Project Management Methodology And Its Impact On Construction Projects

Field Study Of Construction Companies In Private Sector In Khartoum State

THESIS SUBMITTED IN FULFILLMENT OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN BUSINESS ADMINISTRATION

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إِنَّ رَبِّيَ الَّذِي خَلَقَ
(الْإِنْسَانَ ﻣِنْ ﻋَلَقٍ)

(اِقرأْ وَرَبِّكَ الْأَكْرَمُ)

(ذِي ﻋَلَمَ ﺑِآﻟْقَلَمِ)

(مَ اﻹِْنفذَ ﻣَـآ ﻓَيْلَمُ)

(سورة العلق 1-5)
DEDICATION

To my brother and best friend Ayman
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First, I thank so much my Allah for providing me all these supports, health and strength throughout this studying experience.

Secondly, I would like to deeply thank my supervisor Professor Ali AbdllaAlhakem for his ideas, criticism and efforts to make this a better thesis. He supported and guided me in every stage of my study and led me in patience when I was sticking in problems. With his practical and intelligent solutions, he always motivated me. I am deeply thankful to him for his invaluable comments, advices, and endless support and encouragement.

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ABSTRACT

Even though globally the concept of project management has developed in the construction industry the maturity and attitude of construction industry in Sudan towards project management knowledge and practice is still needing more of concern. Therefore this study aimed to investigate the impact of project management (PM) methodology on project effectiveness in construction projects in Sudan. The study provided an empirical analysis of project effectiveness measures in terms of achieving customer satisfaction and improving project performance effectiveness. It quantified the needs for appropriate and correct project management knowledge, tools, and techniques to achieve higher quality results in projects. Also the study identified managerial, environmental, and work ethics practices factors affecting project effectiveness, and which of these factors are the most influencing factors on construction projects effectiveness within project management environment.

This study is confined to private sector instead of public specific of seventy random selected construction companies in Khartoum state focusing on project managers and project operational management levels. The study depended upon two types of sources of information to collect its data: primary information sources, which included, the persons concerned from whom data will be collected through interviews, surveys and questionnaires tools, and the second source was the secondary information sources that included references, journals, reports, electronic sources, case studies, and pervious researches.

The methodology of this study used both qualitative and quantitative methods through utilizing the information gathered from related studies about use of project management methodology and its tools and techniques, managerial and environmental factors affecting the effectiveness of construction project performance. The study used structured interviews with experts in project management to assist in questionnaire development to have set questions, also observations were used to give more detail information about project management practices. In particular, a questionnaire was developed for data gathering, and statistical methods were used for data analysis, to validate the research results and test the study's hypothesis. The study intended to use two measure dimensions for project effectiveness as dependent variables; achieving customer’s satisfaction and
improving effectiveness of project performance. On the other side, the study divided the independent Variables into three main groups and twelve sub factors that were identified as factors affecting the Sudanese construction projects effectiveness. The first group was managerial group that contained six sub factors. The second group was project management practices and tools that included a list of the twenty four project management tools and techniques used in construction sector, and the third group was ethics of work and environmental group that consisted of five factors.

To reach findings of this study SPSS package, comparative analysis, quantitative methods such as graphs and tables in addition to correlation analysis were used. The findings of this study identified two main dimensions of project effectiveness; achieving customer satisfaction and improving project performance effectiveness. They found that using project management methodologies, managerial, environmental, and work ethics factors are significant related to project effectiveness. The results demonstrated that using project management tools and techniques factors have an impact on project effectiveness and can be as critical as the managerial, environmental and work ethics practice factors. The statistical results demonstrated that determining the project objectives before executing the project is the first most important factor related to both project effectiveness dimensions. Also the results found that managerial skills of project manager was ranked as the second most important factor for improving project performance effectiveness. While determining the priorities by top management was ranked as the second most important factor for achieving customer satisfaction. Regarding using project management tools and techniques, the findings showed that using project management tools and techniques is the fifth factor related to improving project performance effectiveness while it is the sixth for achieving customer satisfaction.

Finally, this study suggested the following recommendations: increasing the project management concept awareness amongst project managers, construction project managers, supervisors, and project engineers in construction organizations by training them in how to use project management tools and techniques. It also suggested increasing the practical experience in project management methodology and correlating it with the scientific experience.
مستخلص البحث

على الرغم من تطور مفهوم إدارة المشاريع بقطاع الإنشاعات عالمياً إلا أن نضج ووعى صناعة الإنشاعات في السودان تجاه هذا المفهوم وممارساته لازال يحتاج إلى المزيد من الاهتمام. لذلك هدفت هذه الدراسة إلى البحث في أثر استخدام منهجية إدارة المشاريع على فاعلية المشروع في مشاريع الإنشاعات بالسودان. قامت الدراسة بتوفير تحليل لمقاييس فاعلية المشروع من حيث تحقيق رضاء العمل وتحسين فاعلية أداء المشروع إستناداً إلى الدراسة الميدانية، الملاحظ، والإختبار. كما حددت الدراسة الحواجة لأساليب وممارسات وأدوات إدارة المشاريع الصحيحة والمناسبة لتحقيق أعلى نتائج جيدة للمشروع. كما حددت العوامل الإدارية والبيئية وممارسات أخلاقيات المهنة كعوامل مؤثرة على فاعلية مشاريع الإنشاعات ضمن نطاق بيئة إدارة المشاريع.

حصرت هذه الدراسة في القطاع الخاص بدلاً من القطاع العام، تحديداً في سبعين شركة إنشاعات مختارة بطريقة عشوائية بولاية الخرطوم بالتركيز على مستويات مدراء المشاريع ومستويات إدارة عمليات المشروع. واعتمدت الدراسة على نوعين من المصادر في جمع معلوماتها: مصادر البيانات الأولية وحوادث البيانات والموارد التي تم جمعها من المبحوثين عن طريق المقابلات والمسح والاستبيانات، ومصادر البيانات الثانوية والتي شملت المراجع والمجلات العلمية والتقارير والدراسات والبحث السابقة.

استخدمت الدراسة المناهج الكمية والكرمية مع الإستجابة من البيانات التي تم جمعها من الدراسات السابقة عن استخدام منهجية إدارة المشاريع وأساليبها وأدواتها، العوامل الإدارية والبيئية المؤثرة على فاعلية أداء مشاريع الإنشاعات. كما استخدمت الدراسة المقابلات المنظمة مع
مختصين في مجال إدارة المشاريع ساعدت في تطوير إستبيان الدراسة للحصول على أسئلة الإستبيان، كما استخدمت الملاحظة للحصول على معلومات أكثر تفصيلاً عن ممارسات إدارة المشاريع. كما استخدمت الدراسة الإستبيان لجمع البيانات مع إستخدام الأساليب الإحصائية لتحليل البيانات وأثبات نتائج الدراسة وختيارات فرصياتها. استخدمت الدراسة بعدن لقياس فاعلية المشروع كمترفوتات تابعة وهي: تحقيق رضا العمل وتحسين فاعلية أداء المشروع. من جهة أخرى قسمت الدراسة المتغيرات المستقلة إلى ثلاث مجموعات رئيسية وثاني عشر عاملاً فرعاً والتي تم تحديدها كعوامل مؤثرة على فاعلية مشاريع الإنشاءات السودانية. المجموعة الأولى هي المجموعة الإدارية وتحتوي على ستة عوامل فرعية. المجموعة الثانية كانت ممارسات إدارة المشروع وأساليبها وشملت قائمة بأربعة وعشرون إسلوب وأداة لإدارة المشاريع مستخدمة بقطاع الإنشاءات وكانت المجموعة الثالثة هي العوامل البيئية وممارسات أخلاقيات المهنة وحول على خمسة عوامل.

للمقارنة، المناهج الكمية كالرسوم البيانية والجدول الإحصائية إضافة إلى استخدام تحليل الريباط، خصصت نتائج هذه الدراسة إلى أن قياس فاعلية المشروع يمكن تحديدها بعدين رئيسين هما: تحقيق رضا العميل وتحسين فاعلية أداء المشروع. كما وجدت أن استخدام مناهج إدارة المشروع والعوامل الإدارية والبيئية وممارسات أخلاقيات المهنة لها علاقته ذات دلاله معنوية وتؤثر على فاعلية المشروع. كما أوضح الدراسة أن استخدام أساليب وأدوات إدارة المشروع يمكن إعتبارها من العوامل الحرجة المؤثرة على فاعلية المشروع كالعوامل الإدارية والبيئية وعوامل ممارسات أخلاقيات المهنة. أوضح النتائج الإحصائية أن تحديد أهداف المشروع قبل تنفيذ المشروع يعتبر العامل الأول الأكثر تأثيراً لبعثة فاعلية المشروع. كما وجدت
النتائج أن المهارات الإدارية لمدير المشروع تحتل المركز الثاني كأكبر العوامل تأثيراً على تحسين فاعلية أداء المشروع في حين وجدت أن ترتيب الأولويات من قبل الإدارة العليا تحتل المركز الثاني الأكثر تأثيراً على تحقيق رضا العميل. في ما يتعلق بإستخدام أساليب وتقنيات إدارة المشاريع، أظهرت النتائج استخدام أساليب إدارة المشاريع يعتبر العامل الخامس الأكثر تأثيراً على فاعلية أداء المشروع في حين أظهرت النتائج أنه العامل السادس الأكثر تأثيراً على تحقيق رضا العميل.

أخيراً، أقترحت هذه الدراسة التوصيات التالية: زيادة الوعي لمفهوم إدارة المشاريع بين مدراء المشاريع ومدراء مشاريع الإنشاءات والمشترفين، ومهندسي المواقع لشركات الإنشاءات عن طريق تدريبهم في مجال إدارة المشاريع وكيفية استخدام تقنياتها وأساليبها بطريقة صحيحة. أيضاً أقترحت الدراسة زيادة الخبرات العملية في منهجية إدارة المشاريع وربطها بالخبرات العلمية.
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LIST OF SYMBOLS

AC: Actual cost
ACWP: Actual cost of work performed
ATE: Actual time expended for the work to date
BAC: Budget at competition
BCWP: Budget cost of work performed
BCWS: Budget cost of work scheduled
CPFF contract: Cost plus- fixed-fee contract
CPI: Cost performance index
CPIF contract: Cost plus-incentive-fee contract
CPPF contract: Cost plus-percentage-fee contract
CV: Cost variance
EAC: Estimate at completion
ECTC: Estimated cost to complete
EF: Early finish
ES: Early start
ETC: Estimate to completion
EV: Earned value
EVM: Earned value management
FP contract: Fixed-price contract
FPIF contract: Fixed-price-incentive-fee contract
GDP: Gross domestic product

IFB: Invitation for bid

IMEC: International Program in the Management of Engineering and Construction

LF: Late finish

LS: Late start

OD: Original duration planned for the work to date

PMIS: Project management information system

PMO: Project Management Office

PMTT: Project management tools & techniques

Project ND: Project network diagram

PTPT: Planned total project time

PV: Planned value

QA: Quality assurance

RAM: Responsibility assignment matrix

RBS: Risk breakdown structures

RFB: Request for bid

RFI: Request for information

RFP: Request for proposal

SOW: Statement of Work

SPI: Schedule performance index

SPSS: Statistical program of social science
SV: Schedule variance

SWOT analysis: Strength, weakness, opportunities, and threats analysis

TQM: Total quality management

WBS: Work breakdown structure
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PART ONE: GENERAL FRAMEWORK

CHAPTER ONE INTRODUCTION, GENERAL FRAMEWORK, AND REVIEW OF RELATED LITERATURE
PART ONE: GENERAL FRAMEWORK

CHAPTER ONE: INTRODUCTION, GENERAL FRAMEWORK, AND REVIEW OF RELATED LITERATURE

SECTION ONE: INTRODUCTION

Projects are essential part of human history. Some projects arise in wartime, some from faith, and others from science and commerce. Some projects are monumental, and others are more modest. Ancient Egypt created the great Pyramids. China’s Great wall, which still stands today, took over one thousand years to build. In our own time, men have been placed on the moon and returned safely, high buildings have been built, and great improvement happened in Telecommunication industries.

Recently in Sudan, improvement took place in various field in education, constructions, infrastructures, telecommunications, and building dams, which all need a good knowledge in project management.

Project management is an elaborate method and complicated system of requirements for many industries that improved through many years. Project management is a subject that included all principles of leadership, management, teamwork, analysis, and planning all data with controlling of resources and cost.

Today project management has adapted the management and control functions to suit modern requirements. Moreover, in today’s competitive business environment, engineers cannot afford to be technical experts. In the last decade, many companies have reduced the numbers and levels of management positions and assigned more decision-making authority to teams at lower levels. Therefore, engineers need to have project management skills to manage various aspects of a project-driven technological organization combining engineering problems, human factors, and financial issues.
Consequently, to be successful in this work environment, it is very important for engineers to have some level of project management knowledge before they join the work force.

Nowadays Project management is a competitive advantage tool that no organization can spare, being recognized as the main factor influencing productivity in an increasingly global economy. Today many firms around the world started to work in project form and left their traditional practices of organizing themselves behind. This led to new ways of driving and implementing changes and improvements.

Project management also requires another arrangement to deal with the individual employee in a greater extent. The project orientation enables an organization to cope with the dynamic environment and surroundings. Project orientation requires much more of its members than the traditional organization does. The projects’ success is in great degree depending on the individual project members’ skills and abilities. With this in mind, it is vital that the project members are highly trained in the art of project orientation and what it means to work in a project based organization.

SECTION TWO: GENERAL FRAMEWORK
1.2.1. Justification of the Study

What is a project? What is management? What is project management? What is the impact of project management application on project effectiveness? Why do most of projects fail? Do we need project management scientific methodology in Sudan? Moreover, if we need it, what can we achieve with it? And how can we plan and implement it in order to ensure positive impact? How can we monitor and evaluate our work in order to find out what kind of impacts the project has? Why is this emergent management discipline so important to countries like Sudan?, and many more questions led the researcher to investigate this subject and all related issues to answer these questions, and reaching to findings that could help us improve our project effectiveness and productivity.
1.2.2. Objectives of the Study

The main objectives of this study are to investigate the impact of project management and its practices on project effectiveness, and quantify the need for appropriate and correct project management knowledge, tools, and techniques to achieve higher quality results in projects for construction companies. Moreover, the study try to increase the knowledge in project management field to help in improving project performance in the future.

Besides the above-mentioned objectives, the secondary objectives of the study are to identify managerial, environmental, and work ethics factors affecting project effectiveness and which of these factors are the most influencing factors on construction projects effectiveness.

1.2.3. The Importance of The Study

The importance of this study stems from the importance of using project management that provides advantages, such as:

1. Better control of financial, physical, and human resources.
2. Lower costs and improved productivity.
3. Higher quality and increased reliability.
4. Better internal coordination.
5. Higher impact on meeting strategic goals.
6. Improved stakeholders’ relations.

1.2.4. Problem Statement

Even though the concept of project management has developed in the construction industry for the past 40 years, the maturity and attitude of construction industry in Sudan towards project management knowledge and practice is still of concern.

Until the 1980s, project management primarily focused on providing schedule and resource data to top management in construction industries. Today’s project management involves much more. Many organizations today
have a new or renewed interest in project management. They are recognizing that to be successful, they need to be conversant with and use modern project management techniques.

In this study, a set of metrics were developed to determine the link between project management various types of practices, tools and techniques that project management has offer to project performance outcomes. The study identified the strengths, weakness, and value of project management implementation in construction organizations.

Based on all factors mentioned above the investigation problems formed the following questions:

1. How can high-performing organizations successfully apply several project management concepts, tools, and techniques?
2. How can construction organizations improve their project output by using project management tools and techniques?
3. What will help make a project succeed and what can make it fail?
4. What is the maturity level of project management standards in construction companies?

1.2.5. Study Hypotheses

To solve the above problems, the study aims to test the following hypotheses:

1. There is a relationship between project management application and project effectiveness.
2. There is a relationship between managerial factors and project effectiveness.
3. There is a relationship between environmental factors and project effectiveness.
4. There is a relationship between practices of work ethics factors and project effectiveness.
1.2.6. **Scope and Limitation of The Study**

This study is confined to private sector instead of public client specific some selected construction companies in Khartoum state. The study is confined to seventy private companies.

1.2.7. **Population and Sample of The Study**

The intended population of the research is private construction companies' employees in Khartoum state. The total number of the research population is three hundred effective construction companies have been taken from Sudanese Contractor Union directory, from this number random sample consisting of seventy companies has been selected. The study mainly concentrated on project manager levels and project operational management levels.

1.2.8. **Study Data**

Study depends upon two types of sources of information these include:

1. Primary information sources, which include, the persons concerned from whom data will be collected through interviews, surveys and questionnaires tools.

2. Secondary information sources, these include books, journals, reports, documents from websites, Electronic sources, case studies, and pervious researches.

1.2.9. **Study Methodology**

For the purpose of this study, the descriptive analytical approach has been adopted. The statistical program of social science SPSS has been used for data analysis.

A Questionnaire consisting of descriptive information about participants and firms such as type of organization, experiences, and number of current projects ongoing. Then specific questions about the importance level of attributes and sub attributes of project management have been asked.
The questionnaire has been posted by email and hand distribution, in addition, interview sessions to some qualified respondents have been carried out.

After receiving all questionnaires needed the collected data from the questionnaires have been analyzed by using quantitative approach to test the study hypotheses and determine the correlation nature between its variables.

After establishing the relationship between different variables, the study discussed each relationship on the knowledge gained from early part of literature review and answers received from respondents.

Finally, a conclusion has been drawn to give an overall idea on project management method and their impact on project effectiveness and recommendation for future studies.

1.2.10 Study Overview

This overview clarifies the structure of the thesis and outlines its chapters. The thesis is divided into seven chapters and fifteen main sections based on the characteristics of the topics included in the different sections.

Chapter one: Introduction, general framework, and review of related studies. This chapter included three sections and provided brief information about project management. Furthermore the general framework of the study, objectives, importance of study, problem statement, study hypotheses, scope and limitations of the study, sources of the study, methodology and overview. It also discussed related studies.

Chapter two: Theoretical framework, project management, concepts, and definitions. This chapter handled the theoretical framework of the study. It gave a survey of the broad area of the history, current state and future trends in project management. It also contained basic information, principle, concepts and definitions related to project management and its important elements and knowledge area. These information and concepts are prerequisite for understanding how project management affects the project effectiveness.
Chapter three and four: project planning, executing, controlling, and closing process groups. These two chapters handled the project management process groups starting from planning group, executing, monitoring, controlling, and closing process groups with discussing in detail the main ten project management knowledge areas in which are: integration, scope, time, cost, quality, human resources, communication, risk, procurement and project stakeholder management.

Chapter five: Research methodology & systematic presentation of the study. Covered introduction to the case study of the thesis including framework of the study and explained the approach used in the thesis to analyze data collected from literature review. It also analyzed the data and examined its reliability and validity.

Chapter six: Results and discussion. This chapter showed results and answers received from respondents, followed by data presentation in systematic way including description of tables and charts, forwarding to specify the relationship between the different thesis variables.

Chapter seven: Conclusions and recommendations. The chapter summarized the main findings and covered interpretation of findings and the difference between thesis findings and those of previous theses and the difference between research view and views of various researches. In addition, it made conclusions and directions for further researches.
SECTION THREE: REVIEW OF RELATED LITERATURE

Study Title: Implementation of Project Management Techniques to Baleela New Airport Project

Author

Ayman Babiker khider

Degree

M.Sc. Degree in Highway and Transportation Engineering

Date

2011

University

Sudan University of Science and Technology

Objectives

The study aimed to examine the level of implementation of management techniques in order to compare and confirm the outcomes.

The following sub objectives also were accomplished: reviewing the existing management and planning methods in the construction, how much and how deep planning techniques is taken into account in major construction projects, and what are the main constraints and the main factors that affect the projects in Sudan.

The study discussed the level and methods of management followed in Baleela new airport project, also this study was carried out to know the methods of planning, monitoring, and general ideas about projects activities. The reason for selecting Baleela new airport as a case study is the method of assigning the equipment and the level of work force experience either engineers or technicians.
Methodology

It was descriptive research. Questionnaire was conducted by collecting data about the management from six Sudanese companies working in roads and airports construction projects. There was a profile and organization chart for selected companies. Questionnaires were included the level of management, planning and monitoring, the constraints and problems blocking the application of modern planning techniques. Planning and management systems were used by the companies in Sudanese construction projects. Sizes of the resources mainly were the equipment, work force and materials.

Questionnaire procedures included the level of management attitudes, degree of applying planning techniques, degree of monitoring applied, level of modern planning techniques attitudes, and degree of applied planning techniques. It has done and distributed in the period from August to September 2010. The questionnaire covers six Sudanese contractor companies targeting the project managers. All the companies have responded 100%. The survey focused on how the companies planning and managing the projects and the general concepts about projects management and planning.

Research outcomes

The research findings found that the level of recent management and planning techniques use were poor to fair and sometime not satisfactory in surveyed companies, and some companies showed poor background of management concepts.

Although, most of companies are adopting some methods of planning the study showed lack of project planning is considered as one of the main causes of delay in construction projects especially in small sized companies that means there is a weak knowledge of planning techniques like primavera and MS project.

Study provided guidelines for industrial planning in developing countries, basic principles and practices. The results also found that most of
the companies (66%) are using the planning and monitoring processes, and in 50% of them the resources ownership is above 83% and this indicated that owned companies resources plays a vital role in project success. All companies confirmed the importance of scientific methods of planning techniques for complex projects, and results showed the most used planning techniques are bar chart and critical path method. In addition to all findings mentioned above results found that, 66% of the companies had no specialized sections for planning, department for tendering and making budgets.

Depending on all results that were obtained from the study researcher established some recommendations that could help other researchers interested in project management field in the future. These recommendations included taking more care about project planning, scheduling and monitoring processes because of their importance for project success, establishing departments for planning and monitoring specially in all big companies, and implementing of the recent planning and project management techniques and methodologies and use of computer programs to manage construction projects in a professional way.

**Study Title: Construction Projects Delays – A Case Study of Sudan and Dubai**

**Author**

Eman Babiker Abdallah

**Degree**

Master of Science in Civil Engineering – Construction Management

**Date**

February 2010

**University**

Sudan University of Science and Technology
Objectives

The study aimed to provide a general overview of construction project delays, identify, determine, and evaluate the principal causes and the most frequent factors causing delays in construction projects in Khartoum and Dubai to do efforts needed to control these causes.

In addition to comparing a delay factors in construction projects in Khartoum and Dubai, and to examine the reasons for any differences with determining the most party often responsible for delays in Khartoum and Dubai.

The study also explored existing practical solutions from the construction industries in both countries in order to be able to transmit the solutions to delays used in one country to the other, instead of relying only on academic solutions.

Methodology

The research was designed to address and achieve the objectives. The study was divided into two stages. The first is a comprehensive review of the relevant literature, starting with an overview of the countries concerned in the study, then shedding light on all significant aspects of construction delays as covered by previous work in the field. The second stage was to prepare a questionnaire that was then used to highlight and compare the main causes of construction delay in Khartoum and Dubai.

The survey based on a questionnaire was carried out among randomly selected contractors, consultants and owners. The experience-based survey is a crop of over sample 63 construction projects that had been experienced by 50 professionals from Sudan and Dubai and covered 61 previously identified delay factors grouped into five major categories.

The survey covered Khartoum and all Khartoum state all almost big construction companies work at oil and gas, government companies and companies work at residential field. Dubai covered samples were taken from
the business directory provided by Dubai government web site and Dubai yellow pages.

The population of the study is composed of three parties; owners and their representatives, consultant engineers and contractors. 60 questionnaires were sent, 20 were posted in Dubai, while out of 60 distributed in Khartoum 30 collected by hand and email; in Dubai 10 contractors 5 consultant 5 clients, in Khartoum 16 contractors 7 consultant 7 clients.

Data collected from the survey was analyzed using frequency statistical techniques, frequency Index, Severity weight, and SPSS program, and the main causes of delay were analyzed and ranked according their frequency of occurrence and severity.

**Research outcomes**

The results of the study proved that construction projects suffer delays. 98% of participants were involved in projects that had not been completed as planned. Furthermore, 72% of projects in Sudan had been subject to delay. However, results were found in Dubai as 75% of projects in Dubai had been completed within the project plan or before and 25% of the project delayed.

It was also found that the contractor performance delay group was considered as the most important group while consultant related factors were ranked as the least important category in both countries.

The study found that the two most important causes were related to contractor performance are project management and difficulties in financing the project. While delay of progress payment by the client is the most important causes related to client factor. Contractor material ranked as fifth, contractor equipment ranking as sixth, seventh external factor, eighth contractor, and ninth government regulations.
Article Title: An Empirical Study on the Use of Project Management Tools and Techniques across Project Life Cycle and Their Impact on Project Success

Author
Peerasit Patanakul, Boonkiart Iewwongcharoen & Dragan Milosevic

Date
Spring 2010

Journal

Objectives
The study aimed to investigate the use of project management tools and techniques through project life cycle.

Hypothesis
Study assumed there were statistically significant correlations between the use of project management tools and techniques and the project success.

Methodology
This research was conducted using survey research methods. A questionnaire was developed for data gathering and some statistical methods were used for data analysis such as analysis of variance (ANOVA) and T-test. A panel of experts was formed to assist in questionnaire development and to validate the research results. 4000 project managers from Project Management Institute directory were randomly selected to participate in the study. Out of 4000 targets, 412 usable responses were received. The most 39 project management tools and techniques frequently used by project managers were used in the survey. The four groups of success measures used in this study were internal criteria, customer, business, and overall project success.
Study outcomes

The study results indicated that there are statistically significant correlations between the use of project management tools and techniques and different project success measures in different phases of the project life cycle.

Article Title: A Fresh Look at the Contribution of Project Management to Organizational Performance

Author

Aonique Aubry and Brian Hobbs

Date

February 2011

Journal

Project Management Journal Vol. 42, No. 1, PP 3-16

Objectives

The study aimed to understanding of organizational performance and the contribution that the project management can make. The study tried to enrich the current discussion on the value of project management by presenting empirical results from a research on the performance of project management offices.

In this research the evaluation of the project management office and the evaluation of the perception of its contribution to organizational performance were tracked

Hypothesis

Study assumed there were four organizational performance factors as follows: Human relations, internal processes, rational goals, open systems.
Methodology

The methodological framework for this research was based on empirical investigation of the contribution of project management in general and project management offices (PMOs) in particular to organizational performance. Four organizations participated in this research. The periods covered ranged from 2 to 13 years, with an average of 7.24 years. A total of different project management organizations were analyzed each constituting a case study. Two types of data were collected: interviews and questionnaires.

Transcripts were coded using the 17 criteria from the competing values framework grouped into the four conceptions adapted for use with project management offices. Respondents were chosen to represent different roles, potentially leading to different conceptions of the project management offices contribution to organizational performance. The study discussed 17 elements and related to organizational performance.

In addition to interviews, a questionnaire was built with the objective of capturing the different conceptions of the project management offices contribution and their underlying values. Respondents were asked to assess the importance of each of the criteria in their current context using a 5-point liker scale where 1 was not important at all and 5 was very important, criteria with a score of 4 or 5 were considered important.

Respondents were project managers, project management office director, and manager within project management office, executive, human resource manager, financial manager, manager elsewhere and project management office employee.

Study outcomes

The study showed that the project management office could make a significant contribution to organizational performance regarding human resources. Its findings found that project managers do recognize the important of the project management office's contribution in the human relations and
rational goals criteria. They do not recognize that the internal processes are as important. The project management office director considered all criteria as important. They found that human resource manager does not attribute that much importance to the project management offices contribution to human resource performance. Human resource managers do recognize the project management office within the internal processes and rational goals criteria. Also the findings found that the project management office employees attribute significant importance to human resource and open system criteria but not that much to internal process and rational goal criteria.

**Article Title:** Impact of Project Management Standardization on Project Effectiveness

**Author**

Dragan Milosevic, Lane Inman and Ozay

**Date**

December 2001

**Journal**

Engineering Management Journal, Vol. 13, No. 4, PP 9-16

**Objectives**

The article explored the impact of project management standardization on project effectiveness. It emerged from the observation of three companies. Each has successfully focused on schedule-driven, cost-driven, and quality-driven project effectiveness.

**Hypothesis**

The implementation of standard project management in the organization will improve schedule driven effectiveness, cost driven effectiveness, and quality driven effectiveness.
Methodology

Study identified seven components of project management standardization: process and sequence of activities, organization, information technology, methods (tools and techniques), metrics, culture, and leadership.

It surveyed 239 project managers and team members from various industries and organizations in the United States and Canada. From the responses, study identified cross industry benchmarks that promote higher project effectiveness based on project management standardization.

Informal interviews with project managers from 10 organizations circulated to two academics and three practitioners with previous experiences in project management, then to five project management practitioners with a goal of increasing the clarity of the questions.

Questions covered issues surrounding project management processes, organization, information technologies, methods, matrices, culture, leadership, accomplishment of project goals, and background information of the respondents. Questions classifying companies by type of project effectiveness schedule driven, cost driven and quality driven were not included. 295 responses received from project participants (project directors, project managers and team members) and the final qualifying sample included 239 project participants from different industries.

Study outcomes

The results showed that organization with higher levels of certain types of project management standardization gain higher project effectiveness. Standardization is including project management culture, and structure.
Article Title: The Role of Project Management in Achieving Project Success

Author

A.K. Munns and B.F. Bjeirmi

Date

1996

Journal


Objectives

The aim of the paper is to identify the overlap between the definition of the project and project management and discuss how the confusion between the two may affect their relationship. It identified different individuals involved on the project and project management, together with their objectives, expectations and influence. It demonstrated how a better application of the distinction between the two would bring a higher possibility of project success. It outlined the factors that affect project management and project success.

The objectives of both project management and project are different and the control of time, cost and progress, which are often the project management objectives, should not be confused with measuring project success. Also, experience has shown that it is possible to achieve a successful project even when management has failed and vice versa. There are many examples of projects which were relatively successful despite not being completed on time, or being over budget.

A project adding benefits to the company like financial, marketing and technical can be considered to be the achievement of a specific objective that involves a series of activities and tasks which consume resources. It has to be completed within a set of specifications, having definite start and end dates. In contrast, project management can be defined as the process of controlling the
achievement of the project objectives.

Utilizing the existing organizational structure and resources, it seeks to manage the project by applying a collection of tools and techniques, without adversely disturbing the routine operation of the company. The function of project management includes defining the requirement of the work, establishing the extent of work, allocating the resources required planning the execution of the work, motivating the progress of the work and adjusting deviations from the plan.

**Study outcomes**

Paper concluded for a project to be successful there must, first be an improved application of the role of the project management within projects. Second, the project manager must allow the client to contribute actively in the planning and production phases and at the same time the project team involvement has to be extended into the utilization phase. This will examine also the economic and financial performance.

Successful project management techniques will contribute to the achievement of projects, but project management will not stop a project from failing or succeed. The right project will succeed almost without the success of project management. However, successful project management could enhance its success.

Study results found that the most important causes for project success or failure factors were realistic goals, Competition, Client satisfaction, A definite goal, Profitability, third parties, material availability, the implementation process, the perceived value of the project.

While the most nine important causes for project management success or failure factors were: inadequate basis for project, wrong persons or project manager, top management unsupportive, inadequately defined tasks, lack of project management techniques, management techniques misused, project closedown not planned, lack of commitment to project.
Article Title: A New framework for Determining Critical Success/Failure Factors in Projects

Author

Walid Belassi and Oya Icmeli Tukel

Date

1996

Journal

International Journal of Project Management Vol. 14, No. 3, PP 141-151,

Objectives

The study tried to create a new scheme that classified the critical success or failure factors, and described the impacts of these factors on project performance. The study grouped the success and failure factors and explained the interaction between them rather than the identification of individual factors.

The groups were divided into four groups: first group included factors related to the project; second group included factors related to the project manager and project team members, while the third group formed factors related to the organization, and finally the fourth one included factors related to the external environment.

All the groups are interrelated. A factor in one group can influence a factor in another group and a combination of several factors from various groups might lead to project failure.

Methodology

An empirical study was conducted to test the practicality of using such a scheme. Statistical analyses of the results were used to demonstrate the
differences between the critical success factors identified in previous studies from literature, and the factors identified with the use of this study.

Factors related to project included: the size and the value of a project, the uniqueness of project activities (vs. standard activities), the density of a project network, project lifecycle, and the urgency of a project outcome.

Factors related to project manager and project team members included: skills and characteristics of project managers and team members. Some of skills include ability to delegate, ability to tradeoff, ability to coordinate, competence and competent.

Factors related to organization included: top management support, project organizational structure, functional manager’s support, project champion.

While Factors related to external environment included political, economic, and social, advance in technologies, nature, client, competitors, and sub-contractors.

A questionnaire consisted of two sections and a total of 10 questions were prepared. The first section included questions about the project organization and attributes and the second section included the four factors groups from the framework. Project managers were asked to choose the best answer for the questions in the first section and asked to mark all the critical factors that apply to their situation in the second section.

The final report was mailed to 200 project managers whose names were selected from the Project Management Institute directory. A total of 57 responses were received. Resulting in a response rate of 28% analysis was done using SAS.

**Study outcomes**

The survey results demonstrated that project managers' managerial skills, team members' commitment and their technical background, project attributes and environmental factors are as applicable and can be as critical as
the organizational factors, although the criticality of these factors varies between industries. While in management information system and in manufacturing projects, project managers’ managerial skills are the most critical factors, environmental factors take the lead in construction. Many statistically significant relationships between critical success factors and project characteristics are identified. This is useful to project managers in analyzing a particular factor in detail. Furthermore, these relationships explained interaction among factor groups.

**Previous Literature Summary**

In the literature, some authors perceived project management tools and techniques as project management offices for project management as Aubry and Hobbs (2011, pp.3-16), while others view them as systematic procedures or practices that project managers use for producing specific project management deliverables as per Milosevic et al. (2001, pp.16-33) study. This study subscribes to the latter definition of project management tools and techniques. The most project management tools and techniques were studied in previous studies were: Work Breakdown Structure, Earned Value Management, project selection methods, project charter, cost estimating techniques, benefit/cost analysis, flowcharting, cause-and-effect diagrams, cost of quality, Pareto diagrams, control charts, critical path method, Gantt charts, simulation, schedule crashing, milestone charts, SWOT analysis, stakeholder analysis, responsibility matrix, and contract type selection…etc.

This study fill the gap from the previous studies by inserting project management methodology factor to the factors that have been studied by related studies. Moreover, the study focused on the most frequently used project management tools and techniques used in private construction organization from the contractors’conception and their impact on new measures of project effectiveness that were improving project performance effectiveness and customer satisfaction. This based on interviews that have been done with experts in project management field and project managers.
The study studied each project management tool and its impact on project effectiveness separately. Moreover, made the using of project management methodology as independent group that affect project effectiveness and added this group to managerial and environmental group to form the main three groups affect project effectiveness. Moreover, the study added some tools and techniques and removed others according to the nature of Sudanese construction field and environment. Also, it took the contractor perspective.

Belassi and Tukel (1996, pp.141-151) introduced the critical success and failure factors in projects. They described the impact of the factors on project performance. They investigated the impact of a project manager’s experience and his managerial skills, team members’ commitment and their technical background, project attributes, environment, and organizational factors on the project's success or failure. The paper emphasized the importance of understanding the factors and interactions between them and their impact on project performance. The study concluded that all factors mentioned above could be critical success/failure factors in projects, and their criticality varies between industries.

Other study by Munns and Bjeirmi (1996, pp.81-87) identified the overlap between definition of the project and project management. It demonstrated how a better application of project management would bring a higher possibility of project success. It outlined the factors that affect project management and project success. It found that for successful project and to enhance project success there must be improved application of the role of the project management within projects, client should be attributed actively in the planning and execution processes, using project management techniques, while the causes for project management failure factors were: inadequate basis for project, wrong person or project manager, top management unsupportive, inadequately defined tasks, lack of project management techniques, and management techniques misused.
In her research, with title Construction Projects Delays - A Case study of Sudan and Dubai in 2010, Eman Babiker provided a general view of construction project delays. She identified, determined, and evaluated the principle causes and the most frequent factors causing delays in construction projects in Khartoum and Dubai. The study results proved that construction projects suffer delays in both cities but the importance of delay causes is different between them depending on severity of delays and frequency of delays in each city, which were much higher in Khartoum than Dubai. It found 98% of participants were involved in projects that had not been completed as planned, 72% of projects in Khartoum had been subjected to delay while in Dubai was 25%, on the other hand, 75% of the projects in Dubai had been completed within project plan or before. The study showed contractor performance delay was considered as the most important group while consultant related factors were ranked as the least important category in the both cities. It found the most important causes of delays in Khartoum were contractor performance group followed by owner related factor, while the consultants delay factors were assigned as the least important delay group, it found the most two important causes related to contractor performance were project management and project finance, and the difficulties in financing the projects.

Other literatures concerned about implementation of project management methodologies and techniques, and their impact on projects performance such as in Ayman Babiker in his research in 2011 that examined the level of implementation of management techniques, reviewed the existing management and planning methods in construction projects, reviewed the main constraints and main factors that affect the projects in Sudan, and especially discussed the level and methods of management followed in Baleela airport project. The study found that the level of recent management and planning techniques use like using Primavera and MS projects were poor to fair and sometimes not satisfactory in surveyed companies whereas the most used were bar chart and critical path method. Some companies showed poor
background of project management concepts, the study showed that one of the main causes of delay in construction projects was the lack of project planning especially in small sized companies. The study found 74% of the projects were completed within the budgets, 52% within planned scheduled, and 66% of the surveyed companies are using the planning and monitoring processes. The study also found 66% of surveyed companies had no specialized department for planning, tendering, and making budgets.

The other study by Milosevic et al. in 2001 concerned about project management standardization and their impact on project effectiveness showed that organization with higher levels of certain types of project management standardization gain higher project effectiveness. It showed that the project management standardization including project management culture, structure, and system.

Other point of view on contribution of project management to organizational performance was carried out by Aubry and Hobbs in 2011 aimed to study the project management impact on organizational performance and enrich the current discussion on the value of project management. The study showed that project management makes a significant contribution to organizational performance that related to human resources, rational goals, project delivery methodologies, communication channels, project processes and knowledge management processes.

As can be seen from the previous studies results there were many factors could affect project performance and lead to project success or failure. Moreover, project management standardization and its methodologies for planning, controlling and monitoring, and closing project processes that could significantly impact project performance. Therefore, these factors and project management methodology will be explained in this research from contractor point of views with focusing on project management factors and examining their impact on construction projects in selective construction companies at Khartoum state, and comparing the results with the previous literature.
Definitions

**Activity List.** A documented tabulation of schedule activities that shows the activity description, activity identifier, and a sufficiently detailed scope of work description so project team members understand what work is to be performed.

**Bar Chart.** A graphic display of schedule-related information. In the typical bar chart, schedule activities or work breakdown structure components are listed down the left side of the chart, dates are shown across the top, and activity durations are shown as date-placed horizontal bars.

**Budget.** The approved estimate for the project or any work breakdown structure component or any schedule activity.

**Change Control System.** A set of procedures that describes how modifications to the project deliverables and documentation are managed and controlled.

**Checklist Analysis.** A technique for systematically reviewing materials using a list for accuracy and completeness.

**Claims Administration.** The process of processing, adjudicating, and communicating contract claims.

**Conflict Management.** Handling, controlling, and guiding a conflictual situation to achieve a resolution.

**Crashing.** A technique used to shorten the schedule duration for the least incremental cost by adding resources.

**Critical Path Method.** A method used to estimate the minimum project duration and determine the amount of scheduling flexibility on the logical network paths within the schedule model.

**Customer Satisfaction.** Within the quality management system, a state of fulfillment in which the needs of a customer are met or exceeded for the customer’s expected experiences as assessed by the customer at the moment of evaluation.
**Earned Value Management.** A methodology that combines scope, schedule, and resource measurements to assess project performance and progress.

**Fast Tracking.** A schedule compression technique in which activities or phases normally done in sequence are performed in parallel for at least a portion of their duration.

**Flowchart.** The depiction in a diagram format of the inputs, process actions, and outputs of one or more processes within a system.

**Gantt Chart.** A bar chart of schedule information where activities are listed on the vertical axis, dates are shown on the horizontal axis, and activity durations are shown as horizontal bars placed according to start and finish dates.

**Lessons Learned.** The knowledge gained during a project that shows how project events were addressed or should be addressed in the future with the purpose of improving future performance.

**Methodology.** A system of practices, techniques, procedures, and rules used by those who work in a discipline.

**Performance Measurement Baseline.** An approved, integrated scope-schedule-cost plan for the project work against which project execution is compared to measure and manage performance. The PMB includes contingency reserve, but excludes management reserve.

**Practice.** A specific type of professional or management activity that contributes to the execution of a process and that may employ one or more techniques and tools.

**Procedure.** An established method of accomplishing a consistent performance or result, a procedure typically can be described as the sequence of steps that will be used to execute a process.

**Process.** A systematic series of activities directed towards causing an end result such that one or more inputs will be acted upon to create one or more outputs.
**Program Evaluation and Review Technique (PERT).** A technique for estimating that applies a weighted average of optimistic, pessimistic, and most likely estimates when there is uncertainty with the individual activity estimates.

**Project Charter.** A document issued by the project initiator or sponsor that formally authorizes the existence of a project and provides the project manager with the authority to apply organizational resources to project activities.

**Project Management Information System.** An information system consisting of the tools and techniques used to gather, integrate, and dissemination the outputs of project management processes. It is used to support all aspects of the project from initiating through closing, and can include both manual and automated systems.

**Project Schedule.** An output of a schedule model that presents linked activities with planned dates, durations, milestones, and resources.

**Quality Checklists.** A structured tool used to verify that a set of required steps has been performed.

**Responsibility Assignment Matrix (RAM).** A grid that shows the project resources assigned to each work package.

**Risk Register.** A document in which the results of risk analysis and risk response planning are recorded.

**Stakeholder Register.** A project document including the identification, assessment, and classification of project stakeholders.

**Statement of Work (SOW).** A narrative description of products, services, or results to be delivered by the project.

**SWOT Analysis.** Analysis of strengths, weaknesses, opportunities, and threats of an organization, project, or option.

**Work Authorization System.** A subsystem of the overall project
management system. It is a collection of formal documented procedures that defines how project work will be authorized (committed) to ensure that the work is done by the identified organization, at the right time, and in the proper sequence. It includes the steps, documents, tracking system, and defined approval levels needed to issue work authorizations.

**Work Breakdown Structure (WBS).** A hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables.
PART TWO: THEORETICAL FRAMEWORK

CHAPTER TWO: THEORETICAL FRAMEWORK: PROJECT MANAGEMENT: CONCEPTS, DEFINITIONS AND IMPORTANCE
PART TWO: THEORETICAL FRAMEWORK

CHAPTER TWO: THEORETICAL FRAMEWORK
PROJECT MANAGEMENT: CONCEPTS, DEFINITIONS AND IMPORTANCE

SECTION ONE: CONCEPTS AND DEFINITIONS

2.1.1. Background

In today’s market, companies have more projects under construction implementation than they can afford to provide all the necessary resources for their implementation. The world today is quite different from earlier. New developments are being made every day, and the competition is very tough. If the company cannot complete the project in a proper way or fail to meet its obligations towards its customers at the right time it will lose its market. That means the life span of any project is getting shorter and shorter over time due to reorganizing work through team of individuals working together in an effective and professional way under the leadership of skilled project manager to develop it (Ghattas, and Mcke, 2003, pp.5-6).

Moreover, construction projects have become larger, more complex, and more challenging over the past several years. They include more building systems than they used to. Today project team needs many technically sophisticated cadres like civil, mechanical, electrical, plumbing, telecommunications, data communications, and more skills besides interpersonal, strategic planning and project management skills to accomplish their project in a proper and effective way(Ghattas, and Mcke, 2003, p.16).

The growth of project management has changed significantly over the past forty years, and these changes are expected to continue well into the twenty-first century. During the 1940s, collecting project information was very difficult especially in large projects, because there was no single contact
point for asking whether the project is going right or wrong compared to its plan, and that is causing waste time for customer and contractor. There was only line managers acting as project managers doing the work required by their line organization, and when the work completed they shift the responsibility to other line manager and soon this concept was called "over the fence management" to manage projects (Kerzner, 2009, p.38).

By late 1950, in the United States, the aerospace and defense industries were using project management practically on all projects. In spite of that, the majority of companies used an informal method for managing projects depending on good working relationships between line managers, and handling by functional managers. After that, and during the early 1980s, and because of the increase in size and complexity of projects, companies shifted from informal project management to formal project management process. By the 1990s, companies recognized that implementation of project management methods was necessary, not a choice. This decision was based on six driving factors influencing project management environment including capital project, customer expectations, competitiveness, executive understanding, new project development, and efficiency and effectiveness (Kerzner, 2009, pp. 39-45).

2.1.2. Project Concept and Definitions

Projects are critical to the success of any organization. They are the activities that result in new or changed products, services, environments, processes and organizations. Projects increase sales, reduce costs, improve qualities and customer satisfaction, enhance the work environment, and result in many other benefits (Pinto, 2007, p.8).

There are many general definitions of the term project, but the most known and famous one is that suggested by Project Management Institute and which states that "project is defined as a temporary endeavor undertaken in creating a unique product or service" (Clements and Gido, 2006, p.4).
One of the project definitions defines project, as “an endeavor to accomplish a specific objective through a unique set of interrelated tasks and the effective utilization of resources. It has a well-defined objective stated in terms of scope, schedule, and cost”. Project has a specific period and a customer; its success is based on achieving its scope, planned cost and schedule and customer satisfaction (Clements and Gido, 2006, pp.1-4).

Moreover, a project is considered as a conversion process that needs inputs, outputs, and resources with specified mechanisms to achieve targeted objectives within limitations or constraints. Inputs are some form of want or need which is satisfied through the process to reach the specified needs by using different resources such as people, knowledge and expertise, capital, tools and techniques and technology (Matheen, 2009, pp.9-11).

Other definition defines project as "unique event with a beginning and end date, carried out by people to meet established goals within limitations of cost, schedule, and quality" (Pinto, 2007, p.3). While other project definition considers project as series of organized work, activities, and tasks with defined start and end dates and funding limits towards a specific goals or objectives need to be completed within certain specifications that requires resources and effort (Pinto, 2007, p.4).

Generally, projects have properties that characterize them from other organization ongoing processes. They are temporary ad-hoc endeavors with a clear life cycle. They are initiated as needed, and because projects almost remain unique, they are separated from other organizational routine processes. As a rule, a process refers to ongoing, day-to-day activities in which an organization involves while producing goods or services. Project on the other hand takes place outside the normal repetitive process of the firm. Projects are complex because they typically require the coordinated inputs of many project team members and stakeholders, who may have differing ideas that could affect the project performance and its final objectives within confined budget, resources and agreed on schedule. Stakeholders may be from different
departments in project organization or from other external organizations. In most cases, stakeholders come from both internal and external environment of project organization (Pinto, 2007, pp.5-6).

Projects involve a degree of uncertainly. Unforeseen circumstances may occur once the project is started. They may be due to changes in cost of some of materials that could be higher than originally estimated, inclement weather may also cause a project delay. Moreover additional redesign and modifications in project scope impacts on project performance (Gido, and Clements, 2009, p.9).

No project ever goes hundred percent according to plan. This is particularly true for projects that involve big number of people and stakeholders. In order to ensure that a project is completed successfully project plans need to be updated regularly. Project plans are useful communication tools and effective monitoring and controlling devices for the project (Clarke, 1999, pp.139-145).

In addition to the importance of project plans, there is an effective project control that measures actual progress, compares it to planned progress on a timely and regular basis, and takes corrective action immediately, if necessary (Clements, and Gido, 2006, pp.1-4).

### 2.1.3. Concept of Project Management

According to Attarzadeh and Hock (2008, pp.234-241) project management is a set of tools, techniques, and knowledge that when applied, helps to achieve the three main constraints of scope, cost and time. Based on study literatures, 52.7% of projects were not able to complete on time, and over cost, 31.1% not fulfilled the scope, and only 16.2% succeeded to accomplish their goals. Project management tools and techniques include network activity diagram, bar charts, macro and micro cost estimation approaches and resource scheduling techniques.

By Kerzner (2009, p.8) project management is the planning,
organizing, directing, and controlling of company's resources to complete specific goals and objectives. It is designed to make better use of project resources by getting workflow horizontally as well as vertically within the company.

Today project management is facing considerable management challenges requiring not only technical skills but also broad based sets of people skills, knowledge of leadership, team building, conflict resolution, negotiation, and influence skills as well. Project management has become central to operations in industries, construction and information technology, engineering and new product development. Now project management has become the management of technology, people, culture, stakeholders, and all other diverse factors necessary to complete successfully a project (Pinto, 2007, p.26).

Moreover project management provides senior management with an overview of all project management activities, a big picture of how organizational resources are being used, an assessment of risks their portfolio of projects represent, rough metric for measuring the improvement of managing projects relative to others in the industry, and connects senior management with actual execution management (Larson, and Clifford, 2011, p.13).

Within the actual execution of projects, the process of project management has two dimensions. The first dimension is the technical side of the management process. The second and opposite dimension is the socio-cultural side of project management. The technical side that is the science of project management consists of the formal, disciplines, purely logical parts of the process. It includes integrating, planning, scheduling, controlling and closing project management processes. To facilitate planning and control processes clear project scope statements are set and that links the project and customer expectations. On the other hand, the socio-cultural side that is the art side of project management concentrates on interpersonal skills needed inside
and outside of the organization. It covers leadership, working with others, and team work using problem solving techniques. Also it concerns about using negotiation skills, knowing the organizations’ policies, and building cooperative social network (Pinto, 2007, pp.15-16).

Nowadays Project management has become a way of life. It is used for both big and small projects from building huge towers over a period of five years to building a small room that can be done in a few weeks. In the 21st century Project management is expected to change from getting the job done to strategic project leadership (Labuschange, and Steyn, 2010, pp.69-79).

Moreover, project management has become important for helping an organization to achieve its strategic goals for many reasons related to pressure that the firms face during implementation of their projects. Those reasons restrict in shortened product life cycle, nature of business opportunity, increasing complex and technical products, growth of global market, and controlling of inflation rate by enhancing profits through streamlining of firm internal processes (Pinto, 2007, pp.8-9).

2.1.4. Concept of Methodology

Methodology is the processes that are used to get from point A to point B. It contains project phases, measures progress, implementing corrective actions based on defects found and assigns resources to various phases. It is a set of guidelines or principles that can be applied to a specific situation. Those guidelines might be a list of things to do. Other definition of Methodology defines it as a process that documents a series of steps and procedures to bring about the successful completion of a project, or a defined process for accomplishing an end. One of methodology definition defines it as a series of steps through which the project progresses (Charvat, 2003, p.17).

Other concept defines methodology as a collection of methods, procedures and standards that determine a formation of engineering and management approaches designed to deliver a product, service, or solution.
Other methodology definition is that the methodology is an integrated assembly of tasks, techniques, tools, roles and responsibilities, and milestones used for delivering the project (Charvat, 2003, p.17).

2.1.5. Project Management Methodology

Based on the above-motioned conceptual definitions project management methodology is a set of methods, processes, and practices that are repeatedly carried out to deliver project on time and within budget, while meeting all specifications and expectations. Labuschange, and Steyn, (2010, pp.69-79) defined project management methodology as "the framework or process that specifies steps and tasks required or recommended by an organization to manage a project. The steps are repeated for every project conducted, and by doing that, efficiencies are achieved".

Recently many public and private organizations depend on project management methodology to execute their construction projects and to help improve their internal operations, take advantage of external opportunities under the strong competition in construction and agricultural fields, and achieve technological breakthrough. More and more, however, companies have realized that the primary goal of a project is customer satisfaction, if that goal is neglected a firm runs the risk of doing the wrong things well. Projects that may be done efficiently but ignore customer needs fail commercially, on the other hand projects are considered successful if they meet technical, budgetary, or scheduling goals in addition to customer satisfaction (Pinto, 2007, p.4).

According to a study by Paivi and Miia (2006, pp.6-11) "72% of conducted companies reported that they use a project management methodology and 54% used their own in-house project methodology. The study pointed that organizations used the project management methodologies to control and make their decisions on a project during project management process. Study also showed that project management methodology usually represents a collection of good practices and prior knowledge, common
agreement or commitment across different stakeholders, and a suitable practice across a majority of projects in the organization or its department. Methodologies can be more or less systematic, standardized, documented and formal depending on organization culture and maturity. The study examined the use of project management methodology in terms of goal setting, systematic decision-making and reaching goals.

Typically, project management methodology is based on traditional management function of planning, organizing, motivation, directing, and control besides project manager technical experiences and knowledge, and his proficiency in administrative functions (Matheen, 2009, pp.2-3).

Moreover, many benefits could be gained by using project management techniques. They help to complete the full projects scope on time, and within budget. They make project team more satisfied when feeling of being one of a winning team, which cause enhancing their skills, consequently meet customer satisfaction, and make them willing to take responsibilities on additional projects. By the end when projects are successful, everyone wins (Clements, and Gido, 2006, pp.17-19).

A good Project management methodology can provide better customer satisfaction. It can help organization to be efficient through optimum use of organizational resources, and manage efficiently the challenges coming out from the business environment. It also helps organization to be effective internally within company processes and externally in the market place through accomplishment of the company target objectives and strategies (Kerzner, 2009, pp.933).

Study by Labuschange, and Steyn (2010, pp.69-79) described the characteristics and the types of a project management methodology that is currently used in the consulting engineering industry in South Africa. The
study used Delphi technique\textsuperscript{1} to determine those characteristics. The study pointed that the lack of project management knowledge, experience, and maturity are the most pressing and challenging issues when applying a project management methodology in the South Africa Consulting Engineering Industry. They prevent the successful implementation of project management methodology in any firm. Moreover, companies’ culture could affect the effectiveness of project management methodology application in practice. The report concluded that by applying a project management methodology in South Africa Consulting Engineering Industry more compatible results regarding time, cost, and quality could be achieved and presented to the client (Labuschange, and Steyn, 2010, pp.69-79).

\textbf{2.1.6. Project Management Tools and Techniques}

Project management methodology depends on several tools and techniques that enable project managers to plan and evaluate the progress of the project. They indicate what is to be done. Project management tools can be grouped into six main groups (Matheen, 2009, p.22):

- First group is related to project selection techniques.
- Second group is related to project execution planning techniques.
- Third group is project scheduling and coordinating techniques.
- Fourth group is related to project monitoring and progressing techniques.
- Fifth group is related to project cost and productivity control techniques.
- Sixth group is related to project communication and clean up techniques.

First group for project management tools includes:

1. Cost benefit analysis.
2. Risk and sensitivity analysis.

\textsuperscript{1}Delphi Technique is an information gathering technique used as a way to reach a consensus of experts on a subject. Experts on the subject participate in this technique anonymously. A facilitator uses a questionnaire to solicit ideas about the important project points related to the subject. The responses are summarized and are then recirculated to the experts for further comment.
While second group includes:

1. Work breakdown structure.
2. Project execution plan.
3. Project responsibility matrix.

The third group covers:

1. Bar charts.
2. Line of balance.
3. Network diagram.
4. Life cycle curves.

The fourth group includes:

1. Progress management techniques.
2. Performance monitoring techniques.
3. Updating, reviewing and reporting techniques.

The fifth group includes:

1. Value engineering.
2. Productivity budgeting techniques.
3. Cost work breakdown structure.

The sixth and last group includes:

1. Control room.
2. Computerized information system.

2.1.7. Strategic Planning

Although the principles of strategic planning have been known for several decades, an understanding of their application to project management is relatively new. Nowadays strategic planning plays main roles in achieving the excellence in project management (Kerzner, 2001, p.9).
Project strategy is specific and focuses on the project to be executed and deployed; it is based on a specific set of objectives and project scope. Without a project strategy, it is unlikely that the project would be planned very well (Charvat, 2003, p.14).

Good strategic planning for superiority in project management needs to consider all aspects of the firm starting from working relationships among employees, managers, and management, roles of the team member, to the company’s structure and culture (Kerzner, 2001, p.9).

In addition, strategic planning depends on; first, deciding where the firm want to go, what target objectives must be accomplished, needed decisions to be made, and when they must be made in order to get there. The second step in strategic planning is implementing the plan to achieve the project’s objectives. Strategic planning can help project management to develop a standard methodology that can be used repeatedly for achieving the project goals. Moreover, strategic planning provides large channels of communication of overall objectives to all levels of management in the organization providing vertical feedback loop in the firm, that insures all levels have an opportunity to participate in firm’ objectives (Kerzner, 2001, pp.17-18).

On the other hand, there is integration relationship between strategic alignment, organizational culture environment, portfolio management and project management, this link is connected through the information and feedback exchange. Integration of project is designed to improve project management in the whole organization. It means applying a set of knowledge, skills, tools, and techniques to a collection of projects in order to move the organization toward its strategic goals. This integration movement represents the main idea of project driven firms across all industries. It enables management to have greater flexibility and better control of all project management activities. It puts all major dimensions of project management under one ceiling (Larson, and Clifford, 2011, p.13).
Usually, strategic plans are set by top management whereas project is selected by another group of management, and projects implemented by another. These independent decisions by different groups of managers create a set of conditions leading to conflicts, confusion, and frequently an unsatisfied customer. Under these conditions, resources of the organization were spent uselessly in unproductive activities. Therefore, selection criteria of projects needs to sure each project contributes to strategic goals by all management groups. These will guarantee the optimum use of the organization resources, people, capital and equipment (Larson, and Clifford, 2011, p.14).

### 2.1.8. Project Life Cycle

A project life cycle refers to the stages in a project’s life. Life cycles are important because they verify the logic that controls a project. They also help develop organization plans for carrying out the project, and help decide when resources should be dedicated to the project (Pinto, 2007, p.11).

Project life cycle is divided into four main phases (Pinto, 2007, pp.11-12).

- Concept,
- Planning,
- Execution, and
- Closing.

The concept refers to creation of initial goals and technical specification for project, determination of the scope of the work, assignment of necessary resources and identification of stakeholders. In planning stage all plans including integrating plan, scope plan, time plan, cost plan, quality plan, human resources plan, communication plan, risk plan, and procurement plan are developed. In executing phase, the product or service is created and fabricated. During this stage project costs increase rapidly. Finally, the closing
phase occurs when the completed project is transferred to the customer, and the customer formally accepts the product and the project formally closed.
SECTION TWO: PROJECT SUCCESS AND FAILURE FACTORS, AND PROJECT MANAGEMENT PROCESSES

2.2.1. Project Success Factors

Project success is restricted in four main determinants (Pinto, 2007, pp.13-14):

- Schedule,
- Budget,
- Performance, and
- Customer acceptance.

In time factor, project is constrained by specified period during which it must be completed. The second factor of project success is that the project should be within its approved budget. Projects must meet budgeted portion in order to use resources as efficiently as possible. The third factor of project success is checking that the final product created by the project operates in accordance with technical specifications and meets the project client expectations. Finally, with customer acceptance, project is considered as a successful project.

Study by Clarke (1999, pp.139-145) summarized the main critical factors to the success of projects in many points. It includes communication throughout the project, clear objectives and scope, breaking the project into small tasks, using project plans as working documents. It showed that project success depends on the interrelationship of all those key success factors in project management, and they should not be considered independently from one another.

Other factors that could have effect on project success include project process, budget and resources control, authorization, organization culture, Gantt charts, team interactions, project deadlines, risks, management contingency planning, constrains, training priorities, reporting, using software, milestones specification, and ownership culture (Clarke, 1999, pp.139-145).
Other study by Attarzadeh and Hock (2008, pp.234-241) aimed to investigate the causes of success and failure of the projects undertaken by fifty respondents found that the main ten success factors in successful projects are:

- User involvement,
- Executive management support,
- Clear determent of requirements,
- Proper planning,
- Realistic expectations,
- Smaller project milestones,
- Competent staff,
- Ownership,
- Clear vision and objectives,
- Hard working and focused staff.

Their study found that the most important four factors that contributed to project success were user involvement, executive management support, clear statement of requirements and proper planning. User involvement formed 15.9% and it was the biggest proportion. The second was executive management support with 13.9%, and then clear statement of requirements with 13.0%, and the fourth was proper planning with 9.6%.

2.2.2. Project Failure Factors

Project fails mainly because of unable to plan and cost or schedule estimate correctly, or failure to implement the tasks according to plan because of the ineffective use of project methodology, scope changes or major changes in the requirements or because inspections are poorly done, and thirdly project fails due to human factor including poor communications between project team, sponsor and stakeholders. Project manager with poor training and insufficient skills in management techniques or project management methodologies skills also causes of project failure (Attarzadeh and Hock,
According to Labuschagne, and Steyn (2010, pp.69-79) project failures with respect to time and cost are attributed to misalignment of project objectives between consultants, contractors and client, miscommunication between design and construction departments, contractors, absence of project management practice, and project sponsor dissatisfaction.

The study found that 28% of 258 major transportation infrastructure projects have an average cost overrun, with 90% of the projects overspending for the rest. Other study of 60 large engineering projects by International Program in the Management of Engineering and Construction (IMEC) found that 18% of the projects incurred extensive cost overruns (Labuschagne, and Steyn, 2010, pp.69-79).

A study conducted by Attarzadeh and Hock (2008, pp.234-241) found the most three factors that caused project failure are:
- lack of user involvement,
- lack of planning and estimations, and
- Incomplete requirements and leadership and team member technical skills.

The study recommended applying good project management practices to avoid these failure factors, and leading to project success.

2.2.3. Stages of Worry and Stress levels in Project

There are four main stress levels starting from uniformed optimism that is a period of time at the beginning of a project when worry and stress are low. Vague concern phase when concern begins to mount. Panic phase: worry phase of the project, when the project manager realized that it take an enormous effort to accomplish the task at hand. Wince and take it stage: stage of a project when the project manager must accept the outcome, though it may be unpleasant, as the deadline gets closer in a poorly managed project the level of worry increases. In a well-managed project, the level of worry stays within
more reasonable levels throughout the project life (Ghattas, and Mckee, 2003, p.9).

The major sources of stress are (Ghattas, and Mckee, 2003, p.10);

- Lack of planning,
- Ambiguity of project goals or project organization,
- Lack of support from upper level management,
- Imposed plans or details;
- Technical second guessing,
- Imposed activity plans, lack of communications,
- Lack of feedback or visibility of progress,
- Conflicting objectives or priorities,
- Hurry up and wait:
- Overtime followed by layoffs followed by more overtime,
- Micromanagement,
- Lack of recognition of changed circumstances,
- Inability to deal with change or diversity,
- Badly run meetings,
- Lack of response to major problems, and
- Lack of recognition of accomplishments.

2.2.4. Concept of Project Management Maturity Models

Recently occurrence of Project Management Maturity Models arises due to the huge increase in project management practices among global organizations. Project management maturity model is a system that shows the maturity levels in project management practice for managing projects for different organizations. The maturity models provide the necessary framework to first, analyze and evaluate project management current practices for the organization; second, compare those practices against those of leader competitors or general industry standard; and third, define a systematic way for improving these practices (Pinto, 2007, pp.17-19).
Moreover, project maturity models have become very useful in recent years precisely because they reflect the growing interest in project management. One of the important concepts is that changing in project maturity typically does not occur suddenly; that is, companies that desire to become skilled in their project management approaches simply cannot progress in immediate steps from lack of project management understanding to optimal project practices. Instead, the maturity models record that maturity is an ongoing process, based on continuous improvement through identified steps (Pinto, 2007, p.19).

There are common project maturity models with different project management maturity. Several of these models were developed by private project management consultancies and professional project organizations. The most four well-known models in this field are (Pinto, 2007, pp.20-21):

- Capability Maturity Model,
- Harold Kerzner’s Maturity Model,
- International’s Project Framework, and
- The Maturity Model developed by the Center for Business Practice.

2.2.5. Project Manager

Because projects become more complex and multi-dimensional, a project manager needs various skills. He should have team building, leadership, conflict resolution, and technical skills. Moreover, he should have planning, organizational, entrepreneurial, administrative, management support building skills and resource allocation skills. Thus, the project manager must be both socially and technically aware to understand how the organization functions and how these functions will affect the project organization of the particular job to be done. In addition he must understand the organization culture and its value system he is working with (Matheen, 2009, pp.53-54).

Moreover, in order to effectively control project teams to provide the smooth flow of different resources and materials needed to get the job done,
and to deal with the many forces that bear on the construction process project manager should have a little and suitable knowledge of accounting procedures, legal matters and state regulations. In addition, the project manager's roles in the construction process vary from company to company depending, mainly upon the organization culture and its volume (Levy, 2007, p.10).

Good project manager plays a vital role in achievement of project objectives. He is responsible for obtaining sponsor approval for the project to proceed, determining the project scope and its feasibility to the overall business, ensuring necessary project resources are identified and allocated and planning the project to the relevant detail it requires. Project manager monitors the project cost, quality, schedule and risks. He provides updated reports and summaries to key stakeholders and provides leadership to the project team (Charvat, 2003, p.48).

In addition, project manager must make decisions to guide the actions of others. One of the most common causes of stress among project managers is that they are given responsibility for an area more than the authority needed to make the necessary changes in order for them to meet the requirements placed on them (Matheen, 2009, pp.56).

Therefore, for project managers success there should be a relationship that connects responsibility, authority and credibility. That is no responsibility for areas without authority to carry out their responsibilities. Also there is no authority without accountability (Matheen, 2009, pp.57-58).

2.2.6. Project Management Processes

According to Cleland (2004, p.43) “the project management process is widely accepted as the foundation for projects, but there are many different applications of the components of the process. Depending upon industry, project size, project complexity, project duration, and other critical factors, organizations modify the process to meet their need to deliver products and services to clients. The project management process is defined as a system of
operations that guides a project from its inception to completion including project management tools and techniques.

The project management process is a sequence of project activities needed during project life cycle to achieve project deliverables. It is described in terms of its major functions. Effective project management requires many activities and work packages under each of these functions. It includes five main processes starting from project initiation then planning the project, managing and executing project work, and finally closing the phase or project. All these processes should be controlled by the process of monitoring and controlling. Many other related processes come from these main processes that are related to project integration management, scope management, time and cost management, quality management, human resource and communication management, risk management, procurement management, and stakeholder management (Cleland, and Lewis, 2002, p.42).

Those related processes may include (Cleland, and Lewis, 2002, p.43):

- Developing project objectives, goals, and strategies,
- Developing project work breakdown structure,
- Developing precedence diagrams to establish logical relationship of project activities and milestones,
- Developing time-based schedule for the project, based on the precedence diagram, planning for the resource support of the project,
- Establishing organizational design for the team,
- Identifying and assigning project roles to members of the project team,
- Defining project management policies, procedures, and techniques,
- Preparing project management charter and other related instruments such as: establishing standards for the authority, responsibility, and accountability of the project team,
- Defining project team member needs,
Assessing factors that motivate people to do their best work,
- Providing appropriate controlling and mentoring as required.

The subsidiary processes may also include conducting initial study of impact of motivation on productivity, establishing limits of authority for decision making, developing leadership style, enhancing interpersonal skills, preparing plan for increasing participative management techniques in managing the project team, establishing cost, schedule, and technical performance standards for the project, preparing procurement plans, and evaluating the project progress (Cleland, and Lewis, 2002, p.43).

Typically, Project management process has fundamental tools that are essential to conduct project work. Planning is a major part of project management, and the project participants, especially the project manager, must know how to design the roadmap to project success. Another aspect of project planning is knowing and following the proper sequence for the various components to guide projects to the right solution. Periodic project reviews on major projects are essential to determine the progress achieved at a given point in time as compared to the project plan. Reviews are also an opportunity to assess the value of the benefits of the projects to determine whether they should be continued (Cleland, 2004, pp.53-54).

In project management process project life cycle is considered as a collection of project phases determined by the control needs of the organizations involved in the project. Accordingly, a variety of project life cycle models are in use in organizations today, from traditional models such as the waterfall model\(^1\) to the spiral model\(^2\) to agile\(^3\) models (Cleland, and Gareis, \(...\)

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\(^1\)Waterfall Model is a model based upon the principle that one phase cannot start until the previous one is completed: see Cleland, and Gareis, 2006, p.16-22.

\(^2\)Spiral Model is an iterative model based upon the principle that go through the different phases again and again, until reach a certain degree of maturity of the product to be created which customer can accept. It is even possible that one part of project is still in definition phase while another one is already in implementation phase: see Cleland, and Gareis, 2006, p.16-22.
Managing of any project management knowledge area process like scope, cost, time, quality, human resources, communication, risk, or even procurement separately throughout the project life cycle cannot be considered as project management processes unless there is a well integration and communication between them leading to optimal results. These results of the project management subsidiary processes integration make it possible to measure and evaluate the performance and the efficiency of any project management process. Project management process is providing structural precondition for the accomplishment of the project objectives, effective performance of the project initiation, project controlling, project closing, and continuous project coordination, reducing of project complexity, and management of the project dynamics (Cleland, and Gareis, 2006, pp.2-8, 2-10).

Briefly, the project management process means planning the work and then working the plan to accomplish the project objectives. The effort in managing a project must be focused on establishing a baseline plan that provides a roadmap for how the project scope will be accomplished on time and within budget. This planning effort includes clear definition of the project objectives that have been agreed upon by the customer and the individuals or organization that will perform the project; divide and subdivide the project scope into major work packages; define the specific activities that need to be performed for each work package in order to accomplish the project objective; and graphically represent the activities in the form of a network diagram (Gido, and Clements, 2009, p.12).

Moreover, the project management process is adapted from the general management process. It provides a model for how the management functions

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1Agile Model is an iterative method of determining requirements for engineering and information technology development projects in a highly flexible and interactive manner. It requires empowered individuals from the relevant business, with supplier and customer input. See Cleland, and Gareis, 2006, p.16-22.
of planning, organizing, motivation, directing, and control will be carried out in the commitment of resources on the project. Management is defined as a process consists of forecasting, planning, organize, command, coordinate, and control. Principal responsibilities for general management are strategic management of the firm; vertical organizational structure design; concerned with firm mission, objectives, and goals; ongoing enterprise processes; concerned with firm stakeholders; seeks firm efficiency and effectiveness; integrates functional and project activities (Cleland, and Lewis, 2002, pp.39-40). Whereas the principal responsibilities for project management are specific cost, schedule, and technical performance objectives; matrix or functional organizational design; ad hoc nature; concerned with product, service, and firm process design and development; supports organizational strategies, and concerned with project stakeholders. Principal responsibilities between project management and general management are a little bit different, but both of them have the same basic philosophies and depend on the theories and practices appeared in the management discipline, and although the application of the management process may differ depending on the applications in each area. Both make and implement decisions, allocate resources, manage organizational interfaces, and provide leadership of the people who are involved in the firm and the project (Cleland, and Lewis, 2002, pp.41-42).

SECTION THREE: PROJECT INITIATING PROCESS

Project work begins when the initiating process group starts. Senior management defines the basic requirements and requests. The senior management consists of the people to whom the project manager seeks for guidance and direction concerning the project’s objectives. Senior management may include, depending on the project, managers above the project manager in an organization, the sponsors of the project, the future owners of the product resulting from the project, or any combination of these. The goals of the project are defined in terms of; the scope of the work to be accomplished; the time available to complete the work, and the fund or resources senior management is willing to commit to the project (Cleland,
During the initiating phase a business problem or opportunity is identified, stakeholder expectations are identified, and a business case providing various solution options is defined following by a feasibility to investigate whether each option addresses the business problem and a final recommended solution is then put forward. Once the recommended solution is approved, a project is initiated to deliver the approved solution to the customer by the project team (Westland, 2006, p.3).

Initiating process includes needs identification that is identified by the customer who sees some benefit to undertaking a project that will result in an improvement or advantage over the existing condition. The requirement identification starts with the recognition of a need, problem, or opportunity and ends with the issuance of a request for proposal (RFP) that documents all customer’s needs and associated requirements (Gido, and Clements, 2009, p.30).

Before a request for proposal is prepared, the customer must clearly define the problem or need. This may mean gathering data about the dimension of the problem. It is important that the customer try to quantify the problem so as to determine whether the expected benefits from implementing a solution outweigh the costs or consequences of conducting the project. There will be situations where several needs or opportunities have been identified but there are limited funds or resources available to track all of them (Gido, and Clements, 2009, p.42).

One of the main tools used in project initiating process is the feasibility study that is presented by senior management in the business to the business sponsor or customer. The feasibility study involves undertaking a detailed assessment of a current business problem or opportunity, identifying the various solution options available and determining the likelihood of each alternative solution meeting a customer’s requirements. The feasibility study document provides (Westland, 2006, p.25):
- A full description of the business problem,
- A list of the requirements for a solution to fix the problem,
- A list of all available options for delivering a solution,
- An assessment of the feasibility of each option,
- A list of the risks and issues associated with each option, and
- The preferred solution options for implementation.

Other important tool used in initiating process is the business case that is created to define the problem or opportunity in detail and identify a preferred solution for implementation. The business case includes (Westland, 2006, p.6): a detailed description of the problem or opportunity; a list of the alternative solutions available; an analysis of the business benefits, costs, risks and issues; a description of the preferred solution; a summarized plan for implementation. The business case is then approved by an identified project sponsor, and the required funding is allocated to proceed with a feasibility study.

2.3.1. Project Statement of Work

The growth of most project failures is in the initiation and planning phases. It is during this time that the foundation for the project is established, which will ultimately determine whether the project will succeed or fail. The foundational document for the management of projects is the detailed statement of work. Without a detailed Statement of Work (SOW)\(^1\), Project is managed with unknown objectives. This makes it difficult to determine what is to be accomplished, when the project is finished, and what method will be used for measuring the success of the project. There is no baseline against which to measure progress or change. Project failure is not perceptive and can occur in any industry and in any organization at any time. Reasons for failed and challenged projects include incomplete and changing requirements, scope

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\(^1\)Statement of Work is a narrative description of products, services, or results to be delivered by the project. PMBOK, 5 ed. P. 591.
creep, lack of executive support, lack of skilled resources, lack of client input, changing priorities, lack of planning, unrealistic schedule and reduced funding. However the single most significant cause of project failure is the lack of a clearly defined and detailed statement of work (Cleland, 2004, pp.221-222).

The Statement of work (SOW) is the document that will help in ensuring that expectations are properly established with the client and that the project team does not commit to perform work they are incapable of performing. The benefits of having a detailed SOW for the project can be huge. They include (Cleland, 2004, pp.223-224):

- The basis for responding to a request for proposal (RFP) and negotiations,
- The basis for determining the price of the project,
- The baseline upon which change is measured,
- The baseline to measure when work is satisfactorily completed and payment is justified,
- The determining factor as to how profitable the engagement will be,
- Method of recording, measuring, and analyzing the services and products provided,
- Serves as a necessary baseline for audit purposes, and protects both the service provider and client by clearly defining the roles and responsibilities of each party.

In addition, the SOW has several purposes, including: describing the products or services to be delivered; serving as a basis for the contractor’s response; providing a basis for evaluating the proposals, and defining the role of the contractor.

2.3.2. Project Selection

Project selection is the process of evaluating proposed projects or groups of projects, and then choosing to implement some set of them so that the objectives of the organization will be achieved. Project will have different
costs, benefits, and risks. Rarely are these known with certainty. In the face of such differences, the selection of one project out of a set is a difficult task. Choosing a number of different projects, a portfolio, is even more complex (Meredith, and Mantel, 2009, p.40).

Meredith, and Mantel (2009, p.44) argued that: project evaluation depends on different factors. These factors include:

- Production factors such as effects on waste and rejects, energy requirements, safety of processes, availability of raw materials, and quality of output,
- Marketing factors that include size of potential market for output, consumer acceptance, and estimated life of output,
- Financial factors that include profitability, net present value of the investment, impact on cash flows, payback period, and impact on cash flows,
- Personnel factors which include training requirements, labor skill requirements, and availability of required labor skills, and
- Administrative and miscellaneous factors including meeting government safety standards, meeting government environmental standards, managerial capacity to direct and control new processes.

There are main steps related to the project selection that should be followed. These steps include the following (Gido, and Clements, 2009, p.42):

- Development a set of criteria against which the opportunity will be evaluated. These criteria will probably include both quantitative and qualitative factors such as alignment with company goals, anticipated sales volume, increase in market share, establishment of new markets, anticipated retail price, investment required, technology development required, return on investment, human resources impact, public reaction, competitors’ reaction, expected time frame, and regulatory approval.
- A list of assumptions that will be used as the basis for each opportunity.
Gathering of data and information for each opportunity to help ensure an intelligent decision regarding project selection. Such as methodologies used to calculate simple payback, discounted cash flow, net present value, internal rate of return, return on investment, or life cycle costs associated with each opportunity being considered. In addition to gathering data, it may also be necessary to obtain other information regarding each opportunity. This could include getting information from various stakeholders who would be affected by the opportunity. These could: employees, consumers, or community residents, depending on the specific opportunity. Methods of gathering this information could include surveys, focus groups, interviews, or analysis of available reports, and finally

Evaluation of each opportunity against the criteria. Once all the data and information has been collected, analyzed, and summarized for each opportunity, it should be given to all the individuals who are responsible for performing the evaluation. It is beneficial to have several individuals involved in the evaluation and selection decision in order to get various viewpoints. Each person on the evaluation committee should have a different background and experiences to bring to the decision making process. The benefits and consequences, advantages and disadvantages, plusses and minuses of each opportunity need to be considered and evaluated. They can be quantitative and qualitative, tangible and intangible. Quantitative benefits could be financial, such as an increase in sales or a reduction in costs. There also may be intangible benefits associated with an opportunity, such as improving the company’s public image or employee morale. On the other hand, there are quantitative consequences associated with each opportunity, such as the cost required for implementing the project. Some consequences may be less tangible, such as legal barriers or reaction from a particular supporting group.

Project selection models have two basic types: numeric and
nonnumeric. Both are widely used. Many organizations use both at the same
time, or they use models that are combinations of the two. Nonnumeric models
do not use numbers as inputs whereas numeric models do, but the criteria
being measured may be either objective or subjective (Meredith, and Mantel,

Nonnumeric models sometimes involve a situation where a project is
identified and suggested by a senior or powerful individual in an organization.
Often the project is initiated with a simple comment. Whatever the sponsor
has suggested the project is sacred in the sense that it will be maintained until
successfully concluded, or until the sponsor, personally, recognizes the idea as
a failure and terminates it. This model needs full support by top management
that is certainly an important contributor to project success. Without such
support, the probability of project success is sharply lowered (Meredith, and
Mantel, 2009, p.45).

Other type of nonnumeric models is initiating the projects because they
are required to keep the system in operation. Such a situation is life
threatening such as floods, drought, and landslides. Other projects are initiated
if they will help an organization to maintain a competitive edge over other
organizations. The decision to undertake the project was based on a desire to
maintain the company’s competitive position in that market (Meredith, and
Mantel, 2009, p.45).

Other models of nonnumeric models is the Comparative Benefit Model
that it is used where a firm has several projects, which must be considered, and
some ranking given. The projects are sorted into three qualitative categories:
good, fair and poor. For this purpose, senior management would like to select
a subset of the projects that would most benefit the firm, but the projects do
not seem to be easily comparable. The organization has no formal method of
selecting projects, but members of the Selection Committee think that some
projects will benefit the firm more than others, even if they have no precise
way to define or measure benefit. The process of comparative benefits may be
carried out by one person who is responsible for evaluation and selection, or it
may be performed by a committee charged with this responsibility (Meredith, and Mantel, 2009, pp.45-46).

The second type of project selection criteria is Numeric Models such as project profitability, payback period\(^1\), net present value, internal rate of return, benefit cost ratio\(^2\), and scoring (Meredith, and Mantel, 2009, p.47-50).

### 2.3.3. Project Charter

After the business case and feasibility study have been approved, and project has been selected, a new project is formed. At this point, the project charter is created which is the main output of project initiating process. The charter defines the vision, objectives, and deliverables for the new project. It also describes the organization structure, activities, resources and funding required for undertaking the project. Any risks, issues, planning assumptions and constraints are also identified. After establishing the project charter, the project team is appointed, and finally at the end of the initiation phase, a phase review is performed. This is basically a checkpoint to ensure that the project has achieved its objectives as planned (Westland, 2006, p.6-7).

The project charter is the document that formally authorizes a project. It provides the project manager with the authority to apply organizational resources to project activities. A project manager is identified and assigned as early in the project as is feasible. He should always be assigned prior to the start of planning, and preferably while the project is being developed. In construction industry, it is good practice to train and assign project managers before initiating the project. Projects are usually chartered and authorized by top management, a sponsor, a government agency, a partnering company, a program organization, or a portfolio organization, as a result of one or more of the following: a market demand; a business need; a customer request; a

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1Payback period for a project is the initial fixed investment in the project divided by the estimated annual net cash inflows from the project. See: Meredith, and Mantel, 2009, p.47.

2The benefit cost ratio is the net present value of all future expected cash flows divided by the initial cash investment. If this ratio is greater than 1.0, the project may be accepted. See: Meredith, and Mantel, 2009, p.49.
technological advance and a social need. Charting a project links the project to the ongoing work of the organization. In some organizations, a project is not formally chartered and initiated until completion of a needs assessment, feasibility study, preliminary plan, or some other form of analysis that was separately initiated. Developing the project charter is primarily concerned with documenting the business needs, project justification, current understanding of the customer’s and stakeholder requirements, and the new product, service, or result that is intended to satisfy those requirements (Barkley, 2006, pp.12-14).

Moreover, the project charter addresses the high-level project description, summary of milestone schedule; stakeholder influences; functional organizations and their participation; business case justifying the project, including return on investment, summary budget; organization environmental and external assumptions and constraints (Barkley, 2006, p.15).

Many inputs are involved for charting project. These inputs may include (Barkley, 2006, pp.15-16):
- The contract if the project is being done for an external customer.
- Project statement of work (SOW) which is a description of products or services to be supplied by the project. For internal purposes, the project sponsor provides the statement of work, based on business needs, product, or service requirements. For external purposes, the statement of work can be received from the customer as part of a bid document in form of request for proposal (RFP), request for information (RFI), request for bid (RFB), or as part of a contract.
- Product scope description that documents the product requirements and characteristics of the product or service that the project will undertake to create. The product requirements will generally have less detail during the initiation phase and more detail during later processes, as the product characteristics are progressively elaborated. These requirements should also document the relationship among the products or services being created, the business need, and strategic plan.
Enterprise Environmental Factors that surround and influence the project’s success and performance. These factors include items such as but not limited to organizational or company culture and structure, governmental or industry standards, infrastructure, existing human resources, personnel administration, company work authorization system, marketplace conditions, stakeholder risk tolerances, commercial databases, and project management information systems.

Organizational Process Assets that include formal and informal policies, procedures, plans, and guidelines whose effects on project performance. Organizational process assets also represent the organization’s lessoned learned and records from previous projects like completed schedules, risk data, and earned value data.

2.3.4. Enterprise Environmental Factors

Construction projects do not exist in a vacuum. They are influenced by external political, economic, technological and social factors which either directly affect the project conditions, like the price of materials or the going rate for labor, or they affect the client’s business and impact upon the scope and specifications of the project. To create a business case, Core aspects of these business environmental factors should be identified. These factors affect the project selection, conditions and its objectives. These factors may include:

2.3.4.1. External factors

It is important for the project managers to understand the influence that the external factors have on the feasibility, strategy, design implementation and the outcomes of the project and they should evaluate these factors when recommending certain courses of action and when assessing options. External factors in construction projects arise because they do not normally exist inside a single business. They are likely to have an external effect and they are likely to work with other external organizations in order to deliver the outputs that the client needs (Fewings, 2005, p.57).
2.3.4.2. Political and legal factors

Political factors are connected with government policies that might have an influence on the project. These policies cover all sorts of areas such as; fiscal policy, a government tax, and spending plans. These policies and regulations have a major effect on building design, the types of work available and the methods and resources that are used by contractors (Fewings, 2005, p.58).

2.3.4.3 Economic issues

The economy covers inflation and depreciation rates and these in turn have an influence on the growth of the economy, the ability of clients to invest and spend money, the level of house prices and tenders for business and commercial contracts, the value of stocks and shares, the rate of employment and the funding which is most economically available. Other important things which might affect the way that companies invest, or do business are the borrowing limits that they have and these are directly related to the profits they can make (Fewings, 2005, p.59).

2.3.4.4. Sociological factors

These are related to the fashions that people have and can therefore affect the market demand and the proportion of money that is put into housing and other spending. Communities may also put pressure on developers, contractors and designers to meet societal norms that they feel are acceptable. Environmental concerns show themselves in more energy saving designs, using environmentally sensitive materials and being dependent on less resource. Governments might try and influence this by the use of fiscal policy and incentives (Fewings, 2005, p.59).

2.3.4.5. Technological factors

Technological factors are issues that relate to the advances in technology, which can affect the methods and materials, which are used in construction. They may be the prerogative of the client, the designer or the
individual specialists in response to new opportunities. These factors allow for innovative factors and they may or may not be important to the client’s future business and are unlikely to be so influential in the post design stages of the project (Fewings, 2005, p.59).

2.3.5. Project Stakeholders Management

Project stakeholder refers to any individual or group of individuals that is directly or indirectly impacted by a project. Stakeholders can be internal or external to the project team or they can be internal or external to the project scope. Stakeholder has certain expectations, and consequently, engages in certain types of behavior, sometimes helpful and sometimes destructive (Sutterfield et al. 2006, pp.26-28).

Stakeholders can be many and various and called by different names such as project owner, client, customer, or financial source, project sponsor or director, program manager, project manager, leader, or coordinator, project team, group, or workforce, the project’s users, authorities, professional and business groups, the public, taxpayers, the media, and special-interest groups. Networking with these stakeholders occurs under two different types of conditions. The first condition is undertaking the project entirely within the organization for its own internal purposes, and the second is when the project is undertaken for an outside client and involves some form of legal contract or agreement (Cleland, 2004, p.290).

Many projects fail because project manager is unable to effectively manage in the sometimes hidden and conflicting agendas of project stakeholders. To be effective, Project manager should understand the objectives of each project stakeholder and how they can affect the project in order to effectively manage their needs and desires (Sutterfield et al. 2006, pp.26-28).

In addition, project managers must maintain frequent contact with key stakeholders to keep abreast of developments, assuage concerns, engage in
reality testing, and focus attention on the project. Frequent face-to-face interactions affirm mutual respect and trust in each other (Larson, and Clifford, 2011, p.362).

One of the useful ways used to help project manager to assess each project, stakeholder, and minimize the potential conflicts is Project Stakeholder Management Strategy Framework. This framework aids project managers in managing project stakeholders and their various agendas. There are nine steps to the continuous and dynamic strategic project stakeholder management framework.

- First step requires project manager to identify the project vision and mission.
- Second step requires project manager to conduct a project strength, weakness, opportunities, and threats (SWOT) analysis. Within SWOT analysis, the project manager needs to identify the internal strengths and weaknesses of project team. Project manager also needs to identify the external opportunities and threats that face the project team.
- Third step requires project manager to identify all project stakeholders and their goals in the project, and then
- Fourth step requires project manager to determine his selection criteria and identifies alternative strategies or plans of action for managing each project stakeholder and his goals.
- In step five, the project manager selects the project stakeholder management strategies that he will employ to aid the project stakeholder in achieving his goals while the project manager is able to accomplish his project goals.
- Step six requires the project manager to acquire and allocate resources needed to implement the selected project stakeholder management strategies.
- In step seven actual implementation of selected project stakeholder management strategies is done.
- In step eight, project manager evaluates the implemented project stakeholder management strategies, and makes various project corrective changes in the implemented project stakeholder management strategies where necessary.
- The ninth and final step requires project manager to get feedback from the stakeholders on a regular basis (Sutterfield et al. 2006, pp.29-35).
CHAPTER THREE PROJECT PLANNING
PROCESS
CHAPTER THREE: PROJECT PLANNING

PROCESS

SECTION ONE: PLANNING PROCESSES, PROJECT SCOPE, TIME AND COST PLANNING

3.1.1. Project Planning Processes

Successful planning does not just happen it is a systematical process of project definition and setting its scope and objectives. Almost all projects require formal and detailed planning to achieve their objectives. Planning is the function of determining the organization objectives, establishing the policies and procedures and determining all resources needed to achieve the organization’s target objectives (Larson, and Clifford, 2011, pp.28-30).

Moreover, project planning is very important to improve efficiency of operations and reduce uncertainty. It is divided into four main areas. First area is planning the project work that includes detailed activities relating to the project including schedules and sequences of work. Second area is planning and estimate of work force needed to execute the project. Planning the project money is the third area concerned about project budget in a time-phased manner. The last and the fourth area is planning the information system required for monitoring and controlling the project (Larson, and Clifford, 2011, pp.31-32).

In addition, planning determines what needs to be done, who will do it, how long it will take, and how much it will cost. It includes clearly define the project objectives with dividing and subdividing the project scope into major pieces using Work Breakdown Structure (WBS)\(^1\) tool, define the specific

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\(^1\)Work Breakdown Structure is deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables. It organizes and defines the total scope of the project. See A Guide to The Project Management Body of Knowledge.
activities that need to be performed for each work package in order to accomplish the project objectives (Clements and Gido, 2006, pp.78-79).

Project planning also includes time estimated, cost estimates, and calculation of the project schedule and budget which help to determine whether the project could be completed within the required time, within the assigned funds and with the available resources (Clements and Gido, 2006, p.79).

In project planning process, project objectives is defined in more detail to specify the priorities among the scope, time, and budget aspects of the project and to determine the appropriate levels of decision making authority within the project. This is done throughout the interaction between the project manager and top management after that the project team develops an integrated project management plan, to include the project’s action plan and scope, work flow, schedule, budget, quality plan, human resources plan, communication plan, risk plan, procurement plan, stakeholders plan, and the integration among them (Clements and Gido, 2006, p.79).

Moreover, project management plan develops precedence diagrams to establish logical relationship of project activities and milestones and develop time-based schedule for the project based on the precedence diagram to determine the resource needed to execute the project (Cleland, and Lewis, 2002, p.43).

The project management plan content will vary depending upon the application area and complexity of the project. This process results in a project management plan that is updated and revised through the integrated change control process (Barkley, 2006, pp.12-15).

In addition, the project management plan is considered as a rational determination of how to executed, monitored, controlled, and closed the project. It is defined as developing the plan in the required level of detail with accompanying milestones, and the use of available tools for preparing and monitoring the plan (Barkley, 2006, pp.16-20).
Subsequently, the outcomes of project management planning process group becomes a benchmark against which actual progress can be compared; then, if deviations occur, or the project is not proceeding according to plan, corrective action can be taken and re-planning must be done immediately. In other words taking the time to develop a well-thought-out plan is critical to the successful accomplishment of the project objective. Many projects have overrun their budgets, missed their completion dates, or only partially met their technical specifications because no viable plan was created before the project was started. To avoid this, Project work should be planned, and then the plan should be executed. This means performing the work according to the plan and controlling the work so that the project scope is accomplished within budget and on schedule (Gido, and Clements, 2009, p.111).

In planning processes, all project team involved in project should be participated. By participating in the planning of the work, individuals will become committed to accomplishing it according to the plan and within the schedule and budget (Gido, and Clements, 2009, p.111).

The most important responsibility of the project team is to develop the project plan in agreement with other supportive stakeholders. The project plan must be harmonious with the strategic plan of the enterprise, the functional plans, and, where appropriate, with the plans of the relevant stakeholders (Cleland, and Lewis, 2002, p.309).

Constantly, project planning begins within the framework of strategic planning in the organization. The strategic context of organizational planning sets the stage for project planning. Projects must adhere to the enterprise’s general strategic plan to assure flow down of the enterprise’s mission, vision, objectives, goals, and strategies. Using these concepts, project planning becomes an elaboration of the overall approach to business and provides for consistently building on the enterprise’s capability to perform work through projects.
Understanding the strategic approach to business and linking that to the project planning will provide the required means to pursue work that supports the organization’s objectives (Cleland, and Lewis, 2002, p.312).

In organization, processes of developing the project plan vary from organization to another, but any project plan must contain the following elements:

- **Overview.** This is a short summary of the objectives and scope of the project. It is directed to top management and contains a statement of the goals of the project, a brief explanation of their relationship to the firm’s objectives, a description of the managerial structure that will be used for the project, and a list of the major milestones in the project schedule.

- **Objectives or Scope.** This contains a more detailed statement of the general goals noted in the overview section. The statement should include profit and competitive aims as well as technical goals.

- **General Approach.** This section describes both the managerial and the technical approaches to the work. The technical discussion describes the relationship of the project to available technologies. The subsection on the managerial approach takes note of any deviation from routine procedure and contractual aspects. This section of the plan includes a complete list and description of all reporting requirements, customer supplied resources, interrelationship arrangements, advisory committees, project review and cancellation procedures, proprietary requirements, any specific management agreements, as well as the technical deliverables and their specifications, delivery schedules, and a specific procedure for changing any of the above.

- **Schedules.** This section outlines the various schedules and lists all milestone events. Each task is listed, and the estimated time for each task should be obtained from those who will do the work. The projected baseline schedule is constructed from these inputs. The responsible person or department head should sign off on the final, agreed on schedule.
- Resources. There are two primary aspects to this section. The first is the budget. Both capital and expense requirements are detailed by task, which makes this a project budget. The second aspect is cost monitoring and control procedures. In addition to the usual routine elements, the monitoring and control procedures must be designed to cover special resource requirements for the project, such as special machines, test equipment, laboratory usage or construction, logistics, field facilities, and special materials.

- Personnel. This section lists the expected personnel requirements of the project. Special skills, types of training needed, possible recruiting problems, legal or policy restrictions on work force composition, and any other special requirements.

- Risk Management Plans. This covers potential problems as well as potential positive events that could affect the project.

- Evaluation Methods. Every project should be evaluated against standards and by methods established at the project’s inception, allowing for both the direct and subsidiary goals of the project. These are the elements that makeup the project plan and are the basis for a more detailed planning of the budgets, schedules, work plan, and general management of the project (Meredith, and Mantel, 2009, pp.247-249).

Because the plan is only an estimate of what and when things must be done to achieve the scope or objectives of the project, it is always carried out in an environment of uncertainty. Therefore, the plan must include allowances for risk and features that allow it to be adaptive. The plan must include any constraints on activities and input materials prohibited by law and society. It is a complicated process to manage a project, and plans act as a map of this process. The map must have sufficient detail to determine what must be done next but be simple enough that workers are not lost in a confusion of details. Most organizations, irrespective of the industry, use essentially the same processes for
planning and managing projects, but they often call these processes by different names. What some call setting objectives, others call defining the scope of the project, or identifying requirements. What some call evaluation, others call test and validation. No matter whether the project is carried out for an inside or outside client, the project’s deliverables must be integrated into the client’s operating system (Meredith, and Mantel, 2009, pp.239-242).

3.1.2. **Project Scope Management Planning**

Project scope management is the function of controlling a project in terms of its goals and objectives through the processes of conceptual development, full definition, execution, and termination. It provides the foundation upon which all project work is based. The scope statement addresses seven questions: who, what, when, why, where, how, and how many. This document validates the project scope against the statement of work provided by the customer. Therefore good scope definition is crucial to project success because it helps determine project’s goals, constraints and limitations, all activities to be performed, improve the accuracy of time, cost, and resource estimates. The main techniques used in scope definition include analyzing products, identifying alternative approaches to do the work, understanding and analyzing stakeholder needs, and using expert judgment (Schwable, 2009, p.114).

The main outputs of scope planning are (Schwable, 2009, p.114):

- A scope management plan, which is a document that includes descriptions of how the team will prepare the scope statement which is the main output of scope definition,
- Create the Work Breakdown Structure (WBS),
- Verify completion of the project deliverables that can be a product, service, or other result, and
- Control requests for changes to the project scope.
The breaking down of large activities into manageable units is a fundamental part of project management. To do this one of the most important tools of project management is used. It is the Work Breakdown Structure (WBS) the hierarchical tree of work elements or items accomplished or produced by project team during the project. It identifies individual responsible for each work package, and ensures greater ownership by all those owning a task in the project (Clements and Gido, 2006, p.12).

The Work Breakdown Structure (WBS) helps in effective planning, assignment of responsibility, development of control and information system. Also, it provides a common framework for planning cost and budgets estimates, tracking of time, cost and performance, establishing of scheduling and status reporting procedures and establishment of responsibilities of each project team. Work breakdown structure (WBS) defines what work is done in a detailed way to assign responsibility for the task to be done. It has to be integrated with the project organization structure (Matheen, 2009, p.107).

To design and use the WBS the following steps should be carried out (Meredith, and Mantel, 2009, pp.261-263):

- Listing the task breakdown in successively finer levels of detail by using information from the plan. Each task or package can be individually planned, budgeted, scheduled, monitored, and controlled. If the set of work package descriptions is not complete and properly arranged, it is highly unlikely the project can be completed on time, on budget, and to specification.
- Listing personnel and organizations responsible for each task.
Reviewing all work package information with the individuals or organizations who have responsibility for doing or supporting the work.

3.1.3. Project Time Planning

Scheduling is the time that is required to perform each operation and also the time required to perform the entire series as routed. It is detailed day-to-day planning of operations. It is the assignment of work to the facilities with specifications of time and the sequence in which the work is to be done. There are several scheduling methodologies such as Gantt chart, project schedule, critical path method, index method of scheduling, and programming methods may be used (Matheen, 2009, pp.85-91).

Various factors influence time target for a project. The main factors are work content, work sequence, resources and constraints. The estimated time for the completion of the project is dependent not only on the work content or the sequence; it will also be influenced by resources and constraints (Matheen, 2009, pp.66-69).

In order to make better use of project time management, there are several techniques that project managers can use. These techniques may include delegation, following the schedule, refusing to do the unimportant tasks, looking ahead and continuously asking. One of the most used techniques that project manager is using is the project scheduling, which is the planning of work sequences for making project processes systematic to complete all product by due date. To do effective scheduling specified points should be considered. First question is which work unit will do which job. Second question is when should the work be started and when should be ended, and finally how it will be achieved and by whom and in what sequence (Matheen, 2009, pp.79-80).

Moreover, the schedule converses the project action plan into an operating timetable. It serves as the basis for monitoring and controlling project activity. In
a project environment, the scheduling function is more important than it would be in an ongoing operation because projects lack the continuity of day-to-day operations and often present much more complex problems of coordination (Meredith, and Mantel, 2009, p.333).

One of the most useful and effective methods of presenting project schedule information is the Gantt chart. It shows planned and actual progress for a number of tasks displayed as bars against a horizontal time scale. It is a method of indicating the actual current status for each of a set of tasks compared to the planned progress for each item of the set (Meredith, and Mantel, 2009, p.342).

The Gantt chart as the following figure 3-1 (Gido, and Clements, 2009, p.343) shows combination of two functions of planning and scheduling. In the Bar chart, the scheduling of activities occurs simultaneously with their planning showing the interrelationships among them, and which activities must be finished before others can start and which activities can be performed concurrently.

![Gantt Chart](image)

Figure 3.1 Gantt Chart

The basic approach of all scheduling techniques is to form a network of activity and event relationships that graphically describes the sequential relations...
between the tasks in a project. Tasks that must precede or follow other tasks are then clearly identified, in time as well as function (Meredith, and Mantel, 2009, p.333).

Therefore, in order to do project schedule, project network tool should be created, it is powerful tool for planning and controlling a project that consists of many interrelated activities\(^1\) used for planning, scheduling, and monitoring project progress. Project network is a graphic flow chart of the project job plan. It is developed from the information collected from the project WBS. The network describes the project activities that must be completed, the logical sequences, the interdependencies, critical path\(^2\) of the activities to be completed including the start and finish times for the activities through project life cycle. It is the framework for the project information system that will be used by the project managers to make decisions concerning project time, cost, and performance (Larson, and Clifford, 2011, p.167).

In addition to benefits of project network above mentioned, it also provides other invaluable information. It provides the basis for scheduling labor and equipment. It enhances communication that melds all managers and groups together in meeting the time, cost, and performance objectives of the project. It provides an estimate of project duration. The network gives the times when activities can start and finish and when they can be delayed. It provides the basis for budgeting the cash flow of the project and identifies which activities are critical and, therefore, should not be delayed if the project is to be completed as planned. Basically, project networks minimize surprises by getting the plan out early and allowing corrective feedback (Larson, and Clifford, 2011, pp.167-168).

\(^1\)Activity is an element in the project that consumes time and requires resources.

\(^2\)Critical Path is the longest activity path(s) through the network which, when delayed, will delay the project. The critical path can be distinguished by identifying the collection of activities that all have the same minimum float. See Larson, and Clifford, 2011, p.643.
The project manager must be careful to guarantee continuity by having some of the same people who defined the WBS and work packages develop the network activities. The different amongst the networks, WBS, and work packages is that networks provide the project schedule by identifying dependencies, sequencing, and timing of activities, which the WBS is not designed to do. While the primary inputs for developing a project network plan are work packages.

Drawing the project network places the activities in the right sequence for computing start and finish times of activities. Activity time estimates are taken from the task times in the work package and added to the network. The forward pass is used to determine Earliest Times including early start (ES), early finish (EF) and the expected time for the activity while the backward pass is used to determine the latest times including late start (LS), late finish (LF), and how long the activity be delayed, and which activities represent the critical Path.

The critical path indicates to the project completion time for the plan. The forward pass starts with the first project activity and traces each path through the network to the last project activity. As tracing along the path, activity times should be added. The forward pass assumes every activity will start in time when the last of its predecessors is finished. The backward pass starts with the last project activity on the network. Tracing backward on each path subtracting activity times to find the late start and finish times for each activity. Before the backward pass can be computed, the late finish for the last project activity must be selected. In early planning stages, this time is usually set equal to the early finish of the last project activity. When the forward and backward passes have been computed, it is possible to determine which activities can be delayed by computing the float. If the float of one activity in a path is used, the ES for all activities that follow in the chain will be delayed and their float reduced. Using of

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1 Total Float is the amount of time an activity can be delayed and not delay the project. It is the difference between the LS and ES. See: Larson, and Clifford, 2011, p.169.
total float must be coordinated with all participants in the activities that follow in the chain. After float for each activity is computed, the critical path could be identified that has the least float. Negative float occurs in practice when the critical path is delayed. Delay of any of these critical activities will delay the total project by the same number of days. Critical activities typically represent about 10 percent of the activities of the project. Therefore, project managers pay close attention to the critical path activities to be sure they are not delayed (Larson, and Clifford, 2011, pp.164-170).

Sometimes in specific cases, project managers need to expedite their project period. One of the ways to do this is known as fast-tracking. This term has been applied mostly to construction projects, but the technique can be used in many other types of projects. It refers to overlapping the activity phases of a project. Overlapping two activities will result in shortening the project duration. Although overlapping project activities compresses project time duration it might also, however, results in an increased number of change orders, subsequent loss of productivity, increased cost, and loss of time. Using successful Fast tracking techniques basically depends on effective feedback and feed-forward communication (Meredith, and Mantel, 2009, pp.391-392).

3.1.4. Estimating Project Costs and Budgets

Budgets play an important role in the entire process of management. It is a plan for allocating resources. It serves as a standard for comparison and a baseline from which to measure the difference between the actual and planned uses of resources. It is clear that budgeting procedures must associate resource use with the achievement of organizational goals or the planning and control process becomes useless (Meredith, and Mantel, 2009, p.293).

To create the project budget, there are two fundamentally different strategies for data gathering (Meredith, and Mantel, 2009, p.297):
- Top-down method.
- Bottom-up method.

In top-down, budgeting strategy data collected is based on past data concerning similar activities, and experiences of top and middle managers. These managers estimate overall project cost as well as the costs of the major subprojects that comprise it, and these cost estimates are then given to lower-level managers, who are expected to continue the breakdown into budget estimates for the specific tasks and work packages that comprise the subprojects. This process continues to the lowest level until the budget is broken down into successively finer detail, starting from the top. One of disadvantages of this method is that it is assumed that lower-level managers will argue for more funds. On the other hand, the advantage of this top-down process is that aggregate budgets can often be developed quite accurately, though a few individual elements may be significantly in error (Meredith, and Mantel, 2009, p.297).

The second strategy for collecting data needed to develop the project budget is bottom-up budgeting. In this method, tasks, their schedules, and their individual budgets are constructed following the WBS. The people doing the work are consulted regarding times and budgets for the tasks to ensure the best level of accuracy. Differences of opinion are resolved by the usual discussions between senior, project managers, functional managers and junior managers in order to ensure the accuracy of the estimates. The resulting task budgets are aggregated to give the total direct costs of the project. Indirect costs, reserve for contingencies and administrative will be added with profit value to arrive at the final project budget. The advantages of the bottom-up process are that individuals closer to the work are suited to have a more accurate idea of resource requirements than their superiors or others not personally involved. In addition, the direct involvement of low-level managers in budget preparation increases the
likelihood that they will accept the results with a minimum of complain (Meredith, and Mantel, 2009, p.298).

SECTION TWO: PROJECT QUALITY AND HUMAN RESOURCE PLANNING

3.2.1. Project Quality Plan

Quality is defined as doing the things right and doing them from the first time to meet and exceed customer satisfactions and needs. This is not only enhancing contractor reputation but also it helps to control costs (Levy, 2007, p.221).

Today customers are demanding higher performance requirements and fewer defects or rejects. Moreover, their demands are now being handled using total quality management (TQM). Total quality management could be defined as a system for integrating various organizational elements into the design, development, and manufacturing efforts, providing cost effective products or services that are fully acceptable to the ultimate customer, also it is customer oriented and provides for more meaningful customer satisfaction, and it reduces operating costs, thus enhancing product quality while improving organizational morale (Kerzner, 2009, pp.874-875).

Sometimes project may be completed on time and within the set budget, but not meet the specified quality or performance criteria. In this case, it will be at best attracting criticism and at worst be considered a failure. Striking a balance between meeting the three essential criteria of time, cost and quality is one of the most troublesome tasks of a project manager. Failure in quality can be expensive, dangerous and can destroy an organization’s reputation far quicker than it took to build up (Lester, 2006, p.73).

Therefore, Quality management is an essential part of project management and as with any other attribute; it does not just happen without a systematic approach. To ensure a quality product it has to be defined, planned, designed,
specified, manufactured, constructed and commissioned to an agreed set of standards which involve every department of the organization, and to be most effective, every level of an organization should be involved and be committed to achieving the required performance standards by setting and operating procedures and systems which ensure this. Ideally, all of the project team should be responsible for ensuring that his work meets the quality standards established by management. To ensure that these standards are met, quality assurance requires checks and audits to be carried out on a regular basis (Lester, 2006, p.73).

In addition, meeting the quality expectations of the customer can be a challenging task, and to ensure that the quality expectations are clearly defined and can reasonably be achieved, a quality plan is documented. The quality plan defines the term quality for the project, lists clear and unambiguous quality targets for each deliverable. Each quality target provides a set of criteria and standards to be achieved to meet the expectations of the customer, provides a plan of activities to assure the customer that the quality targets will be met, and identifies the techniques used to control the actual quality level of each deliverable as it is built (Westland, 2006, p.9).

Basically, the quality plan is created by the project manager and project team members by breaking down the project objectives into a work breakdown structure, and then the project activities are broken down into lower level activities until specific quality actions can be identified (Kerzner, 2009, p.889).

The project manager has the ultimate responsibility for quality management on the project. However, the direct measurement of quality may be the responsibility of the quality assurance department or the assistant project manager for quality. Quality management has six concepts that should exist to support each and every project. These concepts include (Kerzner, 2009, p.887):

- Quality policy.
- Quality objectives.
- Quality control and quality audit.
- Quality assurance.
- Quality plan.

First, the quality policy is a document typically created by quality experts and fully supported by top management. The policy should state the quality objectives, the level of quality acceptable to the organization, and the responsibility of the organization’s members for executing the policy and ensuring quality. A quality policy would also include statements by top management committing its support to the policy (Kerzner, 2009, p.887).

Second, quality objectives that are part of an organization’s quality policy and consist of specific objectives and the period for completing them, the quality objectives must be selected carefully. Selecting objectives that are not naturally possible can cause frustration. Good quality objectives should be obtainable, define specific goals, be understandable, and state specific deadlines (Kerzner, 2009, p.888).

Third, quality control, quality assurance, and quality audit are one of the main procedures available to the project management team. Quality control procedures are usually agreed upon the contract. Contracts require validation-passing gates such as quality checks, testing, walkthroughs, and inspections. Quality checks and performance tests are the elementary steps in helping to ensure that site operations and materials respect the specified level of quality. Checking construction workmanship is of great importance (Marco, 2011, pp.148-149).

Quality assurance needed for materials and equipment must be established to assure the satisfactory performance. A walkthrough is a semi-formal work quality control task. Its purpose is to notify the stakeholders that a portion of the scope of work is complete, and get approval. An inspection is a formal review of the quality of a portion of the work done, as well as of the quality of the process.
itself. The stress on quality by the control team often causes more hidden errors and results in lower quality. In turn, quality control inspection delays the detection of cumulative errors that require more time and money to recover or rework (Marco, 2011, p.149).

And finally is the good quality plan that specifies the measures and procedures for monitoring and comparing work output with requirements, and comparing requirements with current needs. The quality plan specifies the measures and procedures for monitoring operational performance. It is prepared after system objectives have been defined (Nicholas, and Steyn, 2008, p.130).

In order to verify that a product or service meets the customer’s requirements requires the measurement of the costs of quality. The costs can be classified as the cost of conformance and the cost of non-conformance. Conformance costs include items such as training, verification, validation, testing, maintenance, calibration, and audits. In contrast, nonconforming costs include items such as scrap, rework, warranty repairs, product recalls, and complaint handling (Kerzner, 2009, p.890).

Typically, Customer satisfaction has a price that must be included in the cost of the product or service. This cost of the product or service includes cost of quality as a direct result of the organization’s quality plan. This cost of quality is included in the following four categories: the first prevention costs that associated with preventing defects in the product or service, such as special training for workers, planning and designing product manufacture, and designing and establishing proven processes. The majority of effort in any quality planning should focus on avoiding defects in products and services. The second cost is appraisal costs that associated with inspection, evaluation, measurement, and tests performed to determine whether a defect exists. The third cost is failure costs that associated with product failure, these costs in a mature quality program should be
minimized and resulted from variances in the development or delivery process. The final and fourth cost is measurement and test costs. Those costs associated with equipment, gauges, and measuring devices (Cleland, 2004, p.469).

3.2.2. Project Human Resource Plan

Human resources are the knowledge, skills, and capabilities of the organization’s employees. This includes the board of directors, managers at all levels and employees as a whole. The board of directors provides the company with considerable experience, political keenness, and connections, and possibly sources of appropriate power. The board of directors is primarily responsible for selecting the project manager and representing the best interest of the diverse stakeholders as a whole (Kerzner, 2001, p.35).

Planning of human resources in project involves the effective use of people in the project, including team building, conflict management, leading, delegating, motivating, performance appraisal, and other such activities associated with managing the human resource (Cleland, 2004, p.85).

Moreover, in planning phase, Organization Breakdown Structures needed because it is a practical method to decompose the pool of human resources needed to execute all of the tasks into different competence areas and then into project roles, independently of the number of individuals that will be assigned the specified role. The organization breakdown structure is prepared with the idea that each task in the project WBS must be assigned to a role or committee of roles. In other words, roles are allocated to detailed tasks (Marco, 2011, p.92).

Besides organization breakdown structure, Responsibility Assignment Matrix (RAM) is used which is one of the important and useful tools developed during human resources planning. It is a method used to display, in tabular format, the individuals responsible for accomplishing the work items in the WBS. It emphasizes who is responsible for each work item and shows each
individual’s role in supporting the overall project (Gido, and Clements, 2009, p.118).

Most of the time managing complex projects represents a challenge requiring skills in team building, leadership, conflict resolution, technical expertise, planning, organization, administration, management support, and the allocation of resources. Therefore selection of skilled project manager able to integrate personnel from many disciplines into an effective work team is a key factor to good project performance (Kerzner, 2009, pp.148-149).

Moreover, with an understanding of the interaction of corporate organization and behavior elements, the manager can build an environment leading to the working team’s needs. He must understand the culture and value system of the organization he is working with. In the same time, must understand the internal and external forces that affect the organization of the project. Thus, the project manager must be both socially and technically aware to understand how the organization functions and how these functions will affect the project organization of the particular job to be done (Kerzner, 2009, pp.148-149).

In addition to skills needed in project manager mentioned above, one of the project manager prime responsibilities is building the project team. Typically, teams can be either functional or multifunctional. A functional team consists of members from the same discipline or organization. Whereas multifunctional team would have members from engineering, manufacturing, marketing, and other fields as appropriate (Barkley, 2006, p.134).

In most projects, the project team is a combination of the project office and functional employees connected by effective communication network, it may include key personnel such as (Cleland, and King, 1983, pp.103-104):

- Project manager.
- Construction Project manager.
– Project construction coordinator.
– Project startup engineer.
– Project engineer.
– Project quality assurance engineer.
– Project cost and schedule supervisor.
– Project administrator.
– Project procurement manager.
– Project assistant controller.

Usually in project, project manager is responsible for the overall execution of the project based on the contract, and client requirements. He also is the director of the communication link between the client's organization and his own company's engineering and construction personnel. His major goal is to keep the project within budget, on schedule, and completed to quality standards acceptable to the client and the company. Whereas construction project manager is responsible for all of the company's activities at the job site. This includes supervision of direct and hire labor, administration of construction contracts, field engineering, field procurement, job safety, construction quality control, jobsite accounting. Construction project manager always needs skilled project team to handle the project such as project construction coordinator who assists the construction manager in evaluating job costs and schedule and coordinates the activities of jobsite personnel with office, design, engineering, procurement, cost, scheduling, and construction personnel. Other team members who could help the project manager is project startup engineer who is responsible for planning the preoperational testing services for the project. He also coordinates the work of the company's startup engineers at the job site and provides technical instruction and guidance to client personnel for preoperational testing services following completion of construction (Cleland, and King, 1983, pp.104-109).

There is also project engineer who prepares the technical scope documents
that describing the project, develops the engineering plan and budget, develops the project design including drawings and specifications also he prepares technical reports and provides technical support of licensing applications, and prepares material requisitions. Project quality assurance engineer is responsible for developing, implementing the quality assurance program for the job, and monitoring, and auditing the quality control activities of the engineering, procurement, construction materials, and construction fabrication groups on the project. Project cost and schedule supervisor is responsible for the preparation of project estimates, budgets, and schedules and for forecasting and monitoring job costs and progress. Project administrator is responsible for providing, staffing, and administrating all the administrative services required by project team members including document control and records management. The project procurement manager is responsible for all procurement functions required by the project including office and field procurement. Project assistant controller is responsible for all finance and accounting matters on the project such as general accounting payroll, accounts payable, billings, employee accounts, time keeping, accounts receivable, and cost and commitments records. He provides functional guidance and advice to the project field accounting managers (Cleland, and King, 1983, pp.104-109).

In fact, project team is a service-oriented group requiring expert organization, strong leadership, and the continuous support of senior management. They help project manager determine the project's needs for staff resources. They also helps project manager to manage the project's schedule, budget, technical performance, and achieve project’s objectives (Cleland, and King, 1983, pp.104-109).

Therefore, to be successful project team, they should have well-established communications network among them such as frequent staff meetings required to plan and implement project activities and monitor progress,
communications between them and senior management that ensure active management support, and finally communications with the client (Cleland, and King, 1983, pp.104-109).

Actually, the project team members should have specialized skills and experiences to accomplish the objective. They must work in concert with one another with common goals and objectives with respecting of each other culture. Therefore, project team is not just an asset, they are the asset, and they deserve to be treated well (Cleland, 2004, pp.327-328).

Furthermore, building high performance team needs trust and interdependence; there are no super stars and no losers. The team members must pull together, watch out for each other, and be able to count on one another. Project team members must assist one another to gain the desired results. Any individual in the team has his own needs that must be satisfied such as achievement, affiliation and power. The strength of these needs influences the behavior of the team members and the performance of the team. That means building a high performance team requires a careful balancing of goals and objectives, technical requirements, skills and competencies and good leadership style (Cleland, 2004, pp.327-328).

In addition, effective teams realize diversity, individuality, and creativity are their greatest advantages and recognize that individual and team contributions are rewarded and recognized appropriately. Therefore, the team takes ownership and pride in their performance. They share responsibilities, authorities, and resources to achieve their collective mission. They feel empowered to do whatever is necessary within their defined boundaries; they motivate, respect, and support each other. Generally, they all contribute their technical competence in their specialty as well as all other skills with maintaining teamwork spirit (Barkley, 2006, p.134).

Teamwork is the technique where the individual team members work
together to achieve a common goal. This involves cooperative relationships, open 
communications, group problem solving and agreement decision-making. Teamwork can only be effective in an environment of honesty, trust, open and 
effective communications, especially listening, individual involvement, pride of 
workmanship, and commitment. In addition, effective teamwork involves positive 
attitude, motivation to perform and improve, ownership of work with pride, 
respect and consideration for others, remaining focused on total customer 

In fact, to maintain teamwork spirit, effective team members should have 
some characteristics in common. They must be technically competent, they need 
strong problem orientation, they need a strong goal orientation, they need high 
self-esteem, they must be sufficiently self-confident and have sufficient trust in 
their fellow team members that they can immediately acknowledge their own 
errors and point out problems caused by the errors of others (Mantel et al. 2008, 
pp.60-61).

Actually, it is very difficult to get all project team members needed with 
the skills required for the project that they have one common objective. 
Definitely, project manager usually faces some project team members that have 
hidden agenda. These employees may play destructive roles on a project team, 
and may hinder project management implementation. Characteristics describe this 
project team member may be one of the following (Kerzner, 2009, pp.181-183):

- The aggressor, criticizes everybody and everything on project management, 
deflates the status and ego of other team members, always acts aggressively,
- The dominator, always tries to take over, professes to know everything about 
project management tries to manipulate people will challenge those in charge 
for leadership role,
− The devil’s advocate, finds fault in all areas of project management, refuses to support project management unless threatened acts more of a devil than an advocate,
− The topic jumper, must be the first one with a new idea/approach to project management, constantly changes topics, cannot focus on ideas for a long time unless it is his idea, tries to keep project management implementation as an action item forever,
− The recognition seeker, always argues in favor of his own ideas and always demonstrates status consciousness,
− Volunteers, to become the project manager if status is recognized, likes to hear himself talk, or likes to boast rather than provide meaningful information,
− The withdrawer, is afraid to be criticized, will not participate openly unless threatened, may withhold information, may be shy,
− The blocker, likes to criticize, rejects the views of others, cites unrelated examples and personal experiences, has multiple reasons why project management will not work.

Indeed, these types of people should not be assigned to project management implementation teams. While, the types of people who should be assigned to implementation teams should be the initiators, the information seekers, the information givers, the encouragers, the harmonizers, and the consensus takers, the gate keepers.

Therefore, in order to build the cohesiveness and effectiveness of the team and select the proper and skilled project team members, it is important according to Barkley (2006, p.136) to pay particular attention to the mission, roles and responsibilities, group dynamics, and interpersonal relationships within the team. According to him, “team building has five stages showing the maturity in the team. These stages compose of: Forming, storming, norming, performing and, adjourning.

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Firstly, in the forming stage, the team is created and ground rules are set, communication are formed, project organization and documentation are established, but discipline in the team has not yet been established.

Secondly, in storming stage team members begin to establish their influence. Team culture and practices begin to develop. The team members start to deal with internal policies and personalities, and conflict arise.

Thirdly, in the norming stage, the team begins to take ownership of the goals and objectives. In this stage, the team's culture is fully established. Roles and responsibilities have been set and the team members are focusing on achievement, performing and generating results.

Fourthly, the performing stage is the project execution phase, monitoring risk, and determining progress against objectives. In this stage, collaboration is at its highest level and the team tends to think and act as a cohesive unit. Rewards and recognition for accomplishment are now occurring on a regular basis. Issue and problem resolution are a shared team effort. The focus of the team is on performance, generating results and project completion.

Fifthly and finally is the adjourning stage, which addresses the fact that projects and teams are temporary. They exist to complete the goals and objectives and then they released frequently to reform for another project (Cleland, 2004, pp.331-332).

In fact, there is mutual relation between project team and project manager. Therefore, project team members should communicate effectively with their project manager in order to be committed to the project, be results oriented, be change oriented, interface effectively and with high morale, demonstrate the capacity for conflict resolution, demonstrate the potential for innovative and creative behavior. On the other hand, project team members expect from their project manager to assist in the problem-solving process by coming up with ideas,
provide proper direction and leadership, provide good environment, and interact informally with the team members (Kerzner, 2009, p.372).

SECTION THREE: PROJECT COMMUNICATION AND RISK PLANNING

3.3.1. Project Communication Planning

Communication is the process by which information is exchanged between individuals through a common system of symbols, signs, or behavior. No doubt, project manager uses communication more than any other process in the project environment to ensure that team members work together on project problems, opportunities, and objectives. He usually uses communication means and channels of information including plans, policies, procedures, objectives, goals, strategies, organizational structure, linear responsibility charts, leader and follower style, meetings, letters, telephone calls, small group interaction to communicate with the project stakeholders (Cleland, and Lewis, 2002, p.483).

Indeed communication process concerned with exchanging information mainly about human resource, financial resources, material resources, and or project scheduling. It is very important for project management success, therefore every effort must be made to ensure complete communication between all the team and stakeholders of the project including sponsors, customers, managers, project managers, suppliers, other support teams, functional organization, people and teams outside the project team (Matheen, 2009, pp.168-170).

Effective and proper communication is vital to the success of the project. It reduces non-productive effort, avoid duplication, help eliminate mistakes, and help to manage uncertainty. It also encourages teamwork by increasing motivation and ensuring the involvement of all project team, and the final result of communication will be is that project more likely to meet its objectives within
allocated time and resources (Clarke, 1999, pp.139-145).

Moreover, effective project communications ensure that the right information is sent to the right person at the right time and in a cost-effective manner. Typical effective communication include a technique for expressing ideas effectively, a process by which meanings are exchanged between individuals through a common system of symbols. Therefore, for communication to be effective, the sender must be credible, the message must be clear, and the receiver must interpret it the way the sender intended (Kerzner, 2009, p.233).

The main purpose of the project communication plan is to express what, who, how, and when information will be transmitted to project stakeholders so, that schedules, issues, and action items can be tracked. Developing a communication plan needs (Larson, and Clifford, 2011, pp.119-120):

- Stakeholder analysis that identifies the target groups. Typical groups could be the customer, sponsor, project team, project office, or anyone who needs project information to make decisions and/or contribute to project progress.

- Information needs. That gathers suitable information to stakeholders who contribute to the project’s progress. Frequent information needs to be found in communication plans are: project status reports, deliverable issues, changes in scope, team status meetings, gating decisions, accepted request changes, action items, and milestone reports.

- Sources of information. When the information needs are identified, the next step is to determine the sources of information. That is, where does the information reside? How will it be collected?

- Dissemination modes. In today’s world, traditional status report meetings are being supplemented by e-mail, teleconferencing, and a variety of database sharing programs to circulate information. In particular, many companies are using the Web to create a virtual project office to store project information.
- Responsibility and timing. Determining who will send out the information. Timing and frequency of distribution appropriate to the information need to be established.

Besides the benefits of developing a communication plan there are also techniques that can be used to improve communications. These techniques may include (Barkley, 2006, pp.143-144):

- Obtaining feedback, possibly in more than one form.
- Establishing multiple communications channels
- Using face-to-face communications if possible
- Determining how sensitive the receiver is to the sender communications
- Being aware of symbolic meaning such as expressions on people’s faces
- Communicating at the proper time
- Reinforcing words with actions
- Using a simple language and redundancy

On the contrary, with every effort to communicate there are always barriers affect negatively on communication process. These barriers include (Kerzner, 2009, p.239):

- Receiver hearing what he wants to hear. These results from people do the same job so long that they no longer listen.
- Sender and receiver having different perceptions. This is vitally important in interpreting contractual requirements, statements of work, and proposal information requests.
- Receiver evaluating the source before accepting the communications.
- Receiver ignore conflicting information and doing as he pleases.
- Words mean different things to different people.
- Communicators ignore nonverbal cues.
- Receiver being emotionally upset.
Generally, project communication takes various forms, including personal communication, meetings, presentations, reports, and project documentation. It can be face to face or use some media, including telephones, voice mail, e-mail, and videoconferencing. It can also be formal or informal, oral or written (Gido, and Clements, 2009, p.394).

In oral communication, body language and tone are important elements. In this type, communication should be straightforward, unambiguous, free of technical terms, and not offensive. Also, in this type, asking for or providing feedback enhances understanding. In other hand, personal written communication is generally carried out through internal memos or external letters. Such tools can be used to communicate effectively with a large group of people. Also, project meetings are another form for project communication (Gido, and Clements, 2009, p.394).

In general, before any meeting, the purpose of the meeting and the people who need to participate should be determined, an agenda should be drawn up and distributed, materials should be prepared, and location arrangements should be made. The actual meeting should start on time, notes should be taken, and the agenda should be reviewed. The meeting leader should facilitate the meeting. And after the meeting, decision and action items should be published and distributed (Gido, and Clements, 2009, p.394).

The other form of communication is presentation. In this communication form project managers and team members are often called on to give formal presentations. In preparing for the presentation, it is important to determine the purpose of the presentation, find out about the target audience, make an outline, develop notes and visual aids, make copies of handout materials, and practice. It should be clear, simple, and interesting, and should conclude within the allowed time (Gido, and Clements, 2009, p.394).

Other form of communication is written reports that are often required
during a project. The two most common types of project reports are (Gido, and Clements, 2009, pp.395-396).

- Progress reports.
- Final reports.

Progress reports often cover accomplishments since the prior report, the current project status, any potential problems that have been identified and corrective actions that are planned, and goals that should be accomplished during the next reporting period. Whereas final reports provide a summary of the project and often include items such as the customer’s original need, the original project objective and requirements, benefits resulting from the project, a description of the project, and a list of deliverables produced. The last form of communication is project documents that may be created throughout a project, such as manuals or drawings. They may need to be revised because of changes made by the customer or the project team.

3.3.2. Project Risk Planning

Risk refers to uncertainty about consequences that individual and organizations face while putting plans into action. In fact, risk in construction projects has great impacts, and much time in construction management is spent focusing on them. Therefore, construction project management has to deal with several kinds of risk, such as (Marco, 2011, p.153):

- External risk sources such as environmental conditions,
- Different productivity than expected,
- Defective work by contractors and subcontractors,
- Financial instability,
- Procurement lead times,
- Inflation,
- Market acceptance,
- Exchange rates,
- Government regulations,
- Labor difficulties,
- Unexpected manufacturing costs,
- Failure to find sufficient skills,
- Community opposition,
- Unrealistically low bids,
- Late-stage design changes,
- Unexpected subsurface conditions, and
- Permit and authorization obstacles.

In the context of projects, risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on project objectives. It has a cause and, if it occurs, there is a consequence. Some potential risk events can be identified before the project starts such as equipment malfunction or change in technical requirements. Others can be anticipated consequences, like schedule slippages or cost overruns. Moreover, risks can be beyond imagination like the 2008 financial meltdown, while risks can have positive consequences such as unexpected price reduction in materials (Larson, and Clifford, 2011, p.211).

Practically, effective project management requires an ability to deal with uncertainty such as the time required to complete a project, the availability and costs of key resources, a wide variety of economic variables, the client, and the actions taken by competitors. Indeed, even the likelihood that the output of a project will perform as expected, all these illustrate the uncertainties faced when managing projects. Therefore, there are actions that may be taken to reduce the uncertainty, and no actions of a project manager can ever eliminate it. One approach that is particularly useful in helping understand the implications of uncertain information is risk analysis. The principle of risk analysis is to make estimations or assumptions about the probability distributions associated with key
parameters and variables and to use analytical decision models or simulation models based on these distributions to evaluate the desires of certain managerial decisions (Mantel et al. 2008, p.19).

In general, risk management includes three areas: risk identification, risk analysis, and response to risk. The process of accomplishing these three tasks is broken down into six sub processes (Mantel et al. 2008, pp.127-128):

- Risk management planning that develops a plan for risk management activities,
- Risk identification that finds those risks that might affect the project,
- Qualitative risk analysis which evaluates the seriousness of the risk and the likelihood it will affect the project,
- Quantitative risk analysis that develops measures for the probability of the risk and its impact on the project,
- Risk response planning that finds ways of reducing negative impacts on the project as well as enhancing positive impacts, and
- Risk monitoring and control that maintains records and evaluates the sub processes above in order to improve risk management.

Typically, the results of the first three steps of the risk management process are summarized in a formal document often called the risk register. A risk register details all identified risks, including descriptions, category, and probability of occurring, impact, responses, contingency plans, owners, and current status. The register is considered as the backbone for the last step in the risk management process (Larson, and Clifford, 2011, p.229).

Generally, the risk management process begins by trying to generate a list of all the possible risks that could affect the project. Typically, this process involves communications between project manager and risk management team
that consisting of core team members and other relevant stakeholders. In addition, relevant stakeholders can be formally included on the risk management team. Then, during the assessment phase, participants will have a chance to analyze and filter out unreasonable risks. To achieve this, organizations usually use Risk Breakdown Structures (RBS)\(^1\) in conjunction with work breakdown structures (WBS) to help management teams identify and eventually analyze risks (Larson, and Clifford, 2011, pp.213-214).

Actually, risk management is a proactive approach rather than reactive. It is a preventive process designed to ensure that surprises are reduced and that negative consequences associated with undesirable events are minimized. It also prepares the project manager to take action when a time, cost, and/or technical advantage is possible. Moreover, successful management of project risk gives the project manager better control over the future and can significantly improve chances of reaching project objectives on time, within budget, and meeting required technical performance (Larson, and Clifford, 2011, pp.213-214).

### 3.3.2.1. Risk identification

Risk identification includes determining which risks may affect the project objective and what the consequences of each risk might be if they occur. The most common approach to identifying the sources of risks is brainstorming that requires the project manager to involve key project team members in identifying potential sources of risk. Each member of the project team can bring his or her experience and insight to help develop a comprehensive list of possible sources of risk. Another source that can be helpful in identifying possible risks is historical information and checklists from past projects. If project evaluations were done on completed projects, they could be a good source for identifying possible risks, as

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1A Risk Breakdown Structure (RBS) allows the project team to classify risky events in a hierarchical system, similar to a WBS. The RBS should be used in conjunction with the “what if “analysis methods to determine potential sources of risk. See Marco, 2011, p.177.
well as information on how to address such risks if they occur again (Gido, and Clements, 2009, p.88).

Moreover, interviewing experts and project managers with specific experience in similar projects can be helpful in identifying possible risks. Another useful way in identifying risk is a what-if analysis. This method involves asking a series of, what would happen if questions. The goal of this analysis is to consider all potentially risky situations in the project and to be able to understand the consequences either qualitatively or quantitatively. Various styles of cause and effect diagrams can be also used to understand the consequences of occurrences (Marco, 2011, p.176).

One of the keys to success in risk identification is the attitude. Project managers have to encourage critical thinking when it comes to risk identification. The goal is to find potential problems before they happen. The RBS and risk profiles are useful tools for making sure no stones are left unturned. It is important that project managers complete the risk management process so members regain confidence in themselves and the project (Larson, and Clifford, 2011, p.216).

In most cases, construction risks may be classified into three broad categories: financial, schedule, and, and design. The most basic financial risk is when there are project cost overruns that impact on the financial strength of the contractor, owner, developer, or whoever bears this risk. On other hand, schedule risks stem from the project not being completed on time, which in turn has drastic financial impacts. The final construction risk generates from the design of the building that occurs when the completed building does not meet the needs of the owner and occupants. Changing needs of the owner over time or poor communication between the design staff and the owner creates this risk. Indeed, financial, schedule and design risks are of prime concern for the project team, who must be aware that the sources of risks are complex and varied (Marco,
3.3.2.2. Risk analysis

There are main factors required to analyze risk. First one is the probability of each risk event occurring and the second one is the range or distribution of possible outcomes if the risk does occur, and the third one is the probabilities of each outcome, and finally the expected timing of each outcome. In most cases, good estimation will not be available, but getting as much data and as accurate estimation as possible will be crucial for the follow-on risk analysis (Mantel et al. 2008, p.128).

In fact, quantification of risk impact will facilitate the creation of contingency plans, as well as adequate contingency budgets in order to confront risky events when they occur. To quantify the consequences of a specified risk on an activity it is required to draw a matrix relationship between all elementary risk sources and the WBS activities. There are three approaches to quantifying risk exposure elements: qualitative, semi-qualitative, and quantitative. Qualitative quantification relies on the use of a range of word values for the risk presented, using various levels for the probability of that risk and its corresponding impact. Such as very high, high, medium, low, very low, critical, medium, marginal, and negligible. A semi-qualitative approach is very similar to a qualitative approach, but the descriptive levels are classified numerically (Marco, 2011, pp.177-178).

The use of a fully quantitative approach facilitates risk ranking most effectively. Moreover, quantitative quantification of risk relies basically on the use of numbers. Thus, the probability of an occurrence is usually given as a simple percentage, unless more accurate data is available in order to create a probability distribution for the occurrence of the event. In addition, the impact of the event is measured in regards to various project parameters such as cost, time, or performance level (Marco, 2011, pp.179-180).
The final output of risk quantification is a Risk Assessment Report and one of the most useful tools used to assess risk is risk assessment matrix shown in figure 3-2 below (Larson, and Clifford, 2011, pp.217-219). It consists of a 5 X 5 array of elements with each element representing a different set of impact and likelihood values. The matrix is divided into red, yellow, and green zones representing major, moderate, and minor risks, respectively. The red zone is centered on the top right corner of the matrix (high impact/high likelihood), while the green zone is centered on the bottom left corner (low impact/low likelihood). The moderate risk, yellow zone extends down the middle of the matrix. Red zone risks receive first priority followed by yellow zone risks, and the green zone risks are typically considered inconsequential and ignored unless their status changes (Larson, and Clifford, 2011, pp.217-219).

Figure 3.2 Risk Assessment Matrix

3.3.2.3. Risk response strategy

Risk response planning involves developing an action plan to reduce the impact or likelihood of each risk, establishing a trigger point for when to implement the actions to address each risk, and assigning responsibility to
specific individuals for implementing each response plan (Gido, and Clements, 2009, pp. 89-90).

Responses to risk can be classified as mitigating, avoiding, transferring, sharing, or retaining (Larson, and Clifford, 2011, p. 219).

- **Mitigating risk.** Reducing risk is usually the first alternative considered. There are basically two strategies for mitigating risk: reduce the likelihood that the event will occur and/or reduce the impact that the adverse event would have on the project. Most risk teams focus first on reducing the likelihood of risk events since, if successful, this may eliminate the need to consider the potentially costly second strategy: testing and prototyping are frequently used to prevent problems from surfacing later in a project. Often identifying the root causes of an event is useful. An alternative mitigation strategy is to reduce the impact of the risk if it occurs (Larson, and Clifford, 2011, p. 219).

- **Avoiding risk.** Risk avoidance is changes the project plan to eliminate the risk or condition. Although it is impossible to eliminate all risk events, some specific risks may be avoided before starting the project (Larson, and Clifford, 2011, p. 220).

- **Transferring risk.** Passing risk to another party is common; this transfer does not change risk. Passing risk to another party almost results in paying a premium for this exemption. Fixed-price contracts are the classic example of transferring risk from an owner to a contractor. The contractor understands his or her firm will pay for any risk event that materializes, therefore, a monetary risk factor is added to the contract bid price. Before deciding to transfer risk, the owner should decide which party could best control activities that would lead to the risk occurrence. Another more obvious ways to transfer risk are insurance, performance bonds, warranties, and guarantees (Larson, and Clifford, 2011, p. 221).
Retaining risk: In some cases, a conscious decision is made to accept the risk of an event occurring. Some risks are so large it is not feasible to consider transferring or reducing the event. In other cases, risks identified in the budget reserve can simply be absorbed if they materialize. The risk is retained by developing a contingency plan to implement if the risk materializes. In a few cases a risk event can be ignored and a cost overrun accepted when the risk event occur. The more effort given to risk response before the project begins, the better the chances are for minimizing project surprises. Knowing that the response to a risk event will be retained, transferred, or mitigated greatly reduces stress and uncertainty (Larson, and Clifford, 2011, p.222).

On the other hand, while it is only natural to focus on negative risks, it is sound practice to engage in active opportunity management as well. This opportunity could impact positively on project performance, and commonly referred to it as a positive risk or opportunity. An opportunity is an event that can have a positive impact on project objectives. Essentially the same process that is used to manage negative risks is applied to positive risks. Opportunities are identified, assessed in terms of likelihood and impact, responses are determined and even contingency plans and funds can be established to take advantage of the opportunity if it occurs. The major exception between managing negative risks and opportunity is in the responses. There are four different types of response to an opportunity (Larson, and Clifford, 2011, p.227):

- Exploit. This tactic seeks to eliminate the uncertainty associated with an opportunity to ensure that it definitely happens.
- Share. This strategy involves allocating some or all of the ownership of an opportunity to another party who is best able to capture the opportunity for the benefit of the project (Larson, and Clifford, 2011, p.227).
- Enhance. Enhancement is the opposite of mitigation in that action is taken to increase the probability and/or the positive impact of an opportunity.
Accept. Accepting an opportunity is being willing to take advantage of it if it occurs, but not taking action to pursue it. While it is only natural to focus on negative risks, it is sound practice to engage in active opportunity management as well (Larson, and Clifford, 2011, p.227).

3.3.2.4. Risk contingency plan

A contingency plan is an alternative plan that will be used if a possible foreseen risk event becomes a reality. Most contingency plans require the expenditure of additional funds for using additional resources, working overtime, paying for expedited shipments, purchasing additional materials, unexpected price escalations, and so forth. Project prices and budgets should include a contingency or management reserve to pay for additional expenses of implementing contingency plans (Gido, and Clements, 2009, p.90).

In addition, contingency planning evaluates alternative remedies for possible foreseen events before the risk event occurs and selects the best plan among alternatives. Therefore, this early contingency planning facilitates a smooth transition to the remedy or work-around plan, and availability of it can significantly increase the chances for project success. On the other hand, Conditions for activating the implementation of the contingency plan should be decided and clearly documented, and it should include a cost estimate and identify the source of funding. So, all parties affected should agree to the contingency plan and have authority to make commitments. Contingency plans also should be communicated to team members so that surprise and resistance are minimized (Larson, and Clifford, 2011, p.223).

SECTION FOUR: PROJECT PROCUREMENT PLANNING

Procurement is referred to a set of activities designed and performed to assure regular flows of materials and services to project, according to the plan. It includes the purchasing activities performed to secure an agreement between the buyer and the supplier, and the services that are needed for executing the project.
Procurement applies to all kind of supply, including construction materials and equipment, subcontract, and professional services. The procurement process has to be carried throughout the project life cycle. Therefore the owner may need to procure design, consulting and project management services in the early stages, as well as the construction material, testing and maintenance services (Marco, 2011, p.14).

Typical procurement process covering tender preparation, bidder selection, purchasing, expediting, inspection, shipping and storage of goods. In general, companies provide services or products based on the requirements set forth in invitations for competitive bids issued by the client or the results of direct contract negotiations with the client. One of the most important factors in preparing a proposal and estimating the cost and profit of a project is the type of contract expected. Moreover, the confidence by which a bid is prepared is usually dependent on how much of a risk the contractor will incur through the contract. There are certain types of contracts provide relief for the contractor since onerous risks exist. The cost must therefore consider how well the contract type covers certain high- and low-risk areas. Therefore, the size and experience of the client’s own staff, urgency of completion, availability of qualified contractors, and other factors must be carefully evaluated. Moreover, the advantages and disadvantages of all basic contractual arrangements must be recognized to select the optimum arrangement for a particular project (Kerzner, 2009, p.839-840).

The key decision in defining the procurement strategy for a construction project is whether to make or to buy. Vendor rating is aimed at advantaging suppliers with best performances, rationalizing and quantifying qualitative aspects of procurement, making clear and collaborative the relations, as well as monitoring changes in the suppliers’ behavior and in the market conditions over time. Moreover