified the applications of project management to various parts of our business. | | |
| 15. My company has successfully integrated cost and schedule control together for both managing projects and reporting status. | | | 16. My company has developed a project management curriculum (i.e., more than one or two courses) to enhance the project management skills of our employees. | | |
| 17. Our executives have recognized what must be done in order to achieve maturity | | | 18. My company views and treats project management as a profession rather than | | |

| Level | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Questions | 1, 3, 14, and 17 | 5, 10, 13, and 20 | 7, 9, 12, and 19 | 4, 6, 8, and 11 | 2, 15, 16, and 18 |
| Kerzner Model Questionnaire | | | | | |
| in project management. | | | a part-time assignment. | | |
| 19. Our lower and middle-level line managers are willing to release their employees for project management training. | | | 20. Our executives have demonstrated a willingness to change our way of doing business in order to mature in project management. | | |

**The Fuzzy Expert System and Kerzner Project Management Maturity**

Kerzner (2009) recognized the possibilities of level overlaps and evolution without keeping sequential order. The feature of consistency was observed as the model used to maturity analysis. Souza et al. (2012) introduced a Fuzzy Sets of Experts System in project management maturity analysis. Organizations can score for two and more levels that creates vagueness to understand what precisely the maturity level of the organization. The fuzzy sets theory, as Zadeh (1965) postulated with the expert system, facilitates the analysis and matches the realities on the ground (Souza et al., 2012).

One of the features of KPMMM is the minimum requirement to meet the level is scoring +6. The Fuzzy Expert System problem of subjectivity facing during the data gathering process tackled with two Triangular Fuzzy Sets proposition of No pass, (-12, -12, +8), and Pass (+4, +12, +12). All levels will be evaluated based on the procedure generated from various combinations resulting in 32 procedures Table 3. The situation of level composition properly evaluated to determine the level Table 3 level composition as presented (Souza et al., 2012) computed based on the minimum α operator in this case 0.6 representing the lowest consistent the lowest possible threshold of consistent response. Souza et al., (2012) came up values for consistency (0.6,1,1) and inconsistent value (0,0,0.6). The Kerzner model would measure the crisp project maturity level, and Fuzzy Expert System supported by software MATLAB analyse the PM maturity level and consistency.

Table 3

*Expert for a Five-Level PM Maturity Questionnaire*

| Rule | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Situation |
|---|---|---|---|---|---|---|
| 1 | No Pass | No Pass | No Pass | No Pass | No Pass | Consistent |
| 2 | No Pass | No Pass | No Pass | No Pass | Pass | Inconsistent |
| 3 | No Pass | No Pass | No Pass | Pass | No Pass | Inconsistent |
| 4 | No Pass | No Pass | No Pass | Pass | Pass | Inconsistent |
| 5 | No Pass | No Pass | Pass | No Pass | No Pass | Inconsistent |
| 6 | No Pass | No Pass | Pass | No Pass | Pass | Inconsistent |
| 7 | No Pass | No Pass | Pass | Pass | No Pass | Inconsistent |
| 8 | No Pass | No Pass | Pass | Pass | Pass | Inconsistent |
| 9 | No Pass | Pass | No Pass | No Pass | No Pass | Inconsistent |
| 10 | No Pass | Pass | No Pass | No Pass | Pass | Inconsistent |
| 11 | No Pass | Pass | No Pass | Pass | No Pass | Inconsistent |
| 12 | No Pass | Pass | No Pass | Pass | Pass | Inconsistent |
| 13 | No Pass | Pass | Pass | No Pass | No Pass | Inconsistent |
| 14 | No Pass | Pass | Pass | No Pass | Pass | Inconsistent |
| 15 | No Pass | Pass | Pass | Pass | No Pass | Inconsistent |
| 16 | No Pass | Pass | Pass | Pass | Pass | Inconsistent |
| 17 | Pass | No Pass | No Pass | No Pass | No Pass | Consistent |
| 18 | Pass | No Pass | No Pass | No Pass | Pass | Inconsistent |
| 19 | Pass | No Pass | No Pass | Pass | No Pass | Inconsistent |
| 20 | Pass | No Pass | No Pass | Pass | Pass | Inconsistent |
| 21 | Pass | No Pass | Pass | No Pass | No Pass | Inconsistent |
| 22 | Pass | No Pass | Pass | No Pass | Pass | Inconsistent |
| 23 | Pass | No Pass | Pass | Pass | No Pass | Inconsistent |
| 24 | Pass | No Pass | Pass | Pass | Pass | Inconsistent |
| 25 | Pass | Pass | No Pass | No Pass | No Pass | Consistent |
| 26 | Pass | Pass | No Pass | No Pass | Pass | Inconsistent |
| 27 | Pass | Pass | No Pass | Pass | No Pass | Inconsistent |
| 28 | Pass | Pass | No Pass | Pass | Pass | Inconsistent |
| 29 | Pass | Pass | Pass | No Pass | No Pass | Consistent |
| 30 | Pass | Pass | Pass | No Pass | Pass | Inconsistent |
| 31 | Pass | Pass | Pass | Pass | No Pass | Consistent |
| 32 | Pass | Pass | Pass | Pass | Pass | Consistent |

Souza et al. (2012) said the Fuzzy Expert System is an excellent instrument to analyse the project management maturity. It is found simple and easy to operationalize in a spreadsheet. The three crucial limits, the no pass, pass, and consistency were essential to measure and define organizations maturity level quantitively.

## Summary

In this chapter, relevant literature to this study was examined. I examined the perceptions of 194 construction project management professionals from contractor, consultant, and client groups relationship between CSFs, project management body of knowledge maturity level, and project success. To address the research questions, relevant variables are identified for both dependent and independent variables applying the Kerzner model of the project maturity model, project management body of knowledge framework of PMI, and other academic writers in fields of construction project management field. The next chapter deals with the methodology of data collection and analysis of these variables.

# Chapter 3: Research Method

## Introduction

This chapter is an explanation of the research design selected to test the hypothesis described in Chapter 1. This chapter clarifies the sampling techniques for data collection, the appropriateness of the research design, and methodology followed in the entire research design. The instrument, reliability, and validity of the instruments, data collection and analysis of quantitative analysis applied, and the ethical issues to ensure the participant's rights are discussed.

## Research Design and Rationale

A quantitative survey research design is preferred for this study because it helps to collect data from three study groups using a sampling theory and statistical analysis for generalization of correlation between the organizational project management maturity level and project success of larger population (Iversen, 2004).

Both variables were measured on the continuous scale made convenient for Spearman and Person correlation test analysis. Spearman correlation factors were employed for the dependent variable and consistency test for the independent variable to check the accurateness and precision of data. The correlation between variables between groups was evaluated using the *t*-test and Pearson correlation statistics.

The survey design was performed with data collection at one point at a time, and I employed a self-administered questionnaire while the data collection was carried out through internet survey and post mail to capture all data relevant to study.

The reason why I chose to collect data through two methods is cost, no paperwork, time, and quality for using the Internet as data collection tool and mailing to address those who do not have internet access, weak data speed, Internet cut to insure included in the study.

## Methodology

### Population

The data for registered construction and consulting companies found in the Ethiopian Construction Project Management Institute and Federal Ministry of Urban Development, Housing, and Construction database was used to identify potential participants based on the above criteria. The survey design covered Category 1 contractors, consultants, and public or private clients. Survey research was conducted on three groups of construction industry stakeholders: contractors, consultants, and employers active at construction contracting activity during the study period.

The scope of the population of study covered the city of Addis Ababa construction industry containing three main participants, contractors who take contracts to execute projects, consultants who are responsible for design study and supervisory tasks and clients presented by project managers who award contracts and the key decision-maker in construction project implementation. There are clearly defined and distinct roles of a project manager in contractor, consultant, and employer while managing specific construction projects. I measured the individual and collective roles to project the success of construction projects and the ultimate

capability of project management knowledge through the survey. The survey research identified a population of 2572 registered contractors, 451 consulting companies MoUDHC (2019).

**Sampling and Sampling Procedures**

The criteria for the study participants were (a) be locally registered professional engineer or architect, (b) managed and completed building construction at least one project in Addis Ababa during the year 2010-2019, (c) hired/owned either construction, consulting company or client company, (d) licensed construction or design company, and (e) project owner.

The public and private client organizations that contracted a building construction project during the year 2014 to 2019 and in use now were considered as far as the contractors and consultants are active in the year 2020 register. Out of the total number of the survey research population, I focused on Category 1 and 2, 138 contractors, and Category 1 and 2, 48 consultants and 12 clients as the study population size is 191. Krejcie and Morgan (1978) recommended a sample size of 100 for a population size of 140, 45 samples for a population of 45, and 40 samples for a population of 12 based on *p*-value 0.05. I used a total sampling of 194 randomly selected project manager professionals from Category 1 and 2 firms and major clients.

## Instrumentation and Operationalization of Constructs

### Survey Instrumentation

Two Likert scale survey instruments developed by Gunduz & Yahya, (2015) for project success assessment and Kerzner (2009) for assessing project management maturity model used previously in other similar research were adopted as instrumentation to collect the required data from the sample group. The Likert continuous scale was used to measure the dependent variable: project success, and the independent variable: project management maturity. The Spearman's correlation factor (*r*) was used to address the level of differences between the groups project success factor ranking and project management maturity level analysis. A *t*-test also is applied to check if there exit significant differences between the means of groups. The Pearson product-moment correlation coefficient was used to examine the relationship between the project success factor and project management maturity level.

### Operationalization of the Variables

Operationalization is useful to link the conceptual definition to a set of measurement techniques chosen in the research process. It is crucial because a single construct might have several meanings, and people may disagree with the definition. The operationalization of variables helps a researcher to give a definition that applies in the study framework. Measuring a construct is the main activities to be addressed in this chapter.

In this study, two valid instruments found from the literature review were used to collect data to measure the project management maturity level (independent variable) and construction project success factor (dependent variable) to project success for contractor, consultant, and client. This is essential to perform the hypothesis test defined in chapter two. The two-project management performance project success factors and project management maturity level correlation were examined for each group under study. The operationalizing of each factor discussed as follows.

The project management maturity level was measured based on Kerzner's model on a continuous seven scale measurement. The score is measured by taking an average of questions from 1 to 20 from KPMMA. The response choices to assess the project management body of knowledge are coded as -3 (*Strongly disagree*), -2 (*Disagree*), -1 (*Slightly disagree*), 0 (*No Opinion*), 1(*Slightly agree*), +2 (*Agree*), +3 (*Strongly agree*). The lowest score implies the project management knowledge level of project management professional organization located at a low level, and the highest score implies the organization has the highest project management knowledge leading to the success of projects at the organization level.

The construction project success factors (CPSFA) were assessed on a Likert continuous scale measurement importance and frequency scale. The score is calculated by taking that average of Questions 1 to 25. The respondents were asked to rate the most important contributing factor to project success. The importance scale rated on questionnaires as 1 (*Very Low*), 2 (*Low*), 3 (*Average*), 4 (*High*), 5

(*Very High*) and for frequency scale: 1 (*Never*), 2 (*Rarely*), 3 (*Sometimes*), 4 (*Often*), 5 (*Always*). The small score indicates that the perception of the project managers towards that factor is less and not critical to the project's success, whereas the highest score indicates that the factors critically important to the project success factor.

## Data Collection

Quantitative data were collected from the study sample through questionnaire survey adopted after a thorough literature review. Two types of questionnaire surveys were sent through e-mail to selected participants of the study. The maximum time to respond to the entire survey took 20-25 minutes. A follow-up reminder was sent to each participant to get the survey back on time. The survey research was proposed to conduct three significant sources of construction industry stakeholders: contractors, consultants, and clients currently work in Ethiopian construction project management. The clearly defined and distinct roles of a project manager are contractor, consultant, and employer while managing specific construction projects. The focus of the study was to enable me to measure individual and collective roles to the success of construction projects through the survey.

The survey questionnaires were e-mailed randomly to contractors, consultants, and clients until I had responses equaling the minimum sample size. An individual at Addis Ababa was hired to facilitate the data collection process. The questionnaires were filled and returned back in 15 days' time.

The CPSFA and KPMMA and the demographic questions of the survey were used to examine the perceptions of project management knowledge established in the construction industry and identifying critical success factors leading construction project success. The CPSFA questionnaires designed to get the level of agreement to the importance of factors critical to project success. A five Likert scale 1 (*strongly disagree*), 2 (*disagree*), 3 (*neither agree nor disagree*), 4 (*agree*), and 5 (*strongly agree*) are provided to each factor to draw the perception of criticality to project success for further statistical analysis and classification.

KPMMA survey measures the project management knowledge at five levels. Participants perceptions about the project management knowledge at respective levels contributing to project success factors will be scored on seven scales: on scale -3 (*Strongly disagree*), -2 (*Disagree*), -1 (*Slightly disagree*), 0 (*No Opinion*), 1 (*Slightly agree*), +2 (*Agree*),+3 (*Strongly agree*). Participants were asked demographic information such as age, educational experience, project management experience in years, and size.

## Data Analysis Plan

### Levels of Project Management Maturity Index

I employed five primary project management maturity levels discussed in literature review sections incorporating the following: Level-1, Level-2, Level-3, Level-4, and Level-5. Here under detail explanation of how each factor is going applied.

Level-1 was measured on a continuous measurement scale range from 1 to 7. The score is computed from Questionnaires 1, 3, 14, and 17 from KPMMA by applying a combined Kerzner model and the Fuzzy Expert System. Responses for each question is coded as it asks about project management knowledge views from experience on scale -3 (*Strongly disagree*), -2 (*Disagree*), -1 (*Slightly disagree*), 0 (*No Opinion*), 1 (*Slightly agree*), +2 (*Agree*) ,+3 (*Strongly agree*). A response choice of N/A designated for missed data and Level-1. The lowest score for Level-1 signified the perception of the project manager disagreement and highest score represent an agreement to the current practice of project management knowledge satisfying either of functionally isolated, lack of senior management support, and project success depend on individual efforts within the organization.

Level-2 was measured on a continuous measurement scale range from 1 to 7. The score is computed from Questionnaires 5, 10, 13, and 20 from KPMMA by applying a combined Kerzner model and the Fuzzy Expert System. Responses for each question is coded as it asks about project management knowledge views from experience on scale -3 (*Strongly disagree*), -2 (*Disagree*), -1 (*Slightly disagree*), 0 (*No Opinion*), 1 (*Slightly agree*), +2 (*Agree*), +3 (*Strongly agree*). A response choice of N/A designated for missed data and Level-2. The lowest score for Level-2 will signify the perception of the project manager disagreement and highest score represent agreement to the current practice of project management knowledge satisfying either of team-oriented (weak), and organizations possess strengths in doing similar work.

Level-3 will be measured on a continuous measurement scale range from 1 to 7. The score is computed from Questionnaires 7, 9, 12, and 19 from KPMMA by applying a combined Kerzner model and the Fuzzy Expert System. Responses for each question is coded as it asks about project management knowledge views from experience on scale -3 (*Strongly disagree*), -2 (*Disagree*), -1 (*Slightly disagree*), 0 (*No Opinion*), 1 (*Slightly agree*), +2 (*Agree*), +3 (*Strongly agree*). A response choice of N/A designated for missed data and Level-3. The lowest score for Level-3 signified the perception of the project manager disagreement and highest score represent an agreement to the current practice of project management knowledge satisfying either of team-oriented (medium) and informal training of PM skills and practices.

Level-4 was measured on a continuous measurement scale range from 1 to 7. The score is computed from Questionnaires 4, 6, 8, and 11 from KPMMA by applying a combined Kerzner model and the Fuzzy Expert System. Responses for each question is coded as it asks about project management knowledge views from experience on scale -3 (*Strongly disagree*), -2 (*Disagree*), -1 (*Slightly disagree*), 0 (*No Opinion*), 1 (*Slightly agree*), +2 (*Agree*), +3 (*Strongly agree*). A response choice of N/A designated for missed data and Level-4. The lowest score for Level-4 signified the perception of the project manager disagreement and highest score represent an agreement to the current practice of project management knowledge, satisfying either of strong teamwork and formal PM training for the project team.

Level-5 was measured on a continuous measurement scale range from 1 to 7. The score is computed from Questionnaires 2, 15, 16, and 18 from KPMMA by applying a combined Kerzner model and the Fuzzy Expert System. Responses for each question is coded as it asks about project management knowledge views from experience on scale -3 (*Strongly disagree*), -2 (*Disagree*), -1 (*Slightly disagree*), 0 (*No Opinion*), 1 (*Slightly agree*), +2 (*Agree*), +3 (*Strongly agree*). A response choice of N/A designated for missed data and Level-5. The lowest score for Level-5 will signify the perception of the project manager disagreement, and the highest score represents an agreement to the current practice of project management knowledge. The KPMMA was designed to assess the independent variable project management maturity, project management body of knowledge PMI (2016) through project managers responsible for the specific organization or project.

**CPSFA Construction Project Success Factor**

A piece of general demographic information and related project information-seeking questionnaires was designed to collect the relevant data from the study sample. The construction project success factor assessment (CPSFA) was used to measure the project success factors (Gunduz & Yahya, 2015). The CPSFA was designed to know the project success factor, and 25 variables are grouped to assesses the level of factor importance to project success. CPSFA applied a 5-point Likert scale containing importance scale and the second the frequency scale. The factors importance scale designates 1 (*Very Low*), 2 (*Low*), 3 (*Average*), 4 (*High*), 5 (*Very*

*High*) and for the frequency section; 1 (*Never*), 2 (*Rarely*), 3 (*Sometimes*), 4 (*Often*), 5 (A*lways*).

The statistical descriptive data analysis method was used to examine the frequency adjusted importance index to precisely determine the rank of the factors in the study. The relative importance index for each factor applying the formula. The result found with the following formula, which is in ranges of 0 to 1 used to rank the factors. The relative importance index is computed by:

$$RII = \frac{\sum W}{A*N}$$

W, stands for the weight given by each respondent's response; A, is the highest weight, and N, is the total number of respondents.

Similarly, the frequency index (FI) computed from the frequency response scale with the formula:

$$\text{Frequency index (FI)} = \overline{\sum W \left[\frac{n}{N}\right] * 100/5}$$

Where W, stands for the weight given to each respondent's response; n is the frequency of response, and N is the total number of responses. The frequency adjusted importance index (FII) is calculated by multiplying the relative importance index and frequency index as follows;

$$FAII = RII*(FI)*100$$

The FAII result will be used as the primary ranking tool of the project success factors. The survey was used to score each level, and their corresponding

crisp project maturity index and fuzzy exert system assisted and PM maturity index and consistency. A software MATLAB as used to examine the project management maturity level of the study groups. The consistent responses were used to determine the level of project management maturity level for each organization included in the study. The Cronbach's α value was calculated to check the internal consistency and reliability of the project management maturity scores and project success factors scores. Hypothesis testing, multiple regression analysis and related assumption tests will be performed, applying the Pearson product-moment correlation coefficient to examine the level of correlation between PMM and CSFs. A Statistical Package for the Social Science (SPSS) tool was used in entire quantitative analysis.

## Threats to Validity

As observed from previous use of both instruments, CPSFA used Spearman's correlation factor *r* to analyse the consistency of results. Accordingly, the *r*-value for UAE vs. the Middle East (excluding UAE) was 0.88614, Clients vs. Contractors 0.882692, Professionals with more than 10 years vs. fewer than 10 years 0.836154 (Gunduz & Yahya, 2015). The high correlation value confirmed the presence of a similar ranking for the various groups. The consistency of survey response is the theme in applying KPMMA in fuzzy expert system analysis. The expert for a five-level maturity procedure showed six out of 32 response patterns likely to be consistent. Souza et al. (2012) proposed the minimum fuzzy operator α 0.6 as lower limits of consistency, in which the instrument performed a positive response showing a higher consistency rate. CPSA and KPMMA considered a reliable

instrument of measurement as both have proved a reasonable rate of reliability factor in previous works.

## Ethical Procedures

The ethical consideration primarily followed the principles for ethical social research designed at Walden University's IRB to protect participant's right. The individuals have given the right to decide about their participation or withdraw at any time. Participants were ensured the research is fully voluntary. The potential risks and benefits associated with research were clearly stated. Participants requested to make informed decision to participate before completing the survey. The informed consent provided to participants all the procedures and the principles stipulated in IRB guidelines.

I assured participants that participation was voluntary and the right to withdraw at any time, preservation of anonymity, confidentiality of personal information, and data protection. Researcher information will be kept confidential and not shared outside the research. The informed consent communicated the potential benefits to society and the expected burden, any potential discomfort that may came from participation like distress resulting from the sensitivity of questions (Valerio & Mainieri, 2008) in research. IRB approval number 06-03-20-0522342 obtained from Walden University to conduct the research.

**Research Questions and Hypotheses**

1. To what extent, if any, do project management body of knowledge (PMBoK), as measured by KPMMA of contractor's significantly predict the project success, as measured by CPSFA?

$H_0$1: The collective effect of the project management body of knowledge of contractor's, as measured by KPMMA, does not significantly predict the project success, as measured by CPSFA.

$H_A$1: The collective effect of the project management body of knowledge of contractor's, as measured by KPMMA, significantly predicts the project success, as measured by CPSFA.

2. To what extent, if any, do project management body of knowledge (PMBoK), as measured by KPMMA of consultant's, significantly predict project success, as measured by CPSFA?

$H_0$2: The collective effect of the project management body of knowledge of consultants, as measured by KPMMA, does not significantly predict the project success.

$H_A$2: The collective effect of the project management body of knowledge of consultants, as measured by KPMMA, significantly predicts the project success.

3. To what extent, if any, do project management body of knowledge (PMBoK), as measured by KPMMA of client's, significantly predict project success, as measured by CPSFA?

$H_0$3*:* The collective effect of the project management body of knowledge of clients, as measured by KPMMA, does not significantly predict the project success.

$H_A$3: The collective effect of the project management body of knowledge of client's, as measured by KPMMA, significantly predicts the project success.

4. What is the level of construction project management body of knowledge of the construction industry, as measured by the KPMMA?

**Summary of the Research Methodology**

This chapter was an explanation of the research design and methodology to be followed. The one point in time cross-sectional survey design will be employed to collect the desired data from the study participants. A dual data collection method web-based and mail were employed to collect data. Various statistical correlation analyses on variables will be carried. I proposed to include 194 project managers experienced in managing building projects as participants from contractors, consultants, and clients. In the following Chapters 4 and 5, the remaining parts of the study data analysis, finding, and conclusion of the study will be discussed.

# Chapter 4: Results

## Introduction

The purpose of this quantitative, correlational study was to examine the CSF and construction project management knowledge maturity level as determined by the survey responses from a sample of project managers of contractors, consultants, and clients engaged in active project sites in the Ethiopian construction industry. The project management maturity level was measured by applying KPMMA. The construction project success aspect of this study was measured by using CPSFA. The CPSFA helps 25 measures of project success: company's technical capabilities, scope and work definition, control system, effective site management, project manager capabilities and commitment, company's financial strength, planning efforts, effective scheduling, commitment to the project, adequate project management technique, adequacy of plans and specifications, effective procurement and tendering methods, client consultation and support, effective communication between stakeholder, top management support, adequate risk analysis, clarity of project mission, effective technical review, personnel selection and training, completion of design at the construction start, effective project briefing, team motivation, harsh climate conditions and environment, political conflicts and corruption, and unforeseen conditions. The correlation between the independent variable project management maturity level, and the project success factors, the dependent variable, was evaluated using the person product-moment correlation coefficient.

## Data Collection and Analysis

In most construction projects, various types of project managers are involved. Each stakeholder will have its designated project managers representing the company's context who is responsible for the successful accomplishment of its portion of the project (Sears Sears, Clough, Rounds, & Segner, 2015). Contractors, consultants, and clients will have their representative project manager for their corresponding part. The target population comprised project managers certified as practicing design and construction professionals who issued a license from MoUDHC working in Ethiopian Construction Industry, contractors, consultants, and clients.

The participant organization and potential project managers' current construction project management status were checked through the Ethiopian Construction Project Management Institute (ECPMI). The primary client organizations assured were; Prime Minister of Ethiopia, Minister of Finance of Ethiopia, Minister of Transport of Ethiopia, Minister of Urban Development and Construction of Ethiopia, Minister of Education of Ethiopia, Minister of Water, Irrigation and Energy of Ethiopia, Ethiopian Railway Construction Corporation, Addis Ababa Light Railway, Addis Ababa Road and Transport Bureau, Addis Ababa City Construction and Housing Bureau, Addis Ababa City Road Authority, Addis Ababa Housing Construction Project Office, Ethiopian Electric Utility, Ethiopian Energy Authority. Out of the entire registry for 2019 to 2020, 138 construction contractors and 48 consultants from category I and II firms and their project manager

lists were identified. Participants were invited through email with the SurveyMonkey link. The survey was uploaded in SurveyMonkey for 10 calendar days. The targeted project managers had the experience of success and failure of projects, knowing the existing challenges, strengths, weaknesses, and opportunities and capable of running projects from inception to completion through the project management process. A total of 198 construction project managers tried to complete the survey (75 % of 259). However, only 193 participants responded all the questions in the survey. The final sample size for the study was 193.

**Demographic Statistics**

The study possessed fewer demographic requirements of project managers. Maintaining the integrity of anonymity of the survey meant less collection of personal information. The demographic survey included demographic variables, consisting of project ownership type, status of professional certification type, age, education level, construction project management experience, rate of successful constriction project accomplishment, project management position, construction industry sector affiliation, project category, and the amount of project managed. Out of 193 participants who responded to the survey, the result showed that a total of 92 (47.9%) were affiliated to private while 96 (50%) were from the public organization and 4 (2.1%) from other organization. Most (98.4%) of the participants were professionally certified to engage in national construction industry architecture, engineering, management, design, and construction services. 86.5 % were 50 years of age or younger, and most (99.5%) had a bachelor's degree or a higher education

level. A total of five (2.6 %) study participants had fewer than 4 years of project management experience, while 188 (97.4%) had more than 5 years of project management experience. A total of 67 (34.75%) respondents responded to the successful project accomplishment rate from 20 to 60% and 126 (65.25%) responded 80% and above. Study participants responded their management position designated capacity; most were engaged in top management level (Project Manager Position, Design team leader, Resident Engineer, Owner) 157, (81.3 %), middle-level management such as Project Team Leader, Project Site Supervisor/Manager 30, (15.5%), and 6 (3.1%) respondents were from project management team members. A total of 48 (24.9%) study participants were from consulting construction industry subsector affiliations, while 100 (51.8%) were from a contractor, and the remaining 45 (23.3%) were from client affiliations. Participants reported the project cost managed with measured in USD value, most participants 157 (80.8%) had managed cumulative project finance more than 20 million USD, and 36 (19.2% reported less than 20 million USD aggregate project cost value as they practiced their project management responsibilities. Appendix D shows a detailed description of frequency tables (Tables D1–D9) for all demographic variables.

## Findings

There were 25 measures of construction project management success factors on importance and frequency scale and 20 measures of project management maturity model containing five levels. The Cronbach's alpha for the dependent variable (project success factors) measured on importance scale was .913 and .811 measured

on the frequency scale. Cronbach's alpha for the independent variable (project management maturity model) was .978. The general rule is listed $\alpha > 0.9$ is excellent, and $0.8 < \alpha < 0.9$ range is a good indicator of internal consistency. Both dependent and independent variables possessed acceptable limits of internal consistency reliability. Appendix E shows the Cronbach's Alpha table for dependent and independent variables (see Table E1).

**ANOVA Test of Variables**

Analysis of variation (ANOVA) test is a recommended method to test the sample mean difference for more than two groups over an independent *t*-test. The following null and alternative hypotheses were tested. Appendix F shows the ANOVA test for Project Success Factors.

In this study, ANOVA tests were performed on three dependent lists and group factors; construction project success factor scored on importance and frequency scale and project management maturity samples on one side and contractors, consultants, and clients as a factor to understand the level of the mean difference. The fundamental assumptions: normal distribution of variables, independence of variable, homogeneity of variances assumptions maintained.

$$\text{Ho:} \quad \mu_{\text{contractor}} = \mu_{\text{consultant}} = \mu_{\text{client}}$$

$$\text{H1:} \quad \mu_{\text{contractor}} \neq \mu_{\text{consultant}} \neq \mu_{\text{client}}$$

The output ANOVA test for project success factor variable on the importance and frequency scale revealed 25 factors significance *p*-value is higher than 0.05. I

rejected the alternative hypothesis that there is a difference between the means of two groups in favor of the null hypothesis (see Table F1 and F3). At least two group means are different. Post hoc Tuky tests for multiple comparisons were used to analyze significant value to locate the difference among groups.

**Critical Success Factor**

The objective of any construction project success is ensured when met the traditional success criteria known as iron triangle (cost, time, and quality). The most significant construction project success factors were assessed based on their level of importance and frequency. Project managers from consultants, contractors, and client organizations were asked to rate that factors based on the level of importance in their project management implementation practice. Appendix G shows detailed crosstabulation for project success factors measured on importance scale (see Tables G1–G25). Appendix H shows detailed crosstabulation for project success factors measured on frequency scale (see Tables H1–H25).

I used the relative importance index method to evaluate the level of the important factor to project success factors. Similarly, I assessed the frequency scale measured success factors to compute the frequency index. From the survey dataset, 25 factors were analyzed for their importance in taking into account the importance and frequency scale of consultants, contractors, and clients. The frequency adjusted importance index (FAII) was calculated by multiplying the relative importance index and frequency index (Appendix E). I used FAII as a ranking guide to the success factor. The relative importance index (RII), frequency index (FI), and the frequency

adjusted importance index (FAII) were computed. Appendix I shows the detailed frequency table of project success factors. Besides, the mean score of the factor variable was examined (Table I5).

## Multiple Regression Analysis

Before running the multiple regression analysis, I tested five important assumptions. The first is checking for the presence of outliers. Regression analysis is highly affected by individual members of the sample with high value. Appendices K, L, and M show a detailed analysis of multiple regression analysis.

I tested for the assumption of homoscedasticity of model error that is generally assumed to have an unknown but finite variance that is constant across all predictor variables (Williams, Grajales, & Kurkiewicz, 2013). The presence of heteroscedasticity assumption was checked by plotting standardized residuals against the predicted value of project success (Figures 1, 2, and 3). To assess if there are any outliers, the standardized residuals from each participant group regression were plotted against the standardized predicted value (Warner, 2012). The visual observation of these plots show residuals were not equally scattered around 0. There was no indication of pattern or heteroscedasticity in these three plots of residuals. I concluded that the assumptions needed for multiple regression were sufficiently met.

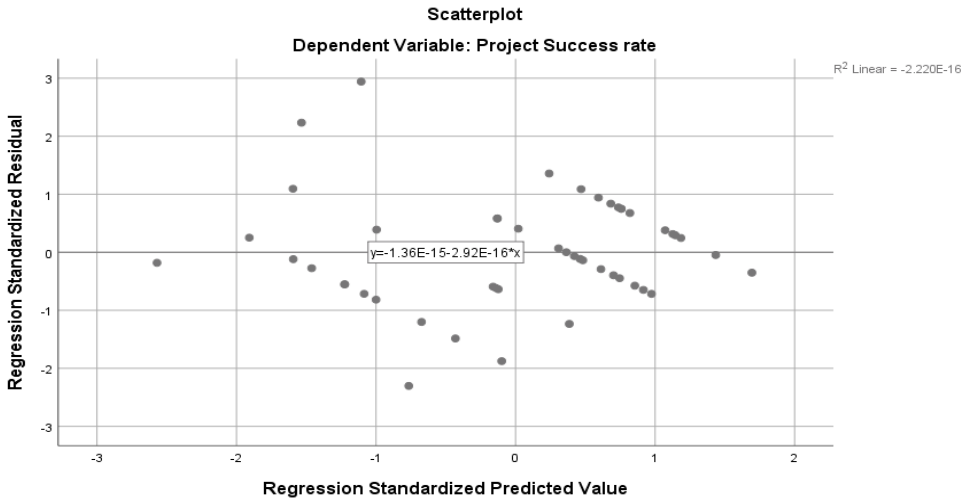


*Figure 1.* Consultant Scatter plot.

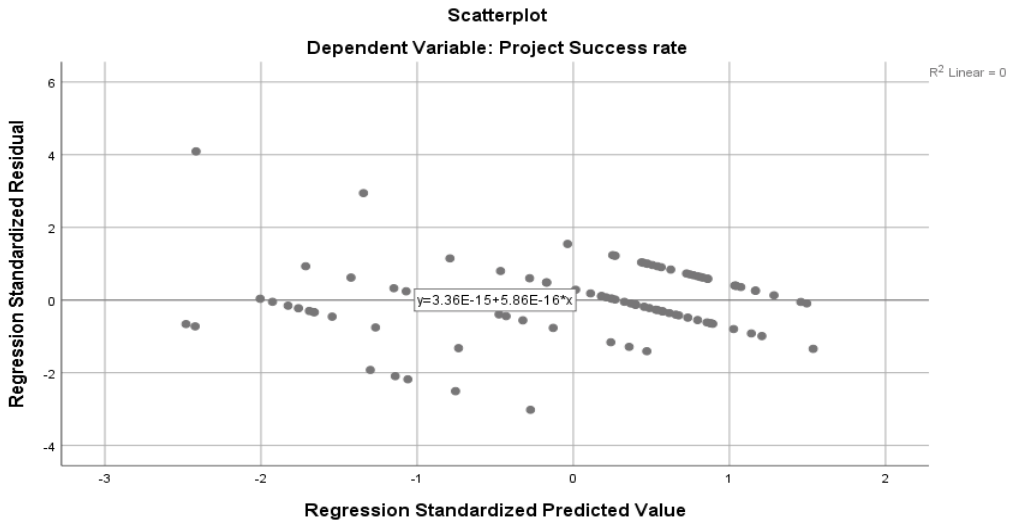


*Figure 2.* Contractor Scatter plot.

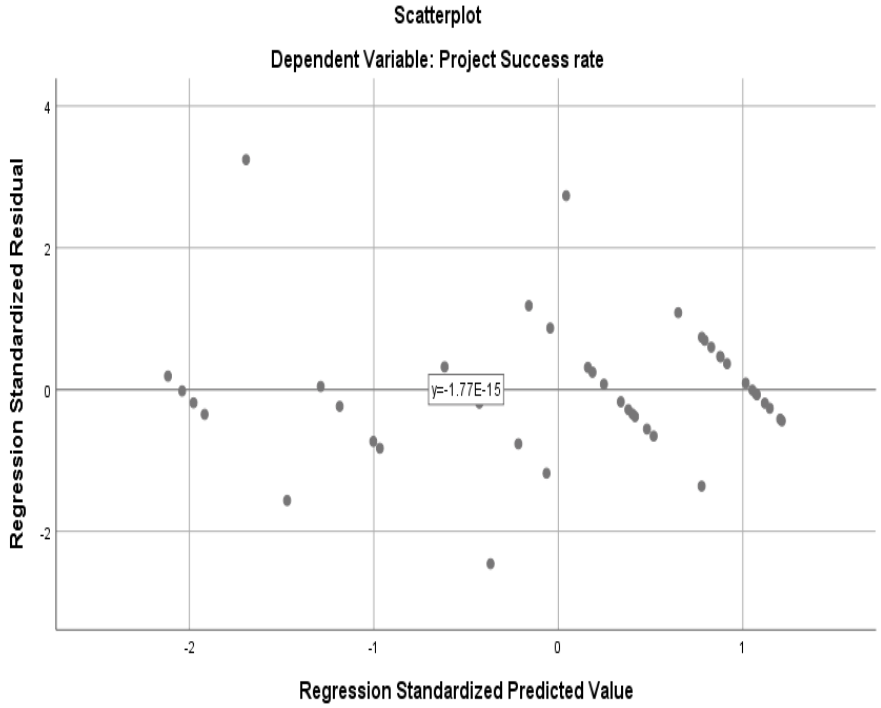


*Figure 3.* Client Scatter plot.

The second assumption I checked was the state of linearity and normality. The assumption of the normal distribution, as stated by Warner (2012), is that multiple regression analysis are evaluated by generating graphs. This assumption requires variables that should normally be distributed (Segrin, 2010). The shape of the distribution of scores, as seen for project success generated for consultant, contractor, and client critical success factor histograms, ensured the normality of distribution (Figures 4, 6, and 8). Similarly, the linearity of distribution further met by the residuals (Figures 5, 7, and 9 P-P plot of regression standardized residuals).

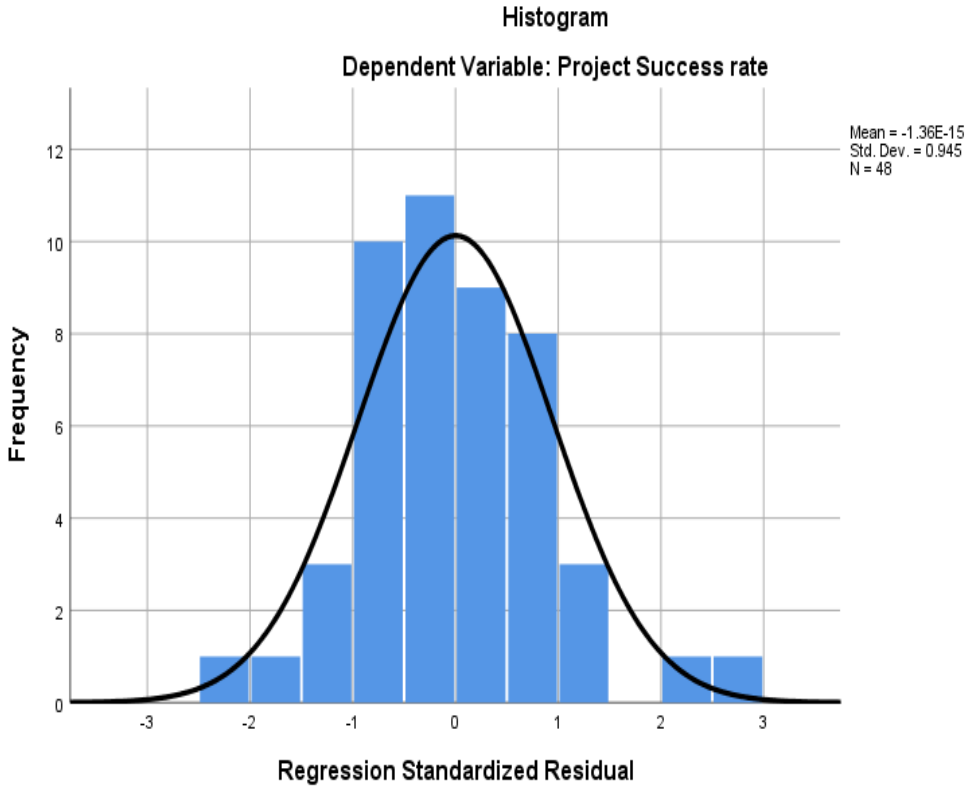


*Figure 4.* Consultant Standardized regression residual histogram.

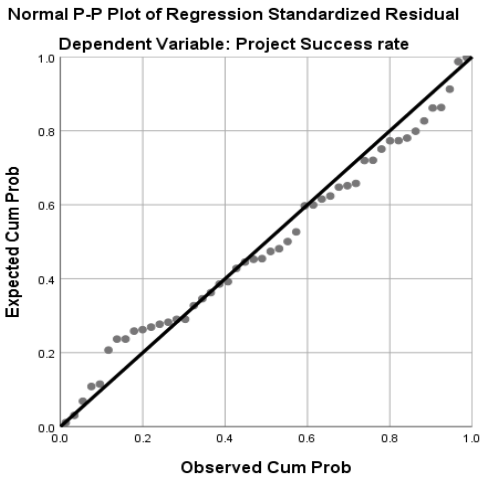


*Figure 5.* Consultant Normal P-P plot for standardized residual

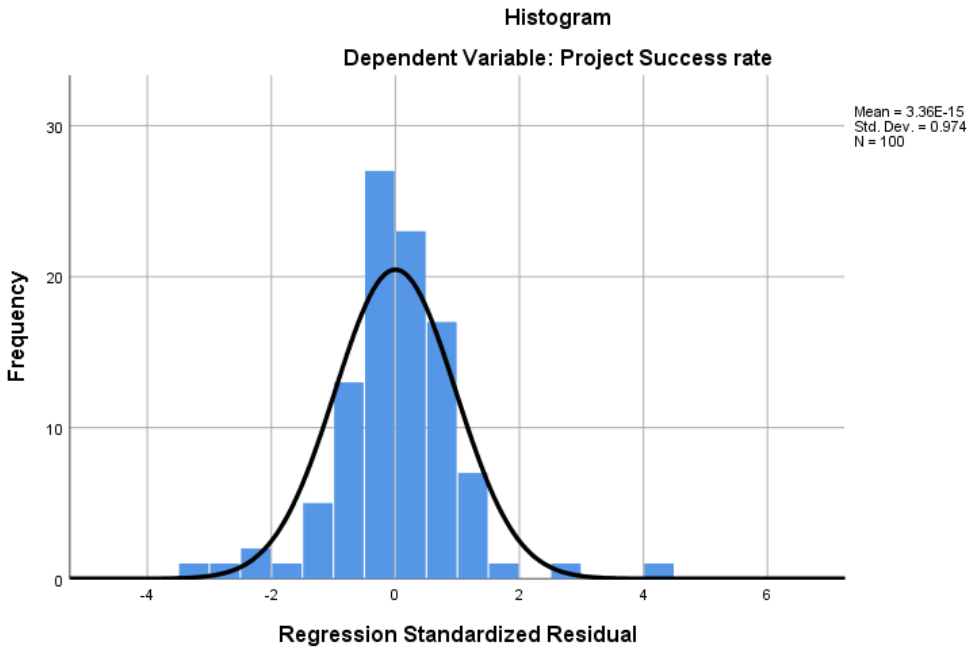


*Figure 6.* Contractor Standardized regression residual histogram.

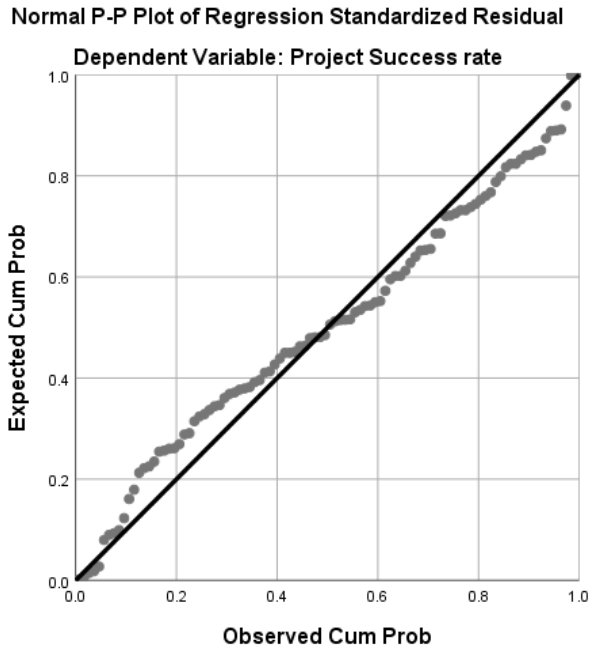


*Figure 7.* Contractor Normal P-P plot for standardized residual.

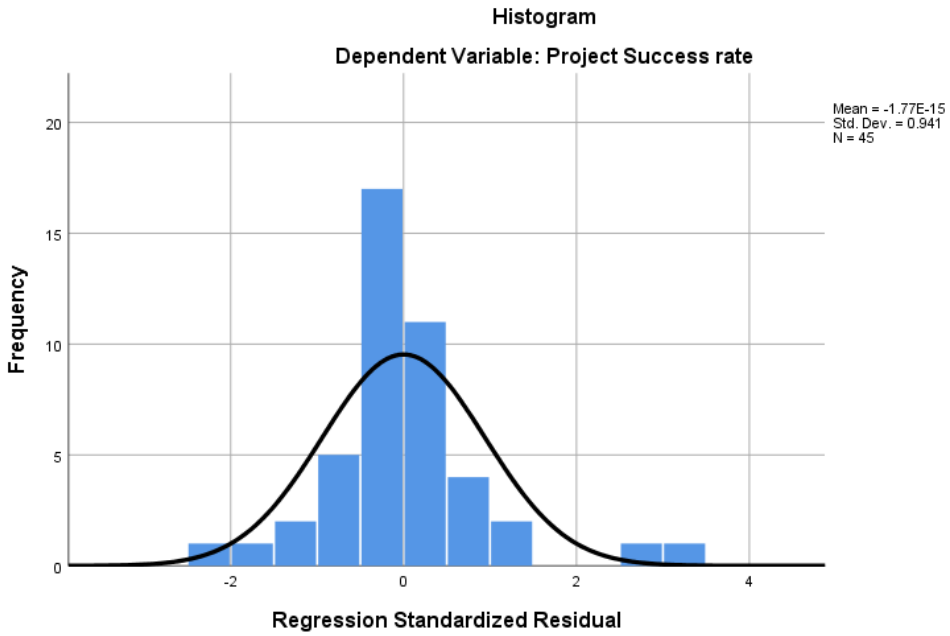


*Figure 8.* Client Standardized regression residual histogram.

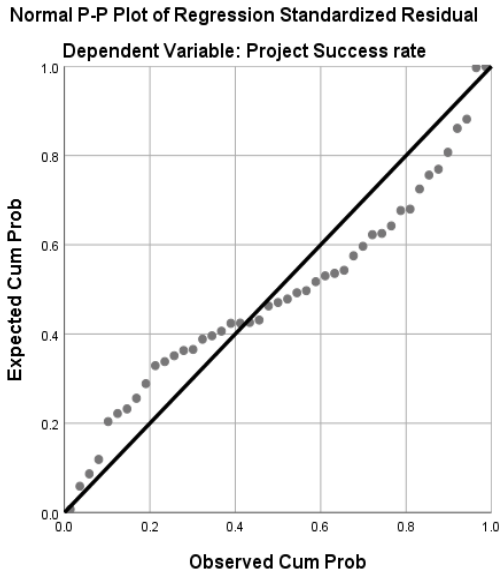


*Figure 9.* Client Normal P-P plot for standardized residual.

The third important assumption I checked is the state of multicollinearity. Multicollinearity is not a significant obstacle in prediction (Williams, Grajales, &

Kurkiewicz, 2013). However, in this study, the number of predictor variables were two, that is below the influence of multicollinearity concern. The assumption of no multicollinearity was met to use the multiple regression analysis (Evans, 2010).

The fourth important assumption tested was the state of outliers. An outlier is an extreme score on either the low or the high end of a frequency distribution (Warner, 2013). I used descriptive statistics *Z* score in combination with boxplot to identify and manage the outliers. Since the data met for the assumption of normality of distribution, it is appropriate to employ the *Z* score to treat the outliers. Missed data caused most outliers. I managed those outliers fit for analysis.

The fifth assumption, I checked were the assumption of independence of errors by examining the model summary Durbin-Watson (DW) value. When this assumption is violated, Williams et al. (2013) explained that it leads to biased estimates of standard errors and significance of regression coefficients remain unbiased. Independence of errors is checked with the DW value to identify the presence of first-order autocorrelation (Evans, 2010). The condition of DW taken as guiding to verify the independence of errors DW value ranges from 0 to 4. If there is no correlation, the value of DW approximately equals 2 (Evans, 2010). If there is a positive correlation, the value of DW equals 4, and if there is a negative correlation, the value of DW equals 0 (Evans, 2010). The DW value for consultant group 2.004 (Table K4), contractor 1.908 (Table L4, and the client is 1.831 (Table M4) shows that the value of DW is below less and equal to 2 implying the assumption is met.

## Evaluation of Test Results

In the Research Questions 1, 2, and 3, I evaluated the prediction of project success from the project management maturity by testing the hypothesis below.

Research Question 1: To what extent, if any, do project management body of knowledge (PMBoK), as measured by KPMMA of contractor's significantly predict the project success, as measured by CPSFA?

$H_0$1: The collective effect of the project management body of knowledge of contractor's, as measured by KPMMA, does not significantly predict the project success, as measured by CPSFA.

$H_A$1: The collective effect of the project management body of knowledge of contractor's, as measured by KPMMA, significantly predicts the project success, as measured by CPSFA.

Appendix K shows the results of multiple regression analyses for the contractor's group sample within the construction industry. Table K1 shows the descriptive statistics of the research variables considered in the regression model. Table K2 presents the correlation between project success factor and maturity variables used at each phase of the regression model. Table K3 shows the variables entered in the regression analysis. Table K4 presents the regression analysis model summary, and it describes the level of relationship between the regression model variables. Table K5 shows the ANOVA table, and Table K6 depicts the coefficients of prediction variables. Table K7 illustrates residual statistics.

The project success rate data for a sample of *N*=100 project manager participants from the contractor group informed a positive correlation between all pairs of variables. The correlation between Level-1 and Level-2 score, *r*= + .449, indicating absence multicollinearity. The maturity Levels 3, 4, and 5 were not attained and hence removed from the analysis. The overall contractor project success rate prediction from Level-1 and Level-2 score, *R*=.739, *R*2=.547, adjusted *R*2=.522. That means when Level-1 and Level-2 score were used as predictors, about 54% of the variance in project success could be predicted. The overall regression was statistically significant, $F(5,94)= 22.656$, $p < .005$. The null hypothesis was rejected. The alternative hypothesis stated the collective effect of the project management body of knowledge of contractors, as measured by KPMMA, significantly predicts the project success, as measured by CPSFA was accepted.

Research Question 2: To what extent do project management bodies of knowledge (PMBoK), as measured by KPMMA of consultants, significantly predict project success, as measured by CPSFA?

$H_0$1: The collective effect of the project management body of knowledge of consultant's, as measured by KPMMA, does not significantly predict the project success, as measured by CPSFA.

$H_A$1: The collective effect of the project management body of knowledge of consultant's, as measured by KPMMA, significantly predicts the project success, as measured by CPSFA.

Appendix L shows the results of multiple regression analyses for the consultant group sample within the construction industry. Table L1 shows the descriptive statistics of the research variables considered in the regression model. Table L2 presents the correlation between project success factor and maturity variables used at each phase of the regression model. Table L3 shows the variables entered in the regression analysis. Table L4 presents the regression analysis model summary, and it describes the level of relationship between the regression model variables. Table L5 shows the ANOVA table, and Table L6 depicts the coefficients of prediction variables. Table L7 represents residual statistics.

The project success rate data for a sample of $N$=48 project manager participants from the consultant group informed that there was a positive correlation between all pairs of variables. The correlation between Level-1 and Level-2 score, $r$ = + .410, indicating absence of multicollinearity. The maturity Levels 3, 4, and 5 were not attained and hence removed from the analysis. The overall consultant project success rate prediction from Level-1 and Level-2 score, $R$=.779, $R$2=.608, adjusted $R$2=.561. That means when Level-1 and Level-2 score were used as predictors, about 60.8% of the variance in project success could be predicted. The overall regression was statistically significant, $F$ (5,42) =13.002, $p <$ .001. The null hypothesis was rejected. The alternative hypothesis stated the collective effect of the project management body of knowledge of consultants, as measured by KPMMA, significantly predicts the project success, as measured by CPSFA was accepted.

Research Question 3: To what extent do project management bodies of knowledge (PMBoK), as measured by KPMMA of clients, significantly predict project success, as measured by CPSFA?

$H_0$1: The collective effect of the project management body of knowledge of client's as measured by KPMMA, does not significantly predict the project success, as measured by CPSFA.

$H_A$1: The collective effect of the project management body of knowledge of client's, as measured by KPMMA, significantly predicts the project success, as measured by CPSFA.

Appendix M shows the results of multiple regression analyses for the client's group sample within the construction industry. Table M1 shows the descriptive statistics of the research variables considered in the regression model. Table M2 presents the correlation between project success factor and maturity variables used at each phase of the regression model. Table M3 shows the variables entered in the regression analysis. Table M4 presents the regression analysis model summary, and it describes the level of relationship between the regression model variables. Table M5 shows the ANOVA table, and Table m6 represents the coefficients of prediction variables. Table M7 describes residual statistics.

The project success rate data for a sample of $N$= 45 project manager participants from the consultant group informed that there was a positive correlation between all pairs of variables. The correlation between Level-1 and Level-2 score, $r$ = + .793, indicating absence of multicollinearity. The maturity Levels-3, 4, and 5

were not attained and hence removed from the analysis. The overall consultant project success rate prediction from Level-1 and Level-2 score, $R$=.945, $R$2=.893, adjusted $R$2=.879. That means when Level-1 and Level-2 score were used as a predictor, about 89.3% of the variance in project success could be predicted. The overall regression was statistically significant, $F$ (5,39) = 64.936, $p$ < .005. The null hypothesis was rejected. The alternative hypothesis stated the collective effect of the project management body of knowledge of clients, as measured by KPMMA, significantly predicts the project success, as measured by CPSFA was accepted.

Research Question 4: What is the level of construction project management body of knowledge of the construction industry, as measured by the KPMMA?

The overall descriptive statistics of the construction industry maturity index were presented (Appendix J). Summary of maturity index after clustering the reshuffled questions were shown evaluated (Appendix N). Table N1 shows a summary of the mean score for aggregate KPMMM for all levels. Table N2–N5 summarized the crosstabulation of descriptive statistics for the entire sample. Table N6 shows the consistency of the level score for respondents. I categorized four questions per level to evaluate the maturity level score using SPSS. The aggregate level score is found by adding the score of each response. The consistency of level was assessed using the 32-rule suggested by Souza et al. (2012). A minimum passing score for maturity level was 6 out of the maximum score of 12.

## Conclusion

This chapter incorporated the statistical analysis of collected data from study participants. The result showed a significant correlation between project success factors and project management maturity measures of contractor, consultant, and client organizations. The study offers adequate evidence that project management maturity level and the critical success factors of these project management companies could be evaluated. Project success can be predicted from the project management maturity level. Chapter 5 covers discussion, implications to positive social change, recommendations for action, and future research based on the findings and literature reviewed.

# Chapter 5: Discussion, Conclusions, and Recommendations

## Introduction

The CSFs are means of project success and needed to meet organizational goals. Countries, organizations, companies engaged in the construction industry benefited from leading through identified CSFs due to the positive and higher contribution, as compared with other factors. Construction project management is the application of knowledge and skills required to accomplish project success. However, critical success factors and knowledge management practices were not adequately addressed in the Ethiopian construction project industry generally, and contractors, consultants, and client organizations specifically. Identifying the CSFs, understanding the state of construction project management knowledge maturity level, and how predicts project success is the point of research.

The specific problem addressed by this research was to evaluate the extent of the PMBoK measured by KPMMM, how much significantly predict the project success measured by CPSFA of contractor, consultant, and client groups, and assess the construction project management maturity level score of the construction industry. The construction project management success factor was the dependent variable, and the project management maturity level was the independent variable.

The population target of the research comprises 14 public organizations (clients), 131 contractors, and 48 consulting companies from Category I and II license classification. Online survey invitations were sent to 259 project managers hired in contractor, consultant, and client organizations. The objective of the

research was to evaluate the prediction of project success from project management maturity score.

The data were collected from 198 construction project managers who completed the online survey (75 % of 259). However, only 193 participants responded to all the questions in the survey. The study's final sample size was 193 (48 consultants, 100 contractors, and 45 clients) project managers. The survey was comprised of demographic, construction project management success factors (dependent variable), and construction project management maturity (independent variable) factors measured by KPMMM. This chapter covers the interpretation and discussion of findings, implications for social change, recommendations, and conclusions reached from the study.

## Interpretation of Findings

The study was established to respond four research questions.

### Hypothesis for Research Question 1

The purpose of the first research question was to evaluate the extent if any project management maturity score predicts the project success rate in contractor organization. The statistical data reported in chapter four informed, Level-1 score was significantly predictive of project success rate when the variable Level-2 score was statistically controlled: $t(94)=3.049$, $p < .005$. The positive slope for the Level-1 score as a predictor of project success rate informed that there was about .026-unit increase in project success rate for each 1-unit increase in Level-1, controlling for the Level-2 score. Similarly, the Level-2 score is a predictive variable of project

success rate when Level-1 is statistically controlled: $t(94)=6.076$, $p < .005$. The slope to predict project success from the Level-2 was approximately $b= .050$, and this means there was about .050 unit increase in project success for each level of increase in maturity Level-2 score.

The $Sr^2$ for Level-1 score controlling Level-2 was .004494. That implied Level-1 score uniquely predicted about 4.49% of the variance in project success when maturity Level- 2 was statistically controlled. When maturity Level-1 was statistically controlled, Level-2 still uniquely predicted 17.80 % of the project success rate variance. It can be said that Level-1 and Level-2 are partly redundant as predictors of project success; to the extent that Level-1 and Level-2 are correlated with each other, they compete to explain some of the same variance in project success. However, each predictor was significantly associated with project success even when the other predictor variable was significantly controlled; both Level-1 and Level-2 score contribute uniquely useful predictive information about project success in this research context.

The predictive equation:

Project success rate= .31+.26 (Level-1 Score) + .50 (Level-2 Score)

The semi partial correlation was squared to analyze the unique variances predictable from each variable of maturity score. For Level-1, the part correlation was SrLevel-1=.212; the value of $Sr^2$Level-1 found by squaring, and it was about .0449. Similarly, Level-2 part correlation were found by SrLevel-2=.422; hence, $Sr^2$ Level-2 = .178.

I found that 54.7% of the variance in project success was predictable from maturity Level-1 and Level-2. 4.49% of the variance in project success rate was uniquely predictable from the Level-1 score. Besides, 17.8% of the variance in project success rate was uniquely predictable from Level-2. The rest 32.71 % of the variance in project success rate could be predicted equally well by maturity Level-1 or Level-2.

**Hypothesis for Research Question 2**

The second research question's purpose was to evaluate the extent if any project management maturity score predicts the project success of a consultant organization.

The statistical data reported in chapter four informed that the Level-1 score was significantly predictive of project success rate when the variable Level-2 score was statistically controlled: $t$ (42) =3.134, $p < .005$. The positive slope for the Level-1 score as a predictor of project success rate informed that there was about .036-unit increase in project success rate for each 1-unit increase in Level-1, controlling for the Level-2 score. Similarly, the Level-2 score is a predictive variable of project success rate when Level-1 is statistically controlled: $t(42)=4.994$, $p < .005$. The slope to predict project success from the Level-2 was approximately $b = .049$, and this means there was about 0.049 unit increase in project success for each level of increase in maturity Level-2 score.

The $Sr^2$ for Level-1 score controlling Level-2 was .0918. That implied Level-1 score uniquely predicted about 9.18% of the variance in project success when

maturity Level-2 was statistically controlled. When maturity Level-1 is statistically controlled, Level-2 still uniquely predicted 23.32% of the variance in the project success rate of consultant project performance. One possible interpretation of this outcome is that maturity Level-1 and Level-2 are partly redundant as a predictor of project success; to the extent that Level-1 and Level-2 are correlated with each other, they compete to explain some of the same variance in project success. However, each predictor was significantly associated with project success even when the other predictor variable was significantly controlled; both Level-1 and Level-2 score contribute uniquely useful predictive information about project success in this research context.

The predictive equation:

Project success rate=.22+.036 (Level-1 Score) + .049 (Level-2 Score)

The semi partial correlation was squared to analyze the unique variances predictable from each variable of maturity score. For Level-1, the part correlation was SrLevel-1=.303; the value of $Sr^2$ Level-1 is found by squaring, and it was about .0918. Similarly, Level 2 part correlation were found by SrLevel-2=.483; hence, $Sr^2$ Level-2=.233.

I found that 60.8% of the variance in project success was predictable from maturity Level-1 and Level-2 score. 9.18% of the variance in project success rate was uniquely predictable from the Level-1 score. Besides, 23.3% of the variance in project success rate was uniquely predictable from Level-2. The rest 6.72 % of the

variance in project success rate could be predicted equally well by maturity Level-1 or Level-2.

**Hypothesis for Research Question 3**

The purpose of the third research question was to evaluate the extent if any project management maturity score predicts the project success of client organization.

I found that the Level-1 score was significantly predictive of project success rate when the variable Level-2 score was statistically controlled: $t$ (39) =6.597, p<.005. The positive slope for the Level-1 score as a predictor of project success rate informed that there was about .073-unit increase in project success rate for each 1-unit increase in Level-1, controlling for the level-2 score. Similarly, the Level-2 score is a predictive variable of project success rate when Level-1 is statistically controlled: $t(39)=5.058$, $p < .005$. The slope to predict project success from the Level-2 was approximately $b = .035$, which means there was about 0.035 unit increase in project success for each level of increase in maturity Level-2 score.

The $Sr^2$ for Level-1 score controlling Level-2 was .1197. That implied Level-1 score uniquely predicted about 11.97 % of the variance in project success when maturity Level-2 was statistically controlled. When maturity Level-1 is statistically controlled, Level-2 still uniquely predicted 7 % of the variance in the project success rate of client project performance. One possible interpretation of this outcome is that maturity Level-1 and Level-2 are partly redundant as a predictor of project success; to the extent that Level-1 and Level-2 are correlated with each other, they compete to

explain some of the same variance in project success. However, each predictor was significantly associated with project success even when the other predictor variable was significantly controlled; both Level-1 and Level-2 score contribute uniquely useful predictive information about project success in this research context.

The predictive equation:

Project success rate=-.25+.073 (Level-1 Score) + .035 (Level-2 Score)

The semi partial correlation was squared to analyze the unique variances predictable from each variable of maturity score. For Level-1, the part correlation was SrLevel-1=.346; the value of $Sr^2$ Level-1 is found by squaring, and it was about .1197. Similarly, Level 2 correlations were found by SrLevel-2=.265; hence, $Sr^2$ Level-2 = .0702.

In conclusion, 89.3 % of the variance in project success was predictable from maturity Level-1 and Level-2 score. 11.97% of the variance in project success rate was uniquely predictable from the Level-1 score. Besides, 7.02% of the variance in the project success rate was uniquely predictable from Level-2. The rest 8.29 % of the project success rate variance could be predicted equally well by maturity Level-1 or Level-2.

**Construction Project Management Maturity Level**

The finding revealed out of 193 participants, six (3%) did not pass while 187 (97%) satisfied the minimum score Level-1 with maturity MS 9.62. In contrast, 83(43%) satisfied the minimum score Level-2 with maturity MS 6.52, 111(57%) did not pass. Whereas 82(43%) satisfied the minimum score Level-3 with maturity MS

5.19, 187 (97%) did not pass. Whereas 6(3%) satisfied the minimum score Level-4 with maturity MS 0.42, and 185 (95%) did not pass. Whereas 8 (5%) satisfied the minimum score Level-5 with maturity MS 1.02. Table J6 depicts the descriptive statistics of consistency of maturity level; out of the total 193 participants, 46 (23.8%) responses were categorized as inconsistent while 147 (76.2%) responses were consistent. The mean score of maturity Level-1 and Level-2 was above the minimum score of 6, implying the minimum requirement to represent the level was satisfied.

The Ethiopia construction industry project management maturity level can be classified at Level-2 with a score of 6.52/12, implying the need to enhance the project management knowledge application in practicing construction project implementation. The finding complies with Mullaly's (2006) research finding, which shows that 60% of international organizations that practice project management are grouped in this category.

**Critical Success Factors**

Factors with mean score 4 (high) and above considered as critical success factors. The mean score ranking identified on the basis of mean score Adequate project management technique, project manager capabilities and commitment, effective site management, commitment to the project, company's technical capabilities, scope and work definition, control system, planning efforts, company's financial strength, effective scheduling, top management support, adequacy of plans and specifications. The CSFs result indicated are the key factors contributing the

success of projects through improving time, cost, and quality. The result matches with previous researchers that project success is dependent on other factors than standardized practice (Pretorius & Jordaan, 2012).

## Implications to Positive Social Change

The literature revealed that the organizational competence of each construction industry parties in Ethiopia lacks adequate capabilities of knowledge to manage projects. The need for vast resources and substantial allocation of the commitment of time remained a challenge to build the capabilities to deliver projects successfully by contemporary construction projects implementing companies (Pennypacker & Grant,2003). Williams (2016) affirmed that multiple interacting criteria clearly define success; multiple interacting factors achieve success. The concept of maturity enables companies to describe their state of organizational effectiveness to perform their objectives (Caliste, 2013). To induce positive social change, knowing the critical few success factors helped project management companies' management efficiency of delivering projects successfully. Concerning implication to social change, the information found from this study could shape the practice of project managers and decision-makers to initiate change to improved project delivery. Practicing project maturity will create a platform for increased knowledge management that, in turn, establish a competing environment. When the construction industry influenced by competing knowledge driven by maturity, then the ultimate benefits go to the community, professionals, stakeholders, and government. The repeated project success lead by companies who knew their project

management maturity will be a source of positive social change for the construction industry and the public.

## Recommendations for Action

The most known project success measure criteria in the construction project are time, cost, and quality and are called the iron triangle (Heravi & Gholami, 2018). Recent research developments practice revealed the outlook towards project success is changing into a more multi-dimensional definition, applying both objective and subjective criteria that the most common approach of labelling success as meeting cost, schedule, and targets (Williams, 2016). In this study, I called the attention of project management regulatory bodies (government), contractors, consultants, and professional societies, and academia construction project success is the effect of applied project management knowledge. I demonstrated the extent of construction project management knowledge maturity level gained from repeated success how it predicts the success of projects. This research confirmed the maturity level of the construction industry reached at Level-1 9.62/12 and 6.52/12 Level-2. The score indicated the challenge of unfulfilled project management knowledge practiced and appropriateness of the construction project management system in place.

I recommend that policymakers, stakeholders, academia, and practitioners draw insights from this research and take the initiative to move up to Level-3. Level-3 is the aspiration of many organizations and ensured when organizations reached the stage of consistent implementation of project management (Mullaly & Thomas, 2010; Villa, 2010). I will disseminate the summary of research findings to the

participant, ECPMI, and the federal government of Ethiopia office of prime minister. I will also give my consent to ECPMI to publish the results.

## Recommendation for Further Research

The relevance of the quantitative research method for this research was unquestionable, which was intended to examine the prediction of project success from construction project management knowledge. I also recommend researching the trend of CSFs, construction project management maturity level, and its prediction of project success. In this process, I suggest increasing the sample frame to address the entire pool of construction contractors and consultants to enhance generalizability.

The study could be replicated using the same instruments (i.e., CPSFA and KPMMM). I suggest the exact type of replication involving similar research methods followed, instrument, and analysis using the same population and context but with a different sample of participants from populations in original research (Walker et al., 2017). The validity of the original research findings could get a chance to be examined with a new sample. If the replication brings the same prediction result, it agrees with the findings reported in published data. A study on the interaction and moderation effect of organizational capability on project success will inform how these two factors related to the organizational success and deliver effective project delivery. However, political conflicts and corruption, unforeseen condition, and harsh climates were ranked as the least important factor for achieving success in projects.

## Limitations

This study is not without limitations. Data were collected from senior, middle, and technical staff of major construction, client, and design organizations only without considering the other types of organizations. Future studies should consider lower category organizations. Unlike other countries in the world, Ethiopia did not establish a regulatory framework for registering professionals based on their competencies and skills. The knowledge of project managers was limited only to basic project management knowledge gained through training and practice that may have a potential bias in response. The research finding might be rechecked by enrolling project managers with construction project management professional backgrounds. As knowledge management study, future research may require longitudinal study to capture the finer details of construction project management capability.

## Conclusions

The findings of this quantitative research study complied with the research hypotheses and assured that (a) the project management maturity Level-1 and Level-2 of contractors significantly predict the project success and (b) the project management maturity Level-1, Level-2 of consultants significantly predict the project success, and (c) the project management maturity Level-1, Level-2 of clients significantly predict the project success. The state of construction project management maturity level found in Level-1 and Level-2. In effect, these stakeholders embraced inconsistent project management knowledge partially landed

on two steps of the ladder. The mix of these levels indicates the project successes were either from an informal and inconsistent approach of project management and individual efforts or from the application of incomplete project management knowledge of the project management team.

Construction project management knowledge maturity (project managers) should be given attention beyond the project implementation to ensure the sustained construction industry. In a country like Ethiopia where the resource is limited, and development demand is high for the built environment including home, energy, irrigation, transport, social and economic infrastructure development; this research brought a more significant opportunity to revisit the policy direction, education, attitude, to improve the project management implementation to next maturity Level-3 and above. In the process, society reaps the benefits generated from the track of global standard project management knowledge, guided projects, and professionalism.

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Appendix A: Demographic Information

Please indicate your choice to each indicator selecting the appropriate option.

1. For which type of project entity are you affiliated?

☐ Private

☐ Public

☐ Other

2. What type of professional registration certificate you hold?

☐ Architecture

☐ Engineering

☐ Management

☐ Design

☐ Construction

☐ NA

3. What is your age?

☐ 21-30 years

☐ 31- 40 years

☐ 41-50 years

☐ 51 and above

4. What is your highest educational level?

☐ Highschool or equivalent

☐ Associate or technical degree

☐ Bachelor's degree

☐ Master's Degree

☒ Doctorate degree

☒ Other

5. How long is your design or construction project management (Project manager) experience?

☒ Less than 4 years

☒ 5-10 Years

☒ 11-15 Years

☒ 16-20 Years

☒ Above 20 years

6. What is the estimated percentage of successful experiences on construction or design projects?

☒ 20%

☒ 40%

☒ 60%

☒ 80%

☒ 100%

7. Which of the following management position best describes you?

☒ Middle level management (Project Team Leader, Project Site Supervisor/Manager)

☒ Top management level (Project Manager Position, Design team leader, Resident Engineer, Owner)

☒ Project team members (Engineers, Architects working under middle level management)

8. Which of the following construction industry sub-sector is your affiliation?

 Consultant

 Contractor

 Client

9. The aggregate amount of construction projects managed throughout your experience. w

 Up to 10 mill USD

 11 – 20 mill USD

 21 – 30 mill USD

 31 – 40 mill USD

 larger than 40 mill USD

Appendix B: Construction Project Success Factor Assessment

Please respond to the following lists of statements based on your project management experience and about your project how important you feel in deciding the overall construction project success on corresponding importance and frequency scales. The factors as you perceived as being likely to enhance the construction project success on scale; 1 (Very low), 2 (Low), 3 (Average), 4 (High), and 5 (Very High). and the occurrence of factors as you perceived as being likely to enhance the construction project success on frequency scale; 1 (Never), 2 (Rarely), 3 (Sometimes), 4 (Often), 5 (Always).

10. Company's technical capabilities

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

11. Scope and work definition

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

12. Control system

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

13. Effective Site Management

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

14. Project manager Capabilities and Commitment

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

15. Company's Financial Strength

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | | Low | Average | High | |

| | Very Low | | | | Very High |
|---|---|---|---|---|---|
| Frequency Scale | ☒ Never | ☒ Rarely | ☒ Sometimes | ☒ Often | ☒ Always |

16. Planning efforts

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | ☒ Very Low | ☒ Low | ☒ Average | ☒ High | ☒ Very High |
| Frequency Scale | ☒ Never | ☒ Rarely | ☒ Sometimes | ☒ Often | ☒ Always |

17. Effective scheduling

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | ☒ Very Low | ☒ Low | ☒ Average | ☒ High | ☒ Very High |
| Frequency Scale | ☒ Never | ☒ Rarely | ☒ Sometimes | ☒ Often | ☒ Always |

18. Commitment to the project

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | ☒ Very Low | ☒ Low | ☒ Average | ☒ High | ☒ Very High |
| Frequency Scale | ☒ Never | ☒ Rarely | ☒ Sometimes | ☒ Often | ☒ Always |

19. Adequate project management technique

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | ☒ Very Low | ☒ Low | ☒ Average | ☒ High | ☒ Very High |
| Frequency Scale | ☒ Never | ☒ Rarely | ☒ Sometimes | ☒ Often | ☒ Always |

20. Adequacy of plans and specifications

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | ☒ Very Low | ☒ Low | ☒ Average | ☒ High | ☒ Very High |
| Frequency Scale | ☒ Never | ☒ Rarely | ☒ Sometimes | ☒ Often | ☒ Always |

21. Effective procurement and tendering methods

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | ☒ Very Low | ☒ Low | ☒ Average | ☒ High | ☒ Very High |
| Frequency Scale | ☒ Never | ☒ Rarely | ☒ Sometimes | ☒ Often | ☒ Always |

22. Client consultation and support

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | ☒ Very Low | ☒ Low | ☒ Average | ☒ High | ☒ Very High |
| Frequency Scale | ☒ Never | ☒ Rarely | ☒ Sometimes | ☒ Often | ☒ Always |

23. Effective communication between stakeholder

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

24. Top management support

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

25. Adequate risk analysis

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

26. Clarity of project mission

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

27. Effective technical review

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

28. Personnel selection and training

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

29. Completion of design at the construction start

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

30. Effective project briefing

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

31. Team motivation

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

32. Harsh climate conditions and environment

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

33.Political conflicts and corruption

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

34. Unforeseen conditions

| | | | | | |
|---|---|---|---|---|---|
| Importance Scale | Very Low | Low | Average | High | Very High |
| Frequency Scale | Never | Rarely | Sometimes | Often | Always |

# Appendix C: Project Management Maturity Assessment

Please respond to the following statements about your project management knowledge on scale -3 (Strongly Disagree), -2(Disagree), -1 (Slightly Disagree), 0 (No Opinion), 1 (Slightly Agree), +2 (Agree), +3 (Strongly Agree).

35. My company recognizes the need for project management. This need is recognized at all levels of management, including senior management.

| -3(Strongly Disagree) | -2(Disagree) | -1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

36. My company has a system in place to manage both cost and schedule. The project management maturity questionnaire system requires charge numbers and cost account codes. The system reports variances from planned targets.

| -3(Strongly Disagree) | -2(Disagree) | -1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

37. My company has recognized the benefits that are possible from implementing project management. These benefits have been recognized at all levels of management, including senior management.

| -3(Strongly Disagree) | -2(Disagree) | -1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

38. My company (or division) has a well-definable project management methodology using life cycle phases.

| -3(Strongly Disagree) | -2(Disagree) | -1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

39. Our executives visibly support project management through executive presentations, correspondence, and by occasionally attending project team meetings/briefings.

| -3(Strongly Disagree) | -2(Disagree) | -1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

40. My company is committed to quality up front planning. We try to do the best we can at planning.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

41. Our lower and middle-level line managers totally and visibly support the project management process.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

42. My company is doing everything possible to minimize “creeping” scope (i.e., scope changes) on our projects.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

43. Our line managers are committed not only to project management, but also to the promises made to project managers for deliverables.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

44. The executives in my organization have a good understanding of the principles of project management.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

45. My company has selected one or more project management software packages to be used as the project tracking system.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

46. Our lower and middle-level line managers have been trained and educated in project management.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

47. Our executives both understand project sponsorship and serve as project sponsors on selected projects.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

48. Our executives have recognized or identified the applications of project management to various parts of our business.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

49. My company has successfully integrated cost and schedule control together for both managing projects and reporting status.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

50. My company has developed a project management curriculum (i.e., more than one or two courses) to enhance the project management skills of our employees.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

51. Our executives have recognized what must be done in order to achieve maturity in project management.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

52. My company views and treats project management as a profession rather than a part-time assignment.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

53. Our lower and middle-level line managers are willing to release their employees for project management training.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

54. Our executives have demonstrated a willingness to change our way of doing business in order to mature in project management.

| - 3(Strongly Disagree) | - 2(Disagree) | - 1(Slightly Disagree) | 0(No Opinion) | 1(Slightly Agree) | 2(Agree) | 3(Strongly Agree) |
|---|---|---|---|---|---|---|
| | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ |

Appendix D: Frequency Tables for Demographic Variables

Table D1

*Frequency Table: Project Entity Affiliation*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Private | 92 | 47.7 | 47.9 | 47.9 |
| | Public | 96 | 49.7 | 50.0 | 97.9 |
| | Other | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 192 | 99.5 | 100.0 | |
| Missing | System | 1 | .5 | | |
| Total | | 193 | 100.0 | | |

Table D2

*Frequency Table: Professional Certificate Registration*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Architecture | 8 | 4.1 | 4.1 | 4.1 |
| | Engineering | 64 | 33.2 | 33.2 | 37.3 |
| | Management | 24 | 12.4 | 12.4 | 49.7 |
| | Design | 7 | 3.6 | 3.6 | 53.4 |
| | Construction | 87 | 45.1 | 45.1 | 98.4 |
| | NA | 3 | 1.6 | 1.6 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table D3

*Frequency Table: Age*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 21-30 years | 14 | 7.3 | 7.3 | 7.3 |
| | 31- 40 years | 71 | 36.8 | 36.8 | 44.0 |
| | 41-50 years | 82 | 42.5 | 42.5 | 86.5 |
| | 51 and above | 26 | 13.5 | 13.5 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table D4

*Frequency Table: Highest Education Level*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Bachelor's degree | 79 | 40.9 | 40.9 | 40.9 |
| | Master's Degree | 104 | 53.9 | 53.9 | 94.8 |
| | Doctorate degree | 9 | 4.7 | 4.7 | 99.5 |
| | Other | 1 | .5 | .5 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table D5

*Frequency Table: Construction or Design Project Management Experience*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Less than 4 years | 5 | 2.6 | 2.6 | 2.6 |
| | 5-10 Years | 48 | 24.9 | 24.9 | 27.5 |
| | 11-15 Years | 50 | 25.9 | 25.9 | 53.4 |
| | 16-20 Years | 43 | 22.3 | 22.3 | 75.6 |
| | Above 20 years | 47 | 24.4 | 24.4 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table D6

*Frequency Table: Project Success Rate*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 20% | 14 | 7.3 | 7.3 | 7.3 |
| | 40% | 25 | 13.0 | 13.0 | 20.2 |
| | 60% | 28 | 14.5 | 14.5 | 34.7 |
| | 80% | 64 | 33.2 | 33.2 | 67.9 |
| | 100% | 62 | 32.1 | 32.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table D7

*Frequency Table: Project Management Position*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Top management level (Project Manager Position, Design team leader, Resident Engineer, Owner) | 157 | 81.3 | 81.3 | 81.3 |
| | Middle level management (Project Team Leader, Project Site Supervisor/Manager) | 30 | 15.5 | 15.5 | 96.9 |
| | Project team members (Engineers, Architects working under middle level management) | 6 | 3.1 | 3.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table D8

*Frequency Table: Construction Industry Sub-Sector Affiliation*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Consultant | 48 | 24.9 | 24.9 | 24.9 |
| | Contractor | 100 | 51.8 | 51.8 | 76.7 |
| | Client | 45 | 23.3 | 23.3 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table D9

*Frequency Table: Aggregate Amount of Construction Projects Managed as Project Manager*

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Up to 10 mill USD | 18 | 9.3 | 9.3 | 9.8 |
| 11 – 20 mill USD | 18 | 9.3 | 9.3 | 19.2 |
| 21 – 30 mill USD | 25 | 13.0 | 13.0 | 32.1 |
| 31 – 40 mill USD | 17 | 8.8 | 8.8 | 40.9 |
| larger than 40 mill USD | 114 | 59.1 | 59.1 | 100.0 |
| Total | 193 | 100.0 | 100.0 | |

Appendix E: Cronbach's Alpha for Dependent and Independent Variable

| Variable | Cronbach's Alpha | *N* of Items |
|---|---|---|
| Project success factors measured in important scale | .913 | 25 |
| Project success factors measured in frequency scale | .811 | 25 |
| Project management maturity level scale | .978 | 20 |

# Appendix F: ANOVA test for Project Success Factors

Table F1

*ANOVA: Project Success Factors on Importance Scale*

| | | Sum of Squares | *df* | Mean Square | *F* | Sig. |
|---|---|---|---|---|---|---|
| Company's technical capabilities | Between Groups | 1.326 | 2 | .663 | 1.446 | .238 |
| | Within Groups | 87.119 | 190 | .459 | | |
| | Total | 88.446 | 192 | | | |
| Scope and work definition | Between Groups | 1.882 | 2 | .941 | 2.042 | .133 |
| | Within Groups | 87.538 | 190 | .461 | | |
| | Total | 89.420 | 192 | | | |
| Control system | Between Groups | 6.029 | 2 | 3.015 | 4.653 | .011 |
| | Within Groups | 123.090 | 190 | .648 | | |
| | Total | 129.119 | 192 | | | |
| Effective site management | Between Groups | 6.831 | 2 | 3.415 | 5.512 | .005 |
| | Within Groups | 117.739 | 190 | .620 | | |
| | Total | 124.570 | 192 | | | |
| Project manager capabilities and commitment | Between Groups | 2.269 | 2 | 1.134 | 2.096 | .126 |
| | Within Groups | 102.840 | 190 | .541 | | |
| | Total | 105.109 | 192 | | | |
| Company's financial strength | Between Groups | 8.505 | 2 | 4.252 | 5.204 | .006 |
| | Within Groups | 155.257 | 190 | .817 | | |
| | Total | 163.762 | 192 | | | |
| Planning efforts | Between Groups | 5.386 | 2 | 2.693 | 4.044 | .019 |
| | Within Groups | 126.521 | 190 | .666 | | |
| | Total | 131.907 | 192 | | | |
| Effective scheduling | Between Groups | 4.892 | 2 | 2.446 | 2.930 | .056 |
| | Within Groups | 158.590 | 190 | .835 | | |
| | Total | 163.482 | 192 | | | |
| Commitment to the project | Between Groups | 6.991 | 2 | 3.495 | 5.360 | .005 |
| | Within Groups | 123.900 | 190 | .652 | | |
| | Total | 130.891 | 192 | | | |
| Adequate project management technique | Between Groups | 4.415 | 2 | 2.207 | .990 | .373 |
| | Within Groups | 419.041 | 188 | 2.229 | | |
| | Total | 423.455 | 190 | | | |
| Adequacy of plans | Between Groups | 18.113 | 2 | 9.056 | 3.877 | .022 |

| | | | | | | |
|---|---|---|---|---|---|---|
| and specifications | Within Groups | 443.867 | 190 | 2.336 | | |
| | Total | 461.979 | 192 | | | |
| Effective | Between Groups | 4.507 | 2 | 2.253 | 2.748 | .067 |
| procurement and | Within Groups | 155.784 | 190 | .820 | | |
| tendering methods | Total | 160.290 | 192 | | | |
| Client consultation | Between Groups | 1.612 | 2 | .806 | 1.132 | .324 |
| and support | Within Groups | 135.228 | 190 | .712 | | |
| | Total | 136.839 | 192 | | | |
| Effective | Between Groups | 1.679 | 2 | .839 | .317 | .729 |
| communication | Within Groups | 500.066 | 189 | 2.646 | | |
| between stakeholder | Total | 501.745 | 191 | | | |
| Top management | Between Groups | 2.281 | 2 | 1.141 | .471 | .625 |
| support | Within Groups | 460.589 | 190 | 2.424 | | |
| | Total | 462.870 | 192 | | | |
| Adequate risk | Between Groups | .370 | 2 | .185 | .187 | .830 |
| analysis | Within Groups | 188.189 | 190 | .990 | | |
| | Total | 188.560 | 192 | | | |
| Clarity of project | Between Groups | 2.138 | 2 | 1.069 | .432 | .650 |
| mission | Within Groups | 470.153 | 190 | 2.474 | | |
| | Total | 472.290 | 192 | | | |
| Effective technical | Between Groups | 1.768 | 2 | .884 | .358 | .700 |
| review | Within Groups | 469.351 | 190 | 2.470 | | |
| | Total | 471.119 | 192 | | | |
| Personnel selection | Between Groups | 4.884 | 2 | 2.442 | .574 | .564 |
| and training | Within Groups | 807.862 | 190 | 4.252 | | |
| | Total | 812.746 | 192 | | | |
| Completion of design | Between Groups | 2.078 | 2 | 1.039 | .372 | .690 |
| at the construction | Within Groups | 530.917 | 190 | 2.794 | | |
| start | Total | 532.995 | 192 | | | |
| Effective project | Between Groups | .183 | 2 | .091 | .037 | .964 |
| briefing | Within Groups | 474.657 | 190 | 2.498 | | |
| | Total | 474.839 | 192 | | | |
| Team motivation | Between Groups | 2.366 | 2 | 1.183 | .447 | .640 |
| | Within Groups | 502.888 | 190 | 2.647 | | |
| | Total | 505.254 | 192 | | | |
| Harsh climate | Between Groups | 5.112 | 2 | 2.556 | .760 | .469 |
| conditions and | Within Groups | 638.847 | 190 | 3.362 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| environment | Total | 643.959 | 192 | | | |
| Political conflicts | Between Groups | 23.059 | 2 | 11.529 | 2.930 | .056 |
| and corruption | Within Groups | 747.604 | 190 | 3.935 | | |
| | Total | 770.663 | 192 | | | |
| Unforeseen condition | Between Groups | 33.739 | 2 | 16.869 | 3.352 | .037 |
| | Within Groups | 956.334 | 190 | 5.033 | | |
| | Total | 990.073 | 192 | | | |

Table F2

*Post hoc test Tukey HSD: Project Success Factors on Importance Scale*

| Dependent Variable | (I) Which of the following construction industry sub-sector is your affiliation? | (J) Which of the following construction industry sub-sector is your affiliation? | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval Lower Bound | Upper Bound |
|---|---|---|---|---|---|---|---|
| Company's technical capabilities | Consultant | Contractor | -.069 | .119 | .830 | -.35 | .21 |
| | | Client | .137 | .141 | .591 | -.19 | .47 |
| | Contractor | Consultant | .069 | .119 | .830 | -.21 | .35 |
| | | Client | .207 | .122 | .208 | -.08 | .49 |
| | Client | Consultant | -.137 | .141 | .591 | -.47 | .19 |
| | | Contractor | -.207 | .122 | .208 | -.49 | .08 |
| Scope and work definition | Consultant | Contractor | .022 | .119 | .982 | -.26 | .30 |
| | | Client | .247 | .141 | .188 | -.09 | .58 |
| | Contractor | Consultant | -.022 | .119 | .982 | -.30 | .26 |
| | | Client | .226 | .122 | .156 | -.06 | .51 |
| | Client | Consultant | -.247 | .141 | .188 | -.58 | .09 |
| | | Contractor | -.226 | .122 | .156 | -.51 | .06 |
| Control system | Consultant | Contractor | -.235 | .141 | .222 | -.57 | .10 |
| | | Client | .192 | .167 | .486 | -.20 | .59 |
| | Contractor | Consultant | .235 | .141 | .222 | -.10 | .57 |
| | | Client | .427* | .144 | .010 | .09 | .77 |
| | Client | Consultant | -.192 | .167 | .486 | -.59 | .20 |
| | | Contractor | -.427* | .144 | .010 | -.77 | -.09 |
| Effective site management | Consultant | Contractor | -.334* | .138 | .044 | -.66 | -.01 |
| | | Client | .079 | .163 | .879 | -.31 | .47 |
| | Contractor | Consultant | .334* | .138 | .044 | .01 | .66 |
| | | Client | .413* | .141 | .011 | .08 | .75 |
| | Client | Consultant | -.079 | .163 | .879 | -.47 | .31 |
| | | Contractor | -.413* | .141 | .011 | -.75 | -.08 |
| Project manager capabilities and | Consultant | Contractor | -.190 | .129 | .307 | -.50 | .12 |
| | | Client | .050 | .153 | .943 | -.31 | .41 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| commitment | Contractor | Consultant | .190 | .129 | .307 | -.12 | .50 |
| | | Client | .240 | .132 | .167 | -.07 | .55 |
| | Client | Consultant | -.050 | .153 | .943 | -.41 | .31 |
| | | Contractor | -.240 | .132 | .167 | -.55 | .07 |
| Company's | Consultant | Contractor | -.196 | .159 | .435 | -.57 | .18 |
| financial strength | | Client | .326 | .188 | .193 | -.12 | .77 |
| | Contractor | Consultant | .196 | .159 | .435 | -.18 | .57 |
| | | Client | .522* | .162 | .004 | .14 | .91 |
| | Client | Consultant | -.326 | .188 | .193 | -.77 | .12 |
| | | Contractor | -.522* | .162 | .004 | -.91 | -.14 |
| Planning efforts | Consultant | Contractor | .012 | .143 | .996 | -.33 | .35 |
| | | Client | .403* | .169 | .048 | .00 | .80 |
| | Contractor | Consultant | -.012 | .143 | .996 | -.35 | .33 |
| | | Client | .391* | .146 | .022 | .05 | .74 |
| | Client | Consultant | -.403* | .169 | .048 | -.80 | .00 |
| | | Contractor | -.391* | .146 | .022 | -.74 | -.05 |
| Effective | Consultant | Contractor | -.190 | .160 | .464 | -.57 | .19 |
| scheduling | | Client | .200 | .190 | .543 | -.25 | .65 |
| | Contractor | Consultant | .190 | .160 | .464 | -.19 | .57 |
| | | Client | .390* | .164 | .048 | .00 | .78 |
| | Client | Consultant | -.200 | .190 | .543 | -.65 | .25 |
| | | Contractor | -.390* | .164 | .048 | -.78 | .00 |
| Commitment to | Consultant | Contractor | -.159 | .142 | .501 | -.49 | .18 |
| the project | | Client | .315 | .168 | .147 | -.08 | .71 |
| | Contractor | Consultant | .159 | .142 | .501 | -.18 | .49 |
| | | Client | .474* | .145 | .004 | .13 | .82 |
| | Client | Consultant | -.315 | .168 | .147 | -.71 | .08 |
| | | Contractor | -.474* | .145 | .004 | -.82 | -.13 |
| Adequate project | Consultant | Contractor | .329 | .264 | .428 | -.30 | .95 |
| management | | Client | .390 | .311 | .424 | -.35 | 1.13 |
| technique | Contractor | Consultant | -.329 | .264 | .428 | -.95 | .30 |
| | | Client | .061 | .268 | .972 | -.57 | .69 |
| | Client | Consultant | -.390 | .311 | .424 | -1.13 | .35 |
| | | Contractor | -.061 | .268 | .972 | -.69 | .57 |
| Adequacy of plans | Consultant | Contractor | .692* | .268 | .029 | .06 | 1.33 |
| and specifications | | Client | .742 | .317 | .053 | -.01 | 1.49 |
| | Contractor | Consultant | -.692* | .268 | .029 | -1.33 | -.06 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Client | .050 | .274 | .982 | -.60 | .70 |
| | Client | Consultant | -.742 | .317 | .053 | -1.49 | .01 |
| | | Contractor | -.050 | .274 | .982 | -.70 | .60 |
| Effective | Consultant | Contractor | -.026 | .159 | .986 | -.40 | .35 |
| procurement and | | Client | .343 | .188 | .164 | -.10 | .79 |
| tendering methods | Contractor | Consultant | .026 | .159 | .986 | -.35 | .40 |
| | | Client | .369 | .163 | .063 | -.02 | .75 |
| | Client | Consultant | -.343 | .188 | .164 | -.79 | .10 |
| | | Contractor | -.369 | .163 | .063 | -.75 | .02 |
| Client consultation | Consultant | Contractor | .208 | .148 | .340 | -.14 | .56 |
| and support | | Client | .064 | .175 | .929 | -.35 | .48 |
| | Contractor | Consultant | -.208 | .148 | .340 | -.56 | .14 |
| | | Client | -.144 | .151 | .607 | -.50 | .21 |
| | Client | Consultant | -.064 | .175 | .929 | -.48 | .35 |
| | | Contractor | .144 | .151 | .607 | -.21 | .50 |
| Effective | Consultant | Contractor | -.221 | .286 | .720 | -.90 | .45 |
| communication | | Client | -.203 | .338 | .820 | -1.00 | .59 |
| between | Contractor | Consultant | .221 | .286 | .720 | -.45 | .90 |
| stakeholder | | Client | .018 | .292 | .998 | -.67 | .71 |
| | Client | Consultant | .203 | .338 | .820 | -.59 | 1.00 |
| | | Contractor | -.018 | .292 | .998 | -.71 | .67 |
| Top management | Consultant | Contractor | -.234 | .273 | .668 | -.88 | .41 |
| support | | Client | -.037 | .323 | .993 | -.80 | .73 |
| | Contractor | Consultant | .234 | .273 | .668 | -.41 | .88 |
| | | Client | .197 | .279 | .762 | -.46 | .86 |
| | Client | Consultant | .037 | .323 | .993 | -.73 | .80 |
| | | Contractor | -.197 | .279 | .762 | -.86 | .46 |
| Adequate risk | Consultant | Contractor | .001 | .175 | 1.000 | -.41 | .41 |
| analysis | | Client | .104 | .207 | .869 | -.38 | .59 |
| | Contractor | Consultant | -.001 | .175 | 1.000 | -.41 | .41 |
| | | Client | .103 | .179 | .832 | -.32 | .53 |
| | Client | Consultant | -.104 | .207 | .869 | -.59 | .38 |
| | | Contractor | -.103 | .179 | .832 | -.53 | .32 |
| Clarity of project | Consultant | Contractor | -.047 | .276 | .984 | -.70 | .60 |
| mission | | Client | .212 | .326 | .792 | -.56 | .98 |
| | Contractor | Consultant | .047 | .276 | .984 | -.60 | .70 |
| | | Client | .260 | .282 | .628 | -.41 | .93 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Client | Consultant | -.212 | .326 | .792 | -.98 | .56 |
| | | Contractor | -.260 | .282 | .628 | -.93 | .41 |
| Effective technical | Consultant | Contractor | -.182 | .276 | .788 | -.83 | .47 |
| review | | Client | .019 | .326 | .998 | -.75 | .79 |
| | Contractor | Consultant | .182 | .276 | .788 | -.47 | .83 |
| | | Client | .201 | .282 | .756 | -.47 | .87 |
| | Client | Consultant | -.019 | .326 | .998 | -.79 | .75 |
| | | Contractor | -.201 | .282 | .756 | -.87 | .47 |
| Personnel | Consultant | Contractor | -.362 | .362 | .577 | -1.22 | .49 |
| selection and | | Client | -.379 | .428 | .650 | -1.39 | .63 |
| training | Contractor | Consultant | .362 | .362 | .577 | -.49 | 1.22 |
| | | Client | -.017 | .370 | .999 | -.89 | .86 |
| | Client | Consultant | .379 | .428 | .650 | -.63 | 1.39 |
| | | Contractor | .017 | .370 | .999 | -.86 | .89 |
| Completion of | Consultant | Contractor | -.101 | .294 | .937 | -.79 | .59 |
| design at the | | Client | .157 | .347 | .893 | -.66 | .98 |
| construction start | Contractor | Consultant | .101 | .294 | .937 | -.59 | .79 |
| | | Client | .258 | .300 | .667 | -.45 | .97 |
| | Client | Consultant | -.157 | .347 | .893 | -.98 | .66 |
| | | Contractor | -.258 | .300 | .667 | -.97 | .45 |
| Effective project | Consultant | Contractor | -.027 | .278 | .995 | -.68 | .63 |
| briefing | | Client | .050 | .328 | .987 | -.72 | .82 |
| | Contractor | Consultant | .027 | .278 | .995 | -.63 | .68 |
| | | Client | .077 | .284 | .961 | -.59 | .75 |
| | Client | Consultant | -.050 | .328 | .987 | -.82 | .72 |
| | | Contractor | -.077 | .284 | .961 | -.75 | .59 |
| Team motivation | Consultant | Contractor | -.113 | .286 | .917 | -.79 | .56 |
| | | Client | .161 | .338 | .882 | -.64 | .96 |
| | Contractor | Consultant | .113 | .286 | .917 | -.56 | .79 |
| | | Client | .274 | .292 | .616 | -.42 | .96 |
| | Client | Consultant | -.161 | .338 | .882 | -.96 | .64 |
| | | Contractor | -.274 | .292 | .616 | -.96 | .42 |
| Harsh climate | Consultant | Contractor | .252 | .322 | .713 | -.51 | 1.01 |
| conditions and | | Client | -.126 | .380 | .941 | -1.03 | .77 |
| environment | Contractor | Consultant | -.252 | .322 | .713 | -1.01 | .51 |
| | | Client | -.379 | .329 | .484 | -1.16 | .40 |
| | Client | Consultant | .126 | .380 | .941 | -.77 | 1.03 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Contractor | .379 | .329 | .484 | -.40 | 1.16 |
| Political conflicts | Consultant | Contractor | .470 | .348 | .370 | -.35 | 1.29 |
| and corruption | | Client | -.361 | .412 | .655 | -1.33 | .61 |
| | Contractor | Consultant | -.470 | .348 | .370 | -1.29 | .35 |
| | | Client | -.831 | .356 | .054 | -1.67 | .01 |
| | Client | Consultant | .361 | .412 | .655 | -.61 | 1.33 |
| | | Contractor | .831 | .356 | .054 | -.01 | 1.67 |
| Unforeseen | Consultant | Contractor | .376 | .394 | .607 | -.55 | 1.31 |
| condition | | Client | -.665 | .466 | .328 | -1.76 | .43 |
| | Contractor | Consultant | -.376 | .394 | .607 | -1.31 | .55 |
| | | Client | -1.041* | .403 | .028 | -1.99 | -.09 |
| | Client | Consultant | .665 | .466 | .328 | -.43 | 1.76 |
| | | Contractor | 1.041* | .403 | .028 | .09 | 1.99 |

*. The mean difference is significant at the 0.05 level.

Table F3

*ANOVA: Project Success Factors on Frequency Scale*

| | | Sum of Squares | *df* | Mean Square | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Company's | Between Groups | 6.376 | 2 | 3.188 | .344 | .709 |
| technical | Within Groups | 1761.614 | 190 | 9.272 | | |
| capabilities | Total | 1767.990 | 192 | | | |
| Scope and work | Between Groups | 10.420 | 2 | 5.210 | 1.031 | .359 |
| definition | Within Groups | 960.450 | 190 | 5.055 | | |
| | Total | 970.870 | 192 | | | |
| Control system | Between Groups | 12.133 | 2 | 6.067 | 1.154 | .317 |
| | Within Groups | 998.447 | 190 | 5.255 | | |
| | Total | 1010.580 | 192 | | | |
| Effective site | Between Groups | 15.145 | 2 | 7.573 | 1.479 | .231 |
| management | Within Groups | 967.834 | 189 | 5.121 | | |
| | Total | 982.979 | 191 | | | |
| Project manager | Between Groups | 15.942 | 2 | 7.971 | 1.576 | .209 |
| capabilities and | Within Groups | 960.752 | 190 | 5.057 | | |
| commitment | Total | 976.694 | 192 | | | |
| Company's | Between Groups | 29.751 | 2 | 14.875 | 1.560 | .213 |
| financial strength | Within Groups | 1811.534 | 190 | 9.534 | | |
| | Total | 1841.285 | 192 | | | |
| Planning efforts | Between Groups | 7.298 | 2 | 3.649 | .692 | .502 |
| | Within Groups | 996.369 | 189 | 5.272 | | |
| | Total | 1003.667 | 191 | | | |
| Effective | Between Groups | 11.227 | 2 | 5.614 | 1.064 | .347 |
| scheduling | Within Groups | 1002.027 | 190 | 5.274 | | |
| | Total | 1013.254 | 192 | | | |
| Commitment to the | Between Groups | 6.191 | 2 | 3.096 | 4.035 | .019 |
| project | Within Groups | 145.788 | 190 | .767 | | |
| | Total | 151.979 | 192 | | | |
| Adequate project | Between Groups | 8.035 | 2 | 4.018 | .404 | .668 |
| management | Within Groups | 1818.960 | 183 | 9.940 | | |
| technique | Total | 1826.995 | 185 | | | |
| Adequacy of plans | Between Groups | .895 | 2 | .447 | .493 | .612 |
| and specifications | Within Groups | 171.584 | 189 | .908 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Total | 172.479 | 191 | | | |
| Effective | Between Groups | 1.187 | 2 | .594 | .600 | .550 |
| procurement and | Within Groups | 187.974 | 190 | .989 | | |
| tendering methods | Total | 189.161 | 192 | | | |
| Client consultation | Between Groups | 1.390 | 2 | .695 | .834 | .436 |
| and support | Within Groups | 158.330 | 190 | .833 | | |
| | Total | 159.720 | 192 | | | |
| Effective | Between Groups | 1.420 | 2 | .710 | .736 | .480 |
| communication | Within Groups | 182.325 | 189 | .965 | | |
| between stakeholder | Total | 183.745 | 191 | | | |
| Top management | Between Groups | .162 | 2 | .081 | .093 | .912 |
| support | Within Groups | 164.838 | 189 | .872 | | |
| | Total | 165.000 | 191 | | | |
| Adequate risk | Between Groups | 6.555 | 2 | 3.278 | .575 | .564 |
| analysis | Within Groups | 1082.750 | 190 | 5.699 | | |
| | Total | 1089.306 | 192 | | | |
| Clarity of project | Between Groups | 3.505 | 2 | 1.752 | .321 | .726 |
| mission | Within Groups | 1036.827 | 190 | 5.457 | | |
| | Total | 1040.332 | 192 | | | |
| Effective technical | Between Groups | 3.824 | 2 | 1.912 | .344 | .709 |
| review | Within Groups | 1050.171 | 189 | 5.556 | | |
| | Total | 1053.995 | 191 | | | |
| Personnel selection | Between Groups | 7.604 | 2 | 3.802 | .694 | .501 |
| and training | Within Groups | 1040.489 | 190 | 5.476 | | |
| | Total | 1048.093 | 192 | | | |
| Completion of | Between Groups | 5.661 | 2 | 2.831 | .489 | .614 |
| design at the | Within Groups | 1087.616 | 188 | 5.785 | | |
| construction start | Total | 1093.277 | 190 | | | |
| Effective project | Between Groups | 2.054 | 2 | 1.027 | .186 | .831 |
| briefing | Within Groups | 1051.334 | 190 | 5.533 | | |
| | Total | 1053.389 | 192 | | | |
| Team motivation | Between Groups | 3.354 | 2 | 1.677 | .307 | .736 |
| | Within Groups | 1038.978 | 190 | 5.468 | | |
| | Total | 1042.332 | 192 | | | |
| Harsh climate | Between Groups | 1.479 | 2 | .739 | .122 | .886 |
| conditions and | Within Groups | 1154.894 | 190 | 6.078 | | |
| environment | Total | 1156.373 | 192 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Political conflicts | Between Groups | 11.169 | 2 | 5.584 | .818 | .443 |
| and corruption | Within Groups | 1296.738 | 190 | 6.825 | | |
| | Total | 1307.907 | 192 | | | |
| Unforeseen | Between Groups | 1.902 | 2 | .951 | .152 | .859 |
| condition | Within Groups | 1182.911 | 189 | 6.259 | | |
| | Total | 1184.813 | 191 | | | |

Table F4

*Post hoc test Tukey HSD: Project Success Factors on Frequency Scale*

| Dependent Variable | (I) Which of the following construction industry subsector is your affiliation? | (J) Which of the following construction industry subsector is your affiliation? | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval Lower Bound | 95% Confidence Interval Upper Bound |
|---|---|---|---|---|---|---|---|
| Company's technical capabilities | Consultant | Contractor | -.331 | .535 | .810 | -1.59 | .93 |
| | | Client | -.510 | .632 | .699 | -2.00 | .98 |
| | Contractor | Consultant | .331 | .535 | .810 | -.93 | 1.59 |
| | | Client | -.179 | .547 | .943 | -1.47 | 1.11 |
| | Client | Consultant | .510 | .632 | .699 | -.98 | 2.00 |
| | | Contractor | .179 | .547 | .943 | -1.11 | 1.47 |
| Scope and work definition | Consultant | Contractor | -.241 | .395 | .815 | -1.17 | .69 |
| | | Client | .335 | .467 | .753 | -.77 | 1.44 |
| | Contractor | Consultant | .241 | .395 | .815 | -.69 | 1.17 |
| | | Client | .576 | .404 | .330 | -.38 | 1.53 |
| | Client | Consultant | -.335 | .467 | .753 | -1.44 | .77 |
| | | Contractor | -.576 | .404 | .330 | -1.53 | .38 |
| Control system | Consultant | Contractor | -.419 | .403 | .552 | -1.37 | .53 |
| | | Client | .149 | .476 | .948 | -.98 | 1.27 |
| | Contractor | Consultant | .419 | .403 | .552 | -.53 | 1.37 |
| | | Client | .568 | .411 | .354 | -.40 | 1.54 |
| | Client | Consultant | -.149 | .476 | .948 | -1.27 | .98 |
| | | Contractor | -.568 | .411 | .354 | -1.54 | .40 |
| Effective site management | Consultant | Contractor | -.507 | .397 | .411 | -1.45 | .43 |
| | | Client | .106 | .472 | .973 | -1.01 | 1.22 |
| | Contractor | Consultant | .507 | .397 | .411 | -.43 | 1.45 |
| | | Client | .613 | .409 | .295 | -.35 | 1.58 |
| | Client | Consultant | -.106 | .472 | .973 | -1.22 | 1.01 |
| | | Contractor | -.613 | .409 | .295 | -1.58 | .35 |
| Project manager capabilities and commitment | Consultant | Contractor | -.628 | .395 | .253 | -1.56 | .31 |
| | | Client | -.121 | .467 | .964 | -1.22 | .98 |
| | Contractor | Consultant | .628 | .395 | .253 | -.31 | 1.56 |
| | | Client | .507 | .404 | .422 | -.45 | 1.46 |
| | Client | Consultant | .121 | .467 | .964 | -.98 | 1.22 |
| | | Contractor | -.507 | .404 | .422 | -1.46 | .45 |
| Company's financial strength | Consultant | Contractor | -.685 | .542 | .418 | -1.97 | .60 |
| | | Client | .186 | .641 | .955 | -1.33 | 1.70 |
| | Contractor | Consultant | .685 | .542 | .418 | -.60 | 1.97 |
| | | Client | .871 | .554 | .260 | -.44 | 2.18 |
| | Client | Consultant | -.186 | .641 | .955 | -1.70 | 1.33 |
| | | Contractor | -.871 | .554 | .260 | -2.18 | .44 |
| Planning efforts | Consultant | Contractor | -.231 | .406 | .836 | -1.19 | .73 |
| | | Client | .245 | .479 | .865 | -.89 | 1.38 |
| | Contractor | Consultant | .231 | .406 | .836 | -.73 | 1.19 |
| | | Client | .477 | .412 | .481 | -.50 | 1.45 |
| | Client | Consultant | -.245 | .479 | .865 | -1.38 | .89 |
| | | Contractor | -.477 | .412 | .481 | -1.45 | .50 |
| Effective scheduling | Consultant | Contractor | -.462 | .403 | .488 | -1.41 | .49 |
| | | Client | .042 | .477 | .996 | -1.08 | 1.17 |
| | Contractor | Consultant | .462 | .403 | .488 | -.49 | 1.41 |
| | | Client | .503 | .412 | .442 | -.47 | 1.48 |
| | Client | Consultant | -.042 | .477 | .996 | -1.17 | 1.08 |
| | | Contractor | -.503 | .412 | .442 | -1.48 | .47 |
| Commitment to the project | Consultant | Contractor | -.305 | .154 | .119 | -.67 | .06 |
| | | Client | .097 | .182 | .854 | -.33 | .53 |
| | Contractor | Consultant | .305 | .154 | .119 | -.06 | .67 |
| | | Client | .402* | .157 | .030 | .03 | .77 |
| | Client | Consultant | -.097 | .182 | .854 | -.53 | .33 |
| | | Contractor | -.402* | .157 | .030 | -.77 | -.03 |
| Adequate | Consultant | Contractor | .251 | .562 | .896 | -1.08 | 1.58 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| project management technique | Contractor | Client | .611 | .682 | .643 | -1.00 | 2.22 |
| | | Consultant | -.251 | .562 | .896 | -1.58 | 1.08 |
| | Client | Client | .360 | .590 | .815 | -1.03 | 1.75 |
| | | Consultant | -.611 | .682 | .643 | -2.22 | 1.00 |
| Adequacy of plans and specifications | Consultant | Contractor | -.360 | .590 | .815 | -1.75 | 1.03 |
| | | Contractor | .132 | .169 | .713 | -.27 | .53 |
| | Contractor | Client | -.009 | .199 | .999 | -.48 | .46 |
| | | Consultant | -.132 | .169 | .713 | -.53 | .27 |
| | Client | Client | -.141 | .171 | .688 | -.55 | .26 |
| | | Consultant | .009 | .199 | .999 | -.46 | .48 |
| | | Contractor | .141 | .171 | .688 | -.26 | .55 |
| Effective procurement and tendering methods | Consultant | Contractor | -.171 | .175 | .592 | -.58 | .24 |
| | | Client | -.032 | .206 | .987 | -.52 | .46 |
| | Contractor | Consultant | .171 | .175 | .592 | -.24 | .58 |
| | | Client | .139 | .179 | .717 | -.28 | .56 |
| | Client | Consultant | .032 | .206 | .987 | -.46 | .52 |
| | | Contractor | -.139 | .179 | .717 | -.56 | .28 |
| Client consultation and support | Consultant | Contractor | .114 | .160 | .757 | -.26 | .49 |
| | | Client | -.090 | .189 | .882 | -.54 | .36 |
| | Contractor | Consultant | -.114 | .160 | .757 | -.49 | .26 |
| | | Client | -.204 | .164 | .427 | -.59 | .18 |
| | Client | Consultant | .090 | .189 | .882 | -.36 | .54 |
| | | Contractor | .204 | .164 | .427 | -.18 | .59 |
| Effective communication between stakeholder | Consultant | Contractor | -.100 | .173 | .830 | -.51 | .31 |
| | | Client | -.246 | .204 | .451 | -.73 | .24 |
| | Contractor | Consultant | .100 | .173 | .830 | -.31 | .51 |
| | | Client | -.145 | .177 | .689 | -.56 | .27 |
| | Client | Consultant | .246 | .204 | .451 | -.24 | .73 |
| | | Contractor | .145 | .177 | .689 | -.27 | .56 |
| Top management support | Consultant | Contractor | -.043 | .164 | .963 | -.43 | .35 |
| | | Client | -.083 | .194 | .903 | -.54 | .37 |
| | Contractor | Consultant | .043 | .164 | .963 | -.35 | .43 |
| | | Client | -.040 | .168 | .969 | -.44 | .36 |
| | Client | Consultant | .083 | .194 | .903 | -.37 | .54 |
| | | Contractor | .040 | .168 | .969 | -.36 | .44 |
| Adequate risk analysis | Consultant | Contractor | -.449 | .419 | .533 | -1.44 | .54 |
| | | Client | -.285 | .495 | .834 | -1.45 | .89 |
| | Contractor | Consultant | .449 | .419 | .533 | -.54 | 1.44 |
| | | Client | .164 | .429 | .922 | -.85 | 1.18 |
| | Client | Consultant | .285 | .495 | .834 | -.89 | 1.45 |
| | | Contractor | -.164 | .429 | .922 | -1.18 | .85 |
| Clarity of project mission | Consultant | Contractor | -.228 | .410 | .843 | -1.20 | .74 |
| | | Client | .075 | .485 | .987 | -1.07 | 1.22 |
| | Contractor | Consultant | .228 | .410 | .843 | -.74 | 1.20 |
| | | Client | .303 | .419 | .750 | -.69 | 1.29 |
| | Client | Consultant | -.075 | .485 | .987 | -1.22 | 1.07 |
| | | Contractor | -.303 | .419 | .750 | -1.29 | .69 |
| Effective technical review | Consultant | Contractor | -.300 | .417 | .753 | -1.28 | .69 |
| | | Client | -.037 | .492 | .997 | -1.20 | 1.12 |
| | Contractor | Consultant | .300 | .417 | .753 | -.69 | 1.28 |
| | | Client | .262 | .423 | .810 | -.74 | 1.26 |
| | Client | Consultant | .037 | .492 | .997 | -1.12 | 1.20 |
| | | Contractor | -.262 | .423 | .810 | -1.26 | .74 |
| Personnel selection and training | Consultant | Contractor | -.484 | .411 | .468 | -1.45 | .49 |
| | | Client | -.321 | .486 | .786 | -1.47 | .83 |
| | Contractor | Consultant | .484 | .411 | .468 | -.49 | 1.45 |
| | | Client | .163 | .420 | .920 | -.83 | 1.16 |
| | Client | Consultant | .321 | .486 | .786 | -.83 | 1.47 |
| | | Contractor | -.163 | .420 | .920 | -1.16 | .83 |
| Completion of design at the construction start | Consultant | Contractor | -.393 | .429 | .631 | -1.40 | .62 |
| | | Client | -.116 | .504 | .971 | -1.31 | 1.08 |
| | Contractor | Consultant | .393 | .429 | .631 | -.62 | 1.40 |
| | | Client | .277 | .432 | .798 | -.74 | 1.30 |
| | Client | Consultant | .116 | .504 | .971 | -1.08 | 1.31 |
| | | Contractor | -.277 | .432 | .798 | -1.30 | .74 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Effective project briefing | Consultant | Contractor | -.252 | .413 | .815 | -1.23 | .72 |
| | | Client | -.169 | .488 | .936 | -1.32 | .98 |
| | Contractor | Consultant | .252 | .413 | .815 | -.72 | 1.23 |
| | | Client | .082 | .422 | .979 | -.92 | 1.08 |
| | Client | Consultant | .169 | .488 | .936 | -.98 | 1.32 |
| | | Contractor | -.082 | .422 | .979 | -1.08 | .92 |
| Team motivation | Consultant | Contractor | -.283 | .411 | .770 | -1.25 | .69 |
| | | Client | -.339 | .485 | .765 | -1.49 | .81 |
| | Contractor | Consultant | .283 | .411 | .770 | -.69 | 1.25 |
| | | Client | -.056 | .420 | .990 | -1.05 | .94 |
| | Client | Consultant | .339 | .485 | .765 | -.81 | 1.49 |
| | | Contractor | .056 | .420 | .990 | -.94 | 1.05 |
| Harsh climate conditions and environment | Consultant | Contractor | -.208 | .433 | .880 | -1.23 | .81 |
| | | Client | -.186 | .512 | .930 | -1.39 | 1.02 |
| | Contractor | Consultant | .208 | .433 | .880 | -.81 | 1.23 |
| | | Client | .022 | .443 | .999 | -1.02 | 1.07 |
| | Client | Consultant | .186 | .512 | .930 | -1.02 | 1.39 |
| | | Contractor | -.022 | .443 | .999 | -1.07 | 1.02 |
| Political conflicts and corruption | Consultant | Contractor | -.013 | .459 | 1.000 | -1.10 | 1.07 |
| | | Client | -.578 | .542 | .536 | -1.86 | .70 |
| | Contractor | Consultant | .013 | .459 | 1.000 | -1.07 | 1.10 |
| | | Client | -.564 | .469 | .452 | -1.67 | .54 |
| | Client | Consultant | .578 | .542 | .536 | -.70 | 1.86 |
| | | Contractor | .564 | .469 | .452 | -.54 | 1.67 |
| Unforeseen condition | Consultant | Contractor | -.096 | .439 | .974 | -1.13 | .94 |
| | | Client | -.282 | .522 | .851 | -1.52 | .95 |
| | Contractor | Consultant | .096 | .439 | .974 | -.94 | 1.13 |
| | | Client | -.186 | .453 | .911 | -1.26 | .88 |
| | Client | Consultant | .282 | .522 | .851 | -.95 | 1.52 |
| | | Contractor | .186 | .453 | .911 | -.88 | 1.26 |

Appendix G: Crosstabulation for Project Success Factors Measured in Importance Scale

Table G1

*Crosstabulation: Company's Technical Capabilities With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Company's technical capabilities | Low | 0 | 0 | 1 | 1 |
| | Average | 5 | 8 | 9 | 22 |
| | High | 25 | 50 | 18 | 93 |
| | Very High | 18 | 42 | 17 | 77 |
| Total | | 48 | 100 | 45 | 193 |

Table G2

*Crosstabulation: Scope and Work Definition With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Scope and work definition | Low | 1 | 2 | 1 | 4 |
| | Average | 5 | 7 | 4 | 16 |
| | High | 21 | 53 | 32 | 106 |
| | Very High | 21 | 38 | 8 | 67 |
| Total | | 48 | 100 | 45 | 193 |

Table G3

*Crosstabulation: Control System With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Control system | Very Low | 0 | 0 | 1 | 1 |
| | Low | 2 | 2 | 3 | 7 |
| | Average | 8 | 5 | 9 | 22 |
| | High | 20 | 48 | 17 | 85 |
| | Very High | 18 | 45 | 15 | 78 |
| Total | | 48 | 100 | 45 | 193 |

Table G4

*Crosstabulation: Effective Site Management With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective site management | Low | 3 | 1 | 4 | 8 |
| | Average | 7 | 6 | 5 | 18 |
| | High | 18 | 37 | 20 | 75 |
| | Very High | 20 | 56 | 16 | 92 |
| Total | | 48 | 100 | 45 | 193 |

Table G5

*Crosstabulation: Project Manager Capabilities and Commitment With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Project manager capabilities and commitment | Low | 1 | 1 | 0 | 2 |
| | Average | 7 | 8 | 10 | 25 |
| | High | 19 | 37 | 16 | 72 |
| | Very High | 21 | 54 | 19 | 94 |
| Total | | 48 | 100 | 45 | 193 |

Table G6

*Crosstabulation: Company's Financial Strength With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Company's financial strength | Very Low | 1 | 0 | 0 | 1 |
| | Low | 2 | 4 | 7 | 13 |
| | Average | 8 | 10 | 8 | 26 |
| | High | 17 | 38 | 18 | 73 |
| | Very High | 20 | 48 | 12 | 80 |
| Total | | 48 | 100 | 45 | 193 |

Table G7

*Crosstabulation: Planning Efforts With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Planning efforts | Very Low | 0 | 0 | 1 | 1 |
| | Low | 2 | 2 | 6 | 10 |
| | Average | 4 | 6 | 5 | 15 |
| | High | 20 | 54 | 18 | 92 |
| | Very High | 22 | 38 | 15 | 75 |
| Total | | 48 | 100 | 45 | 193 |

Table G8

*Crosstabulation: Effective Scheduling With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective scheduling | Very Low | 0 | 1 | 0 | 1 |
| | Low | 5 | 3 | 7 | 15 |
| | Average | 8 | 10 | 8 | 26 |
| | High | 17 | 48 | 17 | 82 |
| | Very High | 18 | 38 | 13 | 69 |
| Total | | 48 | 100 | 45 | 193 |

Table G9

*Crosstabulation: Commitment to the Project With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Commitment to the project | Low | 4 | 3 | 2 | 9 |
| | Average | 4 | 6 | 9 | 19 |
| | High | 15 | 36 | 23 | 74 |
| | Very High | 25 | 55 | 11 | 91 |
| Total | | 48 | 100 | 45 | 193 |

Table G10

*Crosstabulation: Adequate Project Management Technique With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Adequate project management technique | Low | 1 | 1 | 2 | 4 |
| | Average | 8 | 11 | 4 | 23 |
| | High | 11 | 35 | 16 | 62 |
| | Very High | 26 | 52 | 23 | 101 |
| | Missing | 1 | 0 | 0 | 1 |
| Total | | 47 | 99 | 45 | 191 |

Table G11

*Crosstabulation: Adequacy of Plans and Specifications with Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Adequacy of plans and specifications | Very Low | 0 | 0 | 1 | 1 |
| | Low | 1 | 5 | 2 | 8 |
| | Average | 6 | 29 | 12 | 47 |
| | High | 24 | 42 | 20 | 86 |
| | Very High | 16 | 24 | 10 | 50 |
| | Missing | 1 | 0 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table G12

*Crosstabulation: Effective Procurement and Tendering Methods With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective procurement and tendering methods | Very Low | 0 | 0 | 1 | 1 |
| | Low | 4 | 6 | 6 | 16 |
| | Average | 10 | 26 | 15 | 51 |
| | High | 23 | 42 | 15 | 80 |
| | Very High | 11 | 26 | 8 | 45 |
| Total | | 48 | 100 | 45 | 193 |

Table G13

*Crosstabulation: Client Consultation and Support With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Client consultation and support | Low | 3 | 14 | 3 | 20 |
| | Average | 16 | 36 | 13 | 65 |
| | High | 21 | 36 | 26 | 83 |
| | Very High | 8 | 14 | 3 | 25 |
| Total | | 48 | 100 | 45 | 193 |

Table G14

*Crosstabulation: Effective Communication between Stakeholder With Construction industry affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective communication between stakeholder | Very Low | 0 | 1 | 0 | 1 |
| | Low | 5 | 8 | 3 | 16 |
| | Average | 16 | 31 | 11 | 58 |
| | High | 15 | 33 | 18 | 66 |
| | Very High | 12 | 25 | 13 | 50 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 99 | 45 | 192 |

Table G15

*Crosstabulation: Top Management Support With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Top management support | Very Low | 0 | 0 | 2 | 2 |
| | Low | 2 | 4 | 1 | 7 |
| | Average | 16 | 21 | 6 | 43 |
| | High | 15 | 50 | 25 | 90 |
| | Very High | 15 | 24 | 11 | 50 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table G16

*Crosstabulation: Adequate Risk Analysis With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Adequate risk analysis | Very Low | 1 | 1 | 2 | 4 |
| | Low | 7 | 10 | 5 | 22 |
| | Average | 6 | 21 | 8 | 35 |
| | High | 22 | 47 | 21 | 90 |
| | Very High | 12 | 21 | 9 | 42 |
| Total | | 48 | 100 | 45 | 193 |

Table G17

*Crosstabulation: Clarity of Project Mission With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Clarity of project mission | Very Low | 0 | 1 | 0 | 1 |
| | Low | 2 | 7 | 5 | 14 |
| | Average | 17 | 28 | 15 | 60 |
| | High | 17 | 50 | 18 | 85 |
| | Very High | 12 | 13 | 7 | 32 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table G18

*Crosstabulation: Effective Technical Review With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective technical review | Very Low | 0 | 0 | 1 | 1 |
| | Low | 5 | 7 | 4 | 16 |
| | Average | 13 | 29 | 10 | 52 |
| | High | 21 | 49 | 23 | 93 |
| | Very High | 9 | 14 | 7 | 30 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table G19

*Crosstabulation: Personnel Selection and Training With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Personnel selection and training | Very Low | 0 | 0 | 2 | 2 |
| | Low | 6 | 7 | 4 | 17 |
| | Average | 12 | 20 | 9 | 41 |
| | High | 21 | 51 | 21 | 93 |
| | Very High | 9 | 21 | 8 | 38 |
| | Missing | 0 | 1 | 1 | 2 |
| Total | | 48 | 100 | 45 | 193 |

Table G20

*Crosstabulation: Completion of Design at the Construction Start With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Completion of design at the construction start | Very Low | 0 | 3 | 3 | 6 |
| | Low | 7 | 8 | 2 | 17 |
| | Average | 5 | 14 | 8 | 27 |
| | High | 18 | 45 | 19 | 82 |
| | Very High | 18 | 29 | 13 | 60 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table G21

*Crosstabulation: Effective Project Briefing With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective project briefing | Very Low | 0 | 1 | 1 | 2 |
| | Low | 4 | 9 | 4 | 17 |
| | Average | 19 | 43 | 16 | 78 |
| | High | 18 | 39 | 18 | 75 |
| | Very High | 7 | 7 | 6 | 20 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table G22

*Crosstabulation: Team Motivation With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Team motivation | Very Low | 1 | 2 | 2 | 5 |
| | Low | 2 | 7 | 2 | 11 |
| | Average | 12 | 19 | 12 | 43 |
| | High | 18 | 47 | 18 | 83 |
| | Very High | 15 | 24 | 11 | 50 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table G23

*Crosstabulation: Harsh Climate Conditions and Environment With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Harsh climate conditions and environment | Very Low | 8 | 36 | 8 | 52 |
| | Low | 18 | 34 | 15 | 67 |
| | Average | 12 | 13 | 8 | 33 |
| | High | 7 | 14 | 11 | 32 |
| | Very High | 3 | 2 | 3 | 8 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table G24

*Crosstabulation: Political Conflicts and Corruption With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Political conflicts and corruption | Very Low | 15 | 46 | 9 | 70 |
| | Low | 7 | 24 | 7 | 38 |
| | Average | 9 | 9 | 8 | 26 |
| | High | 9 | 15 | 12 | 36 |
| | Very High | 8 | 5 | 9 | 22 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table G25

*Crosstabulation: Unforeseen Conditions With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Unforeseen conditions | Very Low | 10 | 30 | 6 | 46 |
| | Low | 11 | 41 | 11 | 63 |
| | Average | 16 | 19 | 11 | 46 |
| | High | 8 | 9 | 14 | 31 |
| | Very High | 3 | 0 | 2 | 5 |
| | Missing | 0 | 1 | 1 | 2 |
| Total | | 48 | 100 | 45 | 193 |

Appendix H: Crosstabulation for Project Success Factors Measured in Frequency Scale

Table H1

*Crosstabulation: Company's Technical Capabilities With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Company's technical capabilities | Rarely | 1 | 2 | 1 | 4 |
| | Sometimes | 10 | 17 | 14 | 41 |
| | Often | 26 | 57 | 20 | 103 |
| | Always | 11 | 23 | 9 | 43 |
| | Missing | 0 | 1 | 1 | 2 |
| Total | | 48 | 100 | 45 | 193 |

Table H2

*Crosstabulation: Scope and Work Definition With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Scope and work definition | Rarely | 1 | 5 | 3 | 9 |
| | Sometimes | 11 | 22 | 17 | 50 |
| | Often | 24 | 47 | 18 | 89 |
| | Always | 12 | 25 | 7 | 44 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table H3

*Crosstabulation: Control System With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Control system | Never | 2 | 0 | 1 | 3 |
| | Rarely | 3 | 5 | 8 | 16 |
| | Sometimes | 8 | 22 | 8 | 38 |
| | Often | 26 | 50 | 18 | 94 |
| | Always | 9 | 22 | 10 | 41 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table H4

*Crosstabulation: Effective Site Management With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective site management | Rarely | 4 | 3 | 6 | 13 |
| | Sometimes | 12 | 18 | 10 | 40 |
| | Often | 20 | 49 | 18 | 87 |
| | Always | 12 | 29 | 10 | 51 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 44 | 192 |

Table H5

*Crosstabulation: Project Manager Capabilities and Commitment With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Project manager capabilities and commitment | Never | 1 | 0 | 0 | 1 |
| | Rarely | 1 | 2 | 4 | 7 |
| | Sometimes | 17 | 16 | 9 | 42 |
| | Often | 16 | 46 | 18 | 80 |
| | Always | 13 | 35 | 14 | 62 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table H6

*Crosstabulation: Company's Financial Strength With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Company's financial strength | Never | 0 | 0 | 2 | 2 |
| | Rarely | 1 | 6 | 4 | 11 |
| | Sometimes | 15 | 21 | 13 | 49 |
| | Often | 21 | 40 | 13 | 74 |
| | Always | 11 | 31 | 13 | 55 |
| | Missing | 0 | 2 | 0 | 2 |
| Total | | 48 | 100 | 45 | 193 |

Table H7

*Crosstabulation: Planning Efforts With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Planning efforts | Never | 1 | 0 | 2 | 3 |
| | Rarely | 1 | 5 | 6 | 12 |
| | Sometimes | 9 | 22 | 7 | 38 |
| | Often | 23 | 48 | 17 | 88 |
| | Always | 13 | 24 | 13 | 50 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 47 | 100 | 45 | 192 |

Table H8

*Crosstabulation: Effective Scheduling With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective scheduling | Never | 3 | 0 | 1 | 4 |
| | Rarely | 2 | 5 | 6 | 13 |
| | Sometimes | 10 | 22 | 12 | 44 |
| | Often | 24 | 52 | 14 | 90 |
| | Always | 9 | 20 | 12 | 41 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table H9

*Crosstabulation: Commitment to the Project With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Commitment to the project | Never | 1 | 0 | 1 | 2 |
| | Rarely | 4 | 3 | 4 | 11 |
| | Sometimes | 9 | 13 | 8 | 30 |
| | Often | 20 | 47 | 23 | 90 |
| | Always | 14 | 37 | 9 | 60 |
| Total | | 48 | 100 | 45 | 193 |

Table H10

*Crosstabulation: Adequate Project Management Technique With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Adequate project management technique | Rarely | 6 | 5 | 4 | 15 |
| | Sometimes | 12 | 33 | 12 | 57 |
| | Often | 20 | 46 | 18 | 84 |
| | Always | 7 | 15 | 6 | 28 |
| | Missing | 1 | 1 | 0 | 2 |
| Total | | 46 | 100 | 40 | 186 |

Table H11

*Crosstabulation: Adequacy of Plans and Specifications With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Adequacy of plans and specifications | Rarely | 6 | 16 | 7 | 29 |
| | Sometimes | 11 | 27 | 9 | 47 |
| | Often | 21 | 41 | 19 | 81 |
| | Always | 9 | 16 | 10 | 35 |
| Total | | 47 | 100 | 45 | 192 |

Table H12

*Crosstabulation: Effective Procurement and Tendering Methods With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective procurement and tendering methods | Never | 4 | 0 | 1 | 5 |
| | Rarely | 4 | 9 | 8 | 21 |
| | Sometimes | 12 | 37 | 11 | 60 |
| | Often | 21 | 34 | 17 | 72 |
| | Always | 7 | 20 | 8 | 35 |
| Total | | 48 | 100 | 45 | 193 |

Table H13

*Crosstabulation: Client Consultation and Support With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Client consultation and support | Never | 0 | 1 | 0 | 1 |
| | Rarely | 12 | 24 | 4 | 40 |
| | Sometimes | 12 | 34 | 19 | 65 |
| | Often | 19 | 32 | 20 | 71 |
| | Always | 5 | 9 | 2 | 16 |
| Total | | 48 | 100 | 45 | 193 |

Table H14

*Crosstabulation: Effective Communication Between Stakeholder With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective communication between stakeholder | Never | 1 | 1 | 0 | 2 |
| | Rarely | 10 | 15 | 6 | 31 |
| | Sometimes | 15 | 37 | 14 | 66 |
| | Often | 15 | 30 | 17 | 62 |
| | Always | 7 | 16 | 8 | 31 |
| Total | | 48 | 99 | 45 | 192 |

Table H15

*Crosstabulation: Top Management Support With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Top management support | Never | 2 | 1 | 0 | 3 |
| | Rarely | 4 | 7 | 4 | 15 |
| | Sometimes | 19 | 35 | 15 | 69 |
| | Often | 10 | 41 | 18 | 69 |
| | Always | 13 | 15 | 8 | 36 |
| Total | | 48 | 99 | 45 | 192 |

Table H16

*Crosstabulation: Adequate Risk Analysis With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Adequate risk analysis | Never | 4 | 3 | 1 | 8 |
| | Rarely | 9 | 13 | 8 | 30 |
| | Sometimes | 14 | 35 | 11 | 60 |
| | Often | 12 | 35 | 15 | 62 |
| | Always | 9 | 13 | 10 | 32 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table H17

*Crosstabulation: Clarity of Project Mission With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Clarity of project mission | Never | 1 | 3 | 1 | 5 |
| | Rarely | 5 | 10 | 3 | 18 |
| | Sometimes | 19 | 40 | 18 | 77 |
| | Often | 13 | 29 | 20 | 62 |
| | Always | 10 | 17 | 3 | 30 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table H18

*Crosstabulation: Effective Technical Review With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective technical review | Never | 1 | 1 | 0 | 2 |
| | Rarely | 11 | 19 | 8 | 38 |
| | Sometimes | 12 | 39 | 15 | 66 |
| | Often | 17 | 25 | 19 | 61 |
| | Always | 6 | 15 | 3 | 24 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 47 | 100 | 45 | 192 |

Table H19

*Crosstabulation: Personnel Selection and Training With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Personnel selection and training | Never | 2 | 0 | 2 | 4 |
| | Rarely | 11 | 15 | 6 | 32 |
| | Sometimes | 18 | 44 | 14 | 76 |
| | Often | 12 | 32 | 15 | 59 |
| | Always | 5 | 8 | 8 | 21 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table H20

*Crosstabulation: Completion of Design at the Construction Start With Construction industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Completion of design at the construction start | Never | 3 | 3 | 3 | 9 |
| | Rarely | 8 | 17 | 7 | 32 |
| | Sometimes | 15 | 41 | 16 | 72 |
| | Often | 16 | 22 | 10 | 48 |
| | Always | 4 | 16 | 9 | 29 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 46 | 100 | 45 | 191 |

Table H21

*Crosstabulation: Effective Project Briefing With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Effective project briefing | Never | 2 | 3 | 1 | 6 |
| | Rarely | 13 | 19 | 6 | 38 |
| | Sometimes | 12 | 40 | 16 | 68 |
| | Often | 15 | 33 | 19 | 67 |
| | Always | 6 | 4 | 3 | 13 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table H22

*Crosstabulation: Team Motivation With Construction Industry Affiliation*

| | | Construction industry affiliations | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Team motivation | Never | 0 | 1 | 1 | 2 |
| | Rarely | 9 | 14 | 3 | 26 |
| | Sometimes | 19 | 41 | 12 | 72 |
| | Often | 11 | 30 | 19 | 60 |
| | Always | 9 | 13 | 10 | 32 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table H23

*Crosstabulation: Harsh Climate Conditions and Environment With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Harsh climate conditions and environment | Never | 5 | 20 | 3 | 28 |
| | Rarely | 17 | 27 | 14 | 58 |
| | Sometimes | 11 | 16 | 13 | 40 |
| | Often | 13 | 35 | 11 | 59 |
| | Always | 2 | 1 | 4 | 7 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table H24

*Crosstabulation: Political Conflicts and Corruption With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Political conflicts and corruption | Never | 13 | 42 | 9 | 64 |
| | Rarely | 7 | 15 | 4 | 26 |
| | Sometimes | 16 | 14 | 8 | 38 |
| | Often | 7 | 19 | 15 | 41 |
| | Always | 5 | 9 | 9 | 23 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 45 | 193 |

Table H25

*Crosstabulation: Unforeseen Conditions With Construction Industry Affiliation Crosstabulation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Unforeseen conditions | Never | 9 | 27 | 5 | 41 |
| | Rarely | 12 | 35 | 11 | 58 |
| | Sometimes | 18 | 15 | 14 | 47 |
| | Often | 7 | 15 | 12 | 34 |
| | Always | 2 | 7 | 2 | 11 |
| | Missing | 0 | 1 | 0 | 1 |
| Total | | 48 | 100 | 44 | 192 |

Appendix I: Frequency Tables for Construction Project Success Factor Assessment

Variables Measured on Importance and Frequency Scale

Table I1

*Ranking Table: Consultant Construction Project Management Success Factor Importance Index Value Ranking for FAII*

| It No | Project Success Factors | RII (%) | FI (%) | FAII | Ranking Based on FAII |
|---|---|---|---|---|---|
| 1. | Scope and work definition | 85.83% | 79.58% | 68.31% | 1 |
| 2. | Planning efforts | 85.83% | 79.57% | 68.30% | 2 |
| 3. | Company's technical capabilities | 85.42% | 79.58% | 67.98% | 3 |
| 4. | Commitment to the project | 85.42% | 77.50% | 66.20% | 4 |
| 5. | Project manager capabilities and commitment | 85.00% | 76.25% | 64.81% | 5 |
| 6. | Company's financial strength | 82.08% | 77.50% | 63.61% | 6 |
| 7. | Effective site management | 82.92% | 76.67% | 63.57% | 7 |
| 8. | Control system | 82.50% | 75.42% | 62.22% | 8 |
| 9. | Adequacy of plans and specifications | 81.67% | 74.04% | 60.47% | 9 |
| 10. | Adequate project management technique | 85.11% | 70.87% | 60.31% | 10 |
| 11. | Effective scheduling | 80.00% | 74.17% | 59.33% | 11 |
| 12. | Top management support | 77.92% | 71.67% | 55.84% | 12 |
| 13. | Clarity of project mission | 76.25% | 70.83% | 54.01% | 13 |
| 14. | Effective procurement and tendering methods | 77.08% | 69.58% | 53.64% | 14 |
| 15. | Team motivation | 78.33% | 68.33% | 53.53% | 15 |
| 16. | Completion of design at the | 79.58% | 64.35% | 51.21% | 16 |

| | | | | | |
|---|---|---|---|---|---|
| | construction start | | | | |
| 17. | Client consultation and support | 74.17% | 67.08% | 49.75% | 17 |
| 18. | Effective communication between stakeholder | 74.17% | 67.08% | 49.75% | 18 |
| 19. | Effective technical review | 74.17% | 66.81% | 49.55% | 19 |
| 20. | Adequate risk analysis | 75.42% | 65.42% | 49.34% | 20 |
| 21. | Effective project briefing | 71.67% | 64.17% | 45.99% | 21 |
| 22. | Personnel selection and training | 73.75% | 62.08% | 45.79% | 22 |
| 23. | Political conflicts and corruption | 55.00% | 53.33% | 29.33% | 23 |
| 24. | Harsh climate conditions and environment | 51.25% | 55.83% | 28.61% | 24 |
| 25. | Unforeseen conditions | 52.92% | 52.08% | 27.56% | 25 |

Table I2

*Ranking Table: Contractor Construction Project Management Success Factor Importance Index Value Ranking for FAII*

| It No | Project Success Factors | RII (%) | FI (%) | FAII | Ranking based on FAII |
|---|---|---|---|---|---|
| 1. | Effective scheduling | 88.60% | 83.60% | 74.07% | 1 |
| 2. | Company's financial strength | 88.80% | 82.20% | 72.99% | 2 |
| 3. | Company's technical capabilities | 89.60% | 80.20% | 71.86% | 3 |
| 4. | Commitment to the project | 86.80% | 79.60% | 69.09% | 4 |
| 5. | Effective site management | 87.20% | 77.20% | 67.32% | 5 |
| 6. | Control system | 86.00% | 78.00% | 67.08% | 6 |
| 7. | Project manager capabilities and commitment | 85.40% | 77.80% | 66.44% | 7 |
| 8. | Planning efforts | 85.60% | 77.60% | 66.43% | 8 |
| 9. | Adequate project management technique | 87.88% | 73.60% | 64.68% | 9 |
| 10. | Scope and work definition | 83.80% | 76.80% | 64.36% | 10 |
| 11. | Completion of design at the construction start | 78.20% | 72.53% | 56.71% | 11 |
| 12. | Effective procurement and tendering methods | 77.60% | 73.00% | 56.65% | 12 |
| 13. | Top management support | 77.00% | 71.40% | 54.98% | 13 |
| 14. | Personnel selection and training | 75.80% | 67.80% | 51.39% | 14 |
| 15. | Team motivation | 74.14% | 69.09% | 51.22% | 15 |
| 16. | Effective communication between stakeholder | 73.40% | 69.40% | 50.94% | 16 |
| 17. | Effective technical review | 77.20% | 65.60% | 50.64% | 17 |
| 18. | Clarity of project mission | 76.60% | 66.00% | 50.56% | 18 |
| 19. | Adequate risk analysis | 72.80% | 68.80% | 50.09% | 19 |

| | | | | | |
|---|---|---|---|---|---|
| 20. | Adequacy of plans and specifications | 70.00% | 64.80% | 45.36% | 20 |
| 21. | Client consultation and support | 67.80% | 62.60% | 42.44% | 21 |
| 22. | Effective project briefing | 76.20% | 51.40% | 39.17% | 22 |
| 23. | Political conflicts and corruption | 41.80% | 53.40% | 22.32% | 23 |
| 24. | Unforeseen conditions | 41.00% | 47.40% | 19.43% | 24 |
| 25. | Harsh climate conditions and environment | 41.20% | 47.00% | 19.36% | 25 |

Table I3

*Ranking Table: Client Construction Project Management Success Factor Importance Index Value Ranking for FAII*

| It No | Project Success Factors | RII (%) | FI (%) | FAII | Ranking based on FAII |
|---|---|---|---|---|---|
| 1. | Project manager capabilities and commitment | 84.00% | 81.33% | 68.32% | 1 |
| 2. | Adequate project management technique | 86.67% | 73.00% | 63.27% | 2 |
| 3. | Company's technical capabilities | 82.67% | 75.11% | 62.09% | 3 |
| 4. | Effective site management | 81.33% | 74.55% | 60.63% | 4 |
| 5. | Commitment to the project | 79.11% | 75.56% | 59.77% | 5 |
| 6. | Scope and work definition | 80.89% | 72.89% | 58.96% | 6 |
| 7. | Planning efforts | 77.78% | 74.67% | 58.07% | 7 |
| 8. | Top management support | 78.67% | 73.33% | 57.69% | 8 |
| 9. | Control system | 78.67% | 72.44% | 56.99% | 9 |
| 10. | Adequacy of plans and specifications | 76.00% | 74.22% | 56.41% | 10 |
| 11. | Effective communication between stakeholder | 78.22% | 72.00% | 56.32% | 11 |
| 12. | Team motivation | 75.11% | 74.67% | 56.08% | 12 |
| 13. | Company's financial strength | 75.56% | 73.78% | 55.74% | 13 |
| 14. | Effective scheduling | 76.00% | 73.33% | 55.73% | 14 |
| 15. | Adequate risk analysis | 73.33% | 71.11% | 52.15% | 15 |
| 16. | Completion of design at the construction start | 76.44% | 66.67% | 50.96% | 16 |
| 17. | Client consultation and support | 72.89% | 68.89% | 50.21% | 17 |
| 18. | Clarity of project mission | 72.00% | 69.33% | 49.92% | 18 |
| 19. | Effective technical review | 73.78% | 67.56% | 49.84% | 19 |
| 20. | Personnel selection and training | 71.56% | 69.33% | 49.61% | 20 |
| 21. | Effective procurement and tendering methods | 70.22% | 70.22% | 49.31% | 21 |
| 22. | Political conflicts and corruption | 62.22% | 78.22% | 48.67% | 22 |
| 23. | Effective project briefing | 70.22% | 67.56% | 47.44% | 23 |
| 24. | Unforeseen conditions | 56.44% | 57.73% | 32.58% | 24 |
| 25. | Harsh climate conditions | 53.78% | 59.56% | 32.03% | 25 |

Table I4

*Ranking Table: Construction Industry Construction Project Management Success Factor Importance Index Value Ranking for FAII*

| It No | Project Success Factors | RII (%) | FI (%) | FAII | Ranking based on FAII |
|---|---|---|---|---|---|
| 1. | Project manager capabilities and commitment | 86.74% | 80.52% | 69.84% | 1 |
| 2. | Commitment to the project | 85.60% | 80.21% | 68.65% | 2 |
| 3. | Company's technical capabilities | 85.49% | 78.55% | 67.15% | 3 |
| 4. | Effective site management | 86.01% | 78.02% | 67.11% | 4 |
| 5. | Scope and work definition | 84.46% | 77.10% | 65.11% | 5 |
| 6. | Planning efforts | 83.83% | 77.40% | 64.88% | 6 |
| 7. | Control system | 84.04% | 75.65% | 63.58% | 7 |
| 8. | Company's financial strength | 82.59% | 76.89% | 63.50% | 8 |
| 9. | Adequate project management technique | 86.91% | 72.80% | 63.27% | 9 |
| 10. | Effective scheduling | 81.04% | 75.34% | 61.05% | 10 |
| 11. | Top management support | 78.24% | 72.50% | 56.72% | 11 |
| 12. | Adequacy of plans and specifications | 77.93% | 72.71% | 56.66% | 12 |
| 13. | Effective procurement and tendering methods | 75.75% | 71.50% | 54.16% | 13 |
| 14. | Effective communication between stakeholder | 75.10% | 69.27% | 52.03% | 14 |
| 15. | Adequate risk analysis | 75.13% | 67.98% | 51.07% | 15 |
| 16. | Clarity of project mission | 73.47% | 69.43% | 51.01% | 16 |
| 17. | Project manager capabilities and commitment | 86.74% | 80.52% | 69.84% | 17 |
| 18. | Commitment to the project | 85.60% | 80.21% | 68.65% | 18 |
| 19. | Company's technical capabilities | 85.49% | 78.55% | 67.15% | 19 |
| 20. | Effective site management | 86.01% | 78.02% | 67.11% | 20 |
| 21. | Scope and work definition | 84.46% | 77.10% | 65.11% | 21 |
| 22. | Planning efforts | 83.83% | 77.40% | 64.88% | 22 |
| 23. | Control system | 84.04% | 75.65% | 63.58% | 23 |
| 24. | Company's financial strength | 82.59% | 76.89% | 63.50% | 24 |

| | | | | | |
|---|---|---|---|---|---|
| 25. | Adequate project management technique | 86.91% | 72.80% | 63.27% | 25 |

Table I5

*Ranking Table: Construction Industry Construction Project Management Success Factor Importance Index Value Ranking Based on Mean Value*

| Project Success Factors | *N* | Minimum | Maximum | Mean |
|---|---|---|---|---|
| Adequate project management technique | 191 | 2 | 22 | 4.46 |
| Project manager capabilities and commitment | 193 | 2 | 5 | 4.34 |
| Effective site management | 193 | 2 | 5 | 4.30 |
| Commitment to the project | 193 | 2 | 5 | 4.28 |
| Company's technical capabilities | 193 | 2 | 5 | 4.27 |
| Scope and work definition | 193 | 2 | 5 | 4.22 |
| Control system | 193 | 1 | 5 | 4.20 |
| Planning efforts | 193 | 1 | 5 | 4.19 |
| Company's financial strength | 193 | 1 | 5 | 4.13 |
| Effective scheduling | 193 | 1 | 5 | 4.05 |
| Top management support | 193 | 1 | 22 | 4.03 |
| Adequacy of plans and specifications | 193 | 1 | 22 | 4.01 |
| Completion of design at the construction start | 193 | 1 | 22 | 3.99 |
| Personnel selection and training | 193 | 1 | 22 | 3.96 |
| Team motivation | 193 | 1 | 22 | 3.94 |
| Effective communication between stakeholder | 192 | 1 | 22 | 3.87 |
| Effective technical review | 193 | 1 | 22 | 3.80 |
| Effective procurement and tendering methods | 193 | 1 | 5 | 3.79 |
| Clarity of project mission | 193 | 1 | 22 | 3.79 |
| Adequate risk analysis | 193 | 1 | 5 | 3.75 |
| Client consultation and support | 193 | 2 | 5 | 3.59 |
| Effective project briefing | 193 | 1 | 22 | 3.59 |
| Unforeseen conditions | 193 | 1 | 22 | 2.61 |
| Political conflicts and corruption | 193 | 1 | 22 | 2.59 |
| Harsh climate conditions and environment | 193 | 1 | 22 | 2.46 |

Appendix J: Frequency of Project Management Maturity Level

Table J1

*Frequency Table: Project Management Need (Level-1)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | No Opinion | 1 | .5 | .5 | .5 |
| | Slightly Agree | 10 | 5.2 | 5.2 | 5.7 |
| | Agree | 57 | 29.5 | 29.5 | 35.2 |
| | Strongly Agree | 124 | 64.2 | 64.2 | 99.5 |
| | Missing | 1 | .5 | .5 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J2

*Frequency Table: Project Management Implementation (Level-1)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Slightly Agree | 13 | 6.7 | 6.7 | 6.7 |
| | Agree | 66 | 34.2 | 34.2 | 40.9 |
| | Strongly Agree | 113 | 58.5 | 58.5 | 99.5 |
| | Missing | 1 | .5 | .5 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J3

*Frequency Table: Project Management Application (Level-1)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Disagree | 1 | .5 | .5 | .5 |
| | Slightly Disagree | 1 | .5 | .5 | 1.0 |
| | No Opinion | 2 | 1.0 | 1.0 | 2.1 |
| | Slightly Agree | 19 | 9.8 | 9.8 | 11.9 |
| | Agree | 59 | 30.6 | 30.6 | 42.5 |
| | Strongly Agree | 110 | 57.0 | 57.0 | 99.5 |
| | Missing | 1 | .5 | .5 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J4

*Frequency Table: Leadership to Achieve Maturity (Level-1)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 1 | .5 | .5 | .5 |
| | Disagree | 1 | .5 | .5 | 1.0 |
| | Slightly Disagree | 1 | .5 | .5 | 1.6 |
| | No Opinion | 6 | 3.1 | 3.1 | 4.7 |
| | Slightly Agree | 32 | 16.6 | 16.6 | 21.2 |
| | Agree | 59 | 30.6 | 30.6 | 51.8 |
| | Strongly Agree | 91 | 47.2 | 47.2 | 99.0 |
| | Missing | 1 | .5 | .5 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J5

*Frequency Table: Leadership Willingness to Change Project Management (Level-2)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 1 | .5 | .5 | .5 |
| | Slightly Disagree | 4 | 2.1 | 2.1 | 2.6 |
| | No Opinion | 3 | 1.6 | 1.6 | 4.1 |
| | Slightly Agree | 25 | 13.0 | 13.0 | 17.1 |
| | Agree | 61 | 31.6 | 31.6 | 48.7 |
| | Strongly Agree | 98 | 50.8 | 50.8 | 99.5 |
| | Missing | 1 | .5 | .5 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J6

*Frequency Table: Understanding of Project Sponsoring (Level-2)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Disagree | 1 | .5 | .5 | .5 |
| | Slightly Disagree | 1 | .5 | .5 | 1.0 |
| | No Opinion | 5 | 2.6 | 2.6 | 3.6 |
| | Slightly Agree | 21 | 10.9 | 10.9 | 14.5 |
| | Agree | 67 | 34.7 | 34.7 | 49.2 |
| | Strongly Agree | 97 | 50.3 | 50.3 | 99.5 |
| | Missing | 1 | .5 | .5 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J7

*Frequency Table: Leadership Support of Project Management (Level-2)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 1 | .5 | .5 | .5 |
| | Disagree | 3 | 1.6 | 1.6 | 2.1 |
| | Slightly Disagree | 5 | 2.6 | 2.6 | 4.7 |
| | No Opinion | 9 | 4.7 | 4.7 | 9.3 |
| | Slightly Agree | 43 | 22.3 | 22.3 | 31.6 |
| | Agree | 48 | 24.9 | 24.9 | 56.5 |
| | Strongly Agree | 83 | 43.0 | 43.0 | 99.5 |
| | Missing | 1 | .5 | .5 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J8

*Frequency Table: Principle of Project Management (Level-2)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 6 | 3.1 | 3.1 | 3.1 |
| | Slightly Disagree | 1 | .5 | .5 | 3.6 |
| | No Opinion | 8 | 4.1 | 4.1 | 7.8 |
| | Slightly Agree | 28 | 14.5 | 14.5 | 22.3 |
| | Agree | 60 | 31.1 | 31.1 | 53.4 |
| | Strongly Agree | 89 | 46.1 | 46.1 | 99.5 |
| | Missing | 1 | .5 | .5 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J9

*Frequency Table: Middle Level Managers Project Management Support (Level-3)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 1 | .5 | .5 | .5 |
| | Disagree | 5 | 2.6 | 2.6 | 3.1 |
| | Slightly Disagree | 7 | 3.6 | 3.6 | 6.7 |
| | No Opinion | 1 | .5 | .5 | 7.3 |
| | Slightly Agree | 67 | 34.7 | 34.7 | 42.0 |
| | Agree | 80 | 41.5 | 41.5 | 83.4 |
| | Strongly Agree | 28 | 14.5 | 14.5 | 97.9 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J10

*Frequency Table: Knowledge and Skill of Project Management Support (Level-3)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 2 | 1.0 | 1.0 | 1.0 |
| | Disagree | 1 | .5 | .5 | 1.6 |
| | Slightly Disagree | 4 | 2.1 | 2.1 | 3.6 |
| | No Opinion | 12 | 6.2 | 6.2 | 9.8 |
| | Slightly Agree | 96 | 49.7 | 49.7 | 59.6 |
| | Agree | 46 | 23.8 | 23.8 | 83.4 |
| | Strongly Agree | 28 | 14.5 | 14.5 | 97.9 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

T

able J11

*Frequency Table: Commitment of line managers to Project Management (Level-3)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 7 | 3.6 | 3.6 | 3.6 |
| | Disagree | 4 | 2.1 | 2.1 | 5.7 |
| | Slightly Disagree | 5 | 2.6 | 2.6 | 8.3 |
| | No Opinion | 11 | 5.7 | 5.7 | 14.0 |
| | Slightly Agree | 77 | 39.9 | 39.9 | 53.9 |
| | Agree | 55 | 28.5 | 28.5 | 82.4 |
| | Strongly Agree | 29 | 15.0 | 15.0 | 97.4 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J12

*Frequency Table: Project Management Training (Level-3)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 3 | 1.6 | 1.6 | 1.6 |
| | Disagree | 8 | 4.1 | 4.1 | 5.7 |
| | Slightly Disagree | 6 | 3.1 | 3.1 | 8.8 |
| | No Opinion | 15 | 7.8 | 7.8 | 16.6 |
| | Slightly Agree | 84 | 43.5 | 43.5 | 60.1 |
| | Agree | 52 | 26.9 | 26.9 | 87.0 |
| | Strongly Agree | 21 | 10.9 | 10.9 | 97.9 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J13

*Frequency Table: Well Defined Project Management Methodology (Level-4)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 12 | 6.2 | 6.2 | 6.2 |
| | Disagree | 36 | 18.7 | 18.7 | 24.9 |
| | Slightly Disagree | 46 | 23.8 | 23.8 | 48.7 |
| | No Opinion | 22 | 11.4 | 11.4 | 60.1 |
| | Slightly Agree | 38 | 19.7 | 19.7 | 79.8 |
| | Agree | 31 | 16.1 | 16.1 | 95.9 |
| | Strongly Agree | 4 | 2.1 | 2.1 | 97.9 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J14

*Frequency Table: Scope Management (Level-4)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 12 | 6.2 | 6.2 | 6.2 |
| | Disagree | 29 | 15.0 | 15.0 | 21.2 |
| | Slightly Disagree | 46 | 23.8 | 23.8 | 45.1 |
| | No Opinion | 16 | 8.3 | 8.3 | 53.4 |
| | Slightly Agree | 58 | 30.1 | 30.1 | 83.4 |
| | Agree | 24 | 12.4 | 12.4 | 95.9 |
| | Strongly Agree | 4 | 2.1 | 2.1 | 97.9 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J15

*Frequency Table: Project Quality Management (Level-4)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 5 | 2.6 | 2.6 | 2.6 |
| | Disagree | 9 | 4.7 | 4.7 | 7.3 |
| | Slightly Disagree | 15 | 7.8 | 7.8 | 15.0 |
| | No Opinion | 21 | 10.9 | 10.9 | 25.9 |
| | Slightly Agree | 42 | 21.8 | 21.8 | 47.7 |
| | Agree | 82 | 42.5 | 42.5 | 90.2 |
| | Strongly Agree | 15 | 7.8 | 7.8 | 97.9 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J16

*Frequency Table: Project Management Software Package (Level-4)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 25 | 13.0 | 13.0 | 13.0 |
| | Disagree | 31 | 16.1 | 16.1 | 29.2 |
| | Slightly Disagree | 28 | 14.5 | 14.6 | 43.8 |
| | No Opinion | 28 | 14.5 | 14.6 | 58.3 |
| | Slightly Agree | 55 | 28.5 | 28.6 | 87.0 |
| | Agree | 15 | 7.8 | 7.8 | 94.8 |
| | Strongly Agree | 6 | 3.1 | 3.1 | 97.9 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100 | 100.0 | |

Table J17

*Frequency Table: Project Management Curriculum (Level-4)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 11 | 5.7 | 5.7 | 5.7 |
| | Disagree | 29 | 15.0 | 15.0 | 20.7 |
| | Slightly Disagree | 40 | 20.7 | 20.7 | 41.5 |
| | No Opinion | 32 | 16.6 | 16.6 | 58.0 |
| | Slightly Agree | 39 | 20.2 | 20.2 | 78.2 |
| | Agree | 36 | 18.7 | 18.7 | 96.9 |
| | Strongly Agree | 2 | 1.0 | 1.0 | 97.9 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J18

*Frequency Table: Project Management Professionalism (Level-5)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 3 | 1.6 | 1.6 | 1.6 |
| | Disagree | 9 | 4.7 | 4.7 | 6.3 |
| | Slightly Disagree | 5 | 2.6 | 2.6 | 8.9 |
| | No Opinion | 4 | 2.1 | 2.1 | 10.9 |
| | Slightly Agree | 72 | 37.3 | 37.5 | 48.4 |
| | Agree | 72 | 37.3 | 37.5 | 85.9 |
| | Strongly Agree | 23 | 11.9 | 12.0 | 97.9 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100 | 100.0 | |

Table J19

*Frequency Table: Integrated Project Cost and Schedule Management (Level-5)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 4 | 2.1 | 2.1 | 2.1 |
| | Disagree | 24 | 12.4 | 12.4 | 14.5 |
| | Slightly Disagree | 36 | 18.7 | 18.7 | 33.2 |
| | No Opinion | 22 | 11.4 | 11.4 | 44.6 |
| | Slightly Agree | 79 | 40.9 | 40.9 | 85.5 |
| | Agree | 22 | 11.4 | 11.4 | 96.9 |
| | Strongly Agree | 2 | 1.0 | 1.0 | 97.9 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Table J20

*Frequency Table: Project Management System in Place (Level-5)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 7 | 3.6 | 3.6 | 3.6 |
| | Disagree | 47 | 24.4 | 24.4 | 28.0 |
| | Slightly Disagree | 39 | 20.2 | 20.2 | 48.2 |
| | No Opinion | 25 | 13.0 | 13.0 | 61.1 |
| | Slightly Agree | 56 | 29.0 | 29.0 | 90.2 |
| | Agree | 14 | 7.3 | 7.3 | 97.4 |
| | Strongly Agree | 1 | .5 | .5 | 97.9 |
| | Missing | 4 | 2.1 | 2.1 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |

Appendix K: Multiple Regression of Dependent and Independent Variables for Contractor Group

Table K1

*Descriptive Statistics*

| | Mean | Std. Deviation | *N* |
|---|---|---|---|
| Project Success rate | .750 | .2402 | 100 |
| KPMMM Level-1 score | 9.71 | 2.258 | 100 |
| KPMMM Level-2 score | 5.82 | 2.790 | 100 |
| KPMMM Level-3 score | 6.03 | 1.941 | 100 |
| KPMMM Level-4 score | .47 | 3.555 | 100 |
| KPMMM Level-5 score | .64 | 3.135 | 100 |

Table K2

*Correlations*

| | | Project Success rate | KPMMM Level-1 | KPMMM Level-2 | KPMMM Level-3 | KPMMM Level-4 | KPMMM Level-5 |
|---|---|---|---|---|---|---|---|
| Pearson Correlation | Project Success rate | 1.000 | .502 | .656 | -.283 | .191 | .072 |
| | KPMMM Level-1 | .502 | 1.000 | .449 | .011 | .005 | .022 |
| | KPMMM Level-2 | .656 | .449 | 1.000 | -.221 | .437 | .441 |
| | KPMMM Level-3 | -.283 | .011 | -.221 | 1.000 | -.065 | .020 |
| | KPMMM Level-4 | .191 | .005 | .437 | -.065 | 1.000 | .669 |
| | KPMMM Level-5 | .072 | .022 | .441 | .020 | .669 | 1.000 |
| Sig. (1-tailed) | Project Success rate | . | .000 | .000 | .002 | .028 | .237 |
| | KPMMM Level-1 | .000 | . | .000 | .456 | .482 | .413 |
| | KPMMM Level-2 | .000 | .000 | . | .014 | .000 | .000 |
| | KPMMM Level-3 | .002 | .456 | .014 | . | .260 | .422 |
| | KPMMM Level-4 | .028 | .482 | .000 | .260 | . | .000 |
| | KPMMM Level-5 | .237 | .413 | .000 | .422 | .000 | . |
| N | Project Success rate | 100 | 100 | 100 | 100 | 100 | 100 |
| | KPMMM Level-1 | 100 | 100 | 100 | 100 | 100 | 100 |
| | KPMMM Level-2 | 100 | 100 | 100 | 100 | 100 | 100 |
| | KPMMM Level-3 | 100 | 100 | 100 | 100 | 100 | 100 |
| | KPMMM Level-4 | 100 | 100 | 100 | 100 | 100 | 100 |
| | KPMMM Level-5 | 100 | 100 | 100 | 100 | 100 | 100 |

Table K3

*Variables Entered/Removed*

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | KPMMM Level-5 score, KPMMM Level-3 score, KPMMM Level-1 score, KPMMM Level-2 score, KPMMM Level-4 score[b] | . | Enter |

a. Dependent Variable: Project Success rate

b. All requested variables entered.

Table K4

*Model Summary*

| Model | *R* | *R* Square | Adjusted *R* Square | Std. Error of the Estimate | Change Statistics *R* Square Change | *F* Change | *df1* | *df2* | Sig. *F* Change | Durbin-Watson |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .739 | .547 | .522 | .1660 | .547 | 22.656 | 5 | 94 | .000 | 1.908 |

a. Predictors: (Constant), KPMMM Level-5 score, KPMMM Level-3 score, KPMMM Level-1 score, KPMMM Level-2 score, KPMMM Level-4 score

b. Dependent Variable: Project Success rate

Table K5

*ANOVA*

| Model | | Sum of Squares | *df* | Mean Square | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| 1 | Regression | 3.121 | 5 | .624 | 22.656 | .000[b] |
| | Residual | 2.589 | 94 | .028 | | |
| | Total | 5.710 | 99 | | | |

a. Dependent Variable: Project Success rate

b. Predictors: (Constant), KPMMM Level-5 score, KPMMM Level-3 score, KPMMM Level-1 score, KPMMM Level-2 score, KPMMM Level-4 score

Table K6

*Coefficients*

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | Correlations | | |
|---|---|---|---|---|---|---|---|---|---|
| | | *B* | Std. Error | Beta | *t* | Sig. | Zero-order | Partial | Part |
| 1 | (Constant) | .321 | .091 | | 3.509 | .001 | | | |
| | KPMMM Level-1 | .026 | .009 | .248 | 3.049 | .003 | .502 | .300 | .212 |
| | KPMMM Level-2 | .050 | .008 | .581 | 6.076 | .000 | .656 | .531 | .422 |
| | KPMMM Level-3 | -.018 | .009 | -.146 | -2.008 | .048 | -.283 | -.203 | -.139 |
| | KPMMM Level-4 | .006 | .007 | .092 | .952 | .344 | .191 | .098 | .066 |
| | KPMMM Level-5 | -.019 | .007 | -.248 | -2.539 | .013 | .072 | -.253 | -.176 |

a. Dependent Variable: Project Success rate

Table K7

*Residuals Statistics*

| | Minimum | Maximum | Mean | Std. Deviation | *N* |
|---|---|---|---|---|---|
| Predicted Value | .310 | 1.023 | .750 | .1775 | 100 |
| Residual | -.5013 | .6790 | .0000 | .1617 | 100 |
| Std. Predicted Value | -2.481 | 1.536 | .000 | 1.000 | 100 |
| Std. Residual | -3.021 | 4.091 | .000 | .974 | 100 |

a. Dependent Variable: Project Success rate

Appendix L: Multiple Regression of Dependent and Independent Variables for Consultant Group

Table L1

*Descriptive Statistics*

| | Mean | Std. Deviation | *N* |
|---|---|---|---|
| Project Success rate | .729 | .2492 | 48 |
| KPMMM Level-1 score | 9.52 | 2.325 | 48 |
| KPMMM Level-2 score | 6.10 | 2.934 | 48 |
| KPMMM Level-3 score | 6.65 | 2.817 | 48 |
| KPMMM Level-4 score | 1.56 | 3.433 | 48 |
| KPMMM Level-5 score | 2.35 | 3.132 | 48 |

Table L2

*Correlations*

| | | Project Success rate | KPMMM Level-1 score | KPMMM Level-2 score | KPMMM Level-3 score | KPMMM Level-4 score | KPMMM Level-5 score |
|---|---|---|---|---|---|---|---|
| Pearson Correlation | Project Success rate | 1.000 | .565 | .668 | -.309 | .147 | .191 |
| | KPMMM Level-1 | .565 | 1.000 | .410 | -.153 | .192 | .281 |
| | KPMMM Level-2 | .668 | .410 | 1.000 | -.088 | .334 | .445 |
| | KPMMM Level-3 | -.309 | -.153 | -.088 | 1.000 | .030 | .109 |
| | KPMMM Level-4 | .147 | .192 | .334 | .030 | 1.000 | .741 |
| | KPMMM Level-5 | .191 | .281 | .445 | .109 | .741 | 1.000 |
| Sig. (1-tailed) | Project Success rate | . | .000 | .000 | .016 | .159 | .097 |
| | KPMMM Level-1 | .000 | . | .002 | .149 | .096 | .027 |
| | KPMMM Level-2 | .000 | .002 | . | .276 | .010 | .001 |
| | KPMMM Level-3 | .016 | .149 | .276 | . | .420 | .231 |
| | KPMMM Level-4 | .159 | .096 | .010 | .420 | . | .000 |
| | KPMMM Level-5 | .097 | .027 | .001 | .231 | .000 | . |
| N | Project Success rate | 48 | 48 | 48 | 48 | 48 | 48 |
| | KPMMM Level-1 | 48 | 48 | 48 | 48 | 48 | 48 |
| | KPMMM Level-2 | 48 | 48 | 48 | 48 | 48 | 48 |
| | KPMMM Level-3 | 48 | 48 | 48 | 48 | 48 | 48 |
| | KPMMM Level-4 | 48 | 48 | 48 | 48 | 48 | 48 |
| | KPMMM Level-5 | 48 | 48 | 48 | 48 | 48 | 48 |

Table L3

*Variables Entered/Removed*

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | KPMMM Level-5 score, KPMMM Level-3 score, KPMMM Level-1 score, KPMMM Level-2 score, KPMMM Level-4 score[b] | . | Enter |

a. Dependent Variable: Project Success rate

b. All requested variables entered.

Table L4

*Model Summary*

| | | | | | Change Statistics | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model | *R* | *R* Square | Adjusted *R* Square | Std. Error of the Estimate | *R* Square Change | *F* Change | *df*1 | *df*2 | Sig. *F* Change | Durbin-Watson |
| 1 | .779 | .608 | .561 | .1652 | .608 | 13.002 | 5 | 42 | .000 | 2.004 |

a. Predictors: (Constant), KPMMM Level-5 score, KPMMM Level-3 score, KPMMM Level-1 score, KPMMM Level-2 score, KPMMM Level-4 score

b. Dependent Variable: Project Success rate

Table L5

*ANOVA*

| Model | | Sum of Squares | *df* | Mean Square | *F* | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1.773 | 5 | .355 | 13.002 | .000[b] |
| | Residual | 1.146 | 42 | .027 | | |
| | Total | 2.919 | 47 | | | |

a. Dependent Variable: Project Success rate

b. Predictors: (Constant), KPMMM Level-5 score, KPMMM Level-3 score, KPMMM Level-1 score, KPMMM Level-2 score, KPMMM Level-4 score

Table L6

*Coefficients*

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | Correlations | | |
|---|---|---|---|---|---|---|---|---|---|
| | | *B* | Std. Error | Beta | *t* | Sig. | Zero-order | Partial | Part |
| 1 | (Constant) | .224 | .129 | | 1.740 | .089 | | | |
| | KPMMM Level-1 | .036 | .012 | .339 | 3.134 | .003 | .565 | .435 | .303 |
| | KPMMM Level-2 | .049 | .010 | .574 | 4.994 | .000 | .668 | .610 | .483 |
| | KPMMM Level-3 | -.017 | .009 | -.192 | -1.920 | .062 | -.309 | -.284 | -.186 |
| | KPMMM Level-4 | .000 | .010 | -.002 | -.016 | .987 | .147 | -.003 | -.002 |
| | KPMMM Level-5 | -.011 | .012 | -.137 | -.885 | .381 | .191 | -.135 | -.086 |

a. Dependent Variable: Project Success rate

Table L7

*Residuals Statistics*

| | Minimum | Maximum | Mean | Std. Deviation | *N* |
|---|---|---|---|---|---|
| Predicted Value | .230 | 1.058 | .729 | .1942 | 48 |
| Residual | -.3805 | .4858 | .0000 | .1561 | 48 |
| Std. Predicted Value | -2.570 | 1.694 | .000 | 1.000 | 48 |
| Std. Residual | -2.304 | 2.941 | .000 | .945 | 48 |

a. Dependent Variable: Project Success rate

# Appendix M: Multiple Regression of Dependent and Independent Variables for Client Group

Table M1

*Descriptive Statistics*

| | Mean | Std. Deviation | *N* |
|---|---|---|---|
| Project Success rate | .729 | .2735 | 45 |
| KPMMM Level-1 score | 9.51 | 2.139 | 45 |
| KPMMM Level-2 score | 8.53 | 3.402 | 45 |
| KPMMM Level-3 score | 1.78 | 4.364 | 45 |
| KPMMM Level-4 score | -.89 | 5.335 | 45 |
| KPMMM Level-5 score | .47 | 4.208 | 45 |

Table M2

*Correlations*

| | | Project Success rate | KPMMM Level-1 score | KPMMM Level-2 score | KPMMM Level-3 score | KPMMM Level-4 score | KPMMM Level-5 score |
|---|---|---|---|---|---|---|---|
| Pearson Correlation | Project Success rate | 1.000 | .603 | .677 | .215 | .115 | .160 |
| | KPMMM Level-1 | .603 | 1.000 | .793 | .258 | .089 | .114 |
| | KPMMM Level-2 | .677 | .793 | 1.000 | .250 | .082 | .128 |
| | KPMMM Level-3 | .215 | .258 | .250 | 1.000 | .619 | .592 |
| | KPMMM Level-4 | .115 | .089 | .082 | .619 | 1.000 | .872 |
| | KPMMM Level-5 | .160 | .114 | .128 | .592 | .872 | 1.000 |
| Sig. (1-tailed) | Project Success rate | . | .000 | .000 | .078 | .227 | .147 |
| | KPMMM Level-1 | .000 | . | .000 | .043 | .282 | .227 |
| | KPMMM Level-2 | .000 | .000 | . | .049 | .297 | .201 |
| | KPMMM Level-3 | .078 | .043 | .049 | . | .000 | .000 |
| | KPMMM Level-4 | .227 | .282 | .297 | .000 | . | .000 |
| | KPMMM Level-5 | .147 | .227 | .201 | .000 | .000 | . |
| N | Project Success rate | 45 | 45 | 45 | 45 | 45 | 45 |
| | KPMMM Level-1 | 45 | 45 | 45 | 45 | 45 | 45 |
| | KPMMM Level-2 | 45 | 45 | 45 | 45 | 45 | 45 |
| | KPMMM Level-3 | 45 | 45 | 45 | 45 | 45 | 45 |
| | KPMMM Level-4 | 45 | 45 | 45 | 45 | 45 | 45 |
| | KPMMM Level-5 | 45 | 45 | 45 | 45 | 45 | 45 |

Table M3

*Variables Entered/Removed*

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | KPMMM Level-5 score, KPMMM Level-3 score, KPMMM Level-1 score, KPMMM Level-2 score, KPMMM Level-4 score[b] | . | Enter |

a. Dependent Variable: Project Success rate

b. All requested variables entered.

Table M4

*Model Summary*

| Model | *R* | *R* Square | Adjusted *R* Square | Std. Error of the Estimate | Change Statistics *R* Square Change | *F* Change | *df*1 | *df*2 | Sig. *F* Change | Durbin-Watson |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .945 | .893 | .879 | .0951 | .893 | 64.936 | 5 | 39 | .000 | 1.831 |

a. Predictors: (Constant), KPMMM Level-5 score, KPMMM Level-3 score, KPMMM Level-1 score, KPMMM Level-2 score, KPMMM Level-4 score

b. Dependent Variable: Project Success rate

Table M5

*ANOVA*

| Model | | Sum of Squares | *df* | Mean Square | *F* | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 2.939 | 5 | .588 | 64.936 | .000[b] |
| | Residual | .353 | 39 | .009 | | |
| | Total | 3.292 | 44 | | | |

a. Dependent Variable: Project Success rate

b. Predictors: (Constant), KPMMM Level-5 score, KPMMM Level-3 score, KPMMM Level-1 score, KPMMM Level-2 score, KPMMM Level-4 score

Table M6

*Coefficients*

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | Correlations | | |
|---|---|---|---|---|---|---|---|---|---|
| | | *B* | Std. Error | Beta | *t* | Sig. | Zero-order | Partial | Part |
| 1 | (Constant) | -.256 | .070 | | -3.638 | .001 | | | |
| | KPMMM Level-1 | .073 | .011 | .571 | 6.597 | .000 | .903 | .726 | .346 |
| | KPMMM Level-2 | .035 | .007 | .438 | 5.058 | .000 | .877 | .629 | .265 |
| | KPMMM Level-3 | -.006 | .004 | -.103 | -1.481 | .147 | .215 | -.231 | -.078 |
| | KPMMM Level-4 | .001 | .006 | .022 | .199 | .844 | .115 | .032 | .010 |
| | KPMMM Level-5 | .005 | .007 | .080 | .738 | .465 | .160 | .117 | .039 |

a. Dependent Variable: Project Success rate

Table M7

*Residuals Statistics*

| | Minimum | Maximum | Mean | Std. Deviation | *N* |
|---|---|---|---|---|---|
| Predicted Value | .182 | 1.042 | .729 | .2585 | 45 |
| Residual | -.2339 | .3086 | .0000 | .0896 | 45 |
| Std. Predicted Value | -2.116 | 1.212 | .000 | 1.000 | 45 |
| Std. Residual | -2.458 | 3.244 | .000 | .941 | 45 |

a. Dependent Variable: Project Success rate

# Appendix N: Construction Industry Maturity Index Descriptive Statistics

Table N1

*Descriptive Statistics*

| | *N* | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| KPMMM Level-1 score | 193 | 0 | 12 | 9.62 | 2.238 |
| KPMMM Level-2 score | 193 | -3 | 12 | 6.52 | 3.166 |
| KPMMM Level-3 score | 193 | -8 | 12 | 5.19 | 3.446 |
| KPMMM Level-4 score | 193 | -12 | 9 | .42 | 4.081 |
| KPMMM Level-5 score | 193 | -8 | 8 | 1.03 | 3.481 |
| Valid N (listwise) | 193 | | | | |

Table N2

*Crosstabulation: Level-1 With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Level-1 | No Pass | 1 | 3 | 2 | 6 |
| | Level-1 | 47 | 97 | 43 | 187 |
| Total | | 48 | 100 | 45 | 193 |

Table N3

*Crosstabulation: Level-2 With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Level-2 | No Pass | 29 | 46 | 35 | 110 |
| | Level-2 | 19 | 54 | 10 | 83 |
| Total | | 48 | 100 | 45 | 193 |

Table N4

*Crosstabulation: Level-3 With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Level-3 | No Pass | 22 | 51 | 38 | 111 |
| | Level-3 | 26 | 49 | 7 | 82 |
| Total | | 48 | 100 | 45 | 193 |

Table N5

*Crosstabulation: Level-4 With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Level-4 | No Pass | 48 | 97 | 42 | 187 |
| | Level-4 | 0 | 3 | 3 | 6 |
| Total | | 48 | 100 | 45 | 193 |

Table N6

*Crosstabulation: Level-5 With Construction Industry Affiliation*

| | | Construction industry affiliation | | | |
|---|---|---|---|---|---|
| | | Consultant | Contractor | Client | Total |
| Level-5 | No Pass | 44 | 100 | 41 | 185 |
| | Level-5 | 4 | 0 | 4 | 8 |
| Total | | 48 | 100 | 45 | 193 |

Table N7

*Frequency: Consistent and Inconsistent Response*

| Consistency | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Inconsistent | 46 | 23.8 | 23.8 | 23.8 |
| | Consistent | 147 | 76.2 | 76.2 | 100.0 |
| | Total | 193 | 100.0 | 100.0 | |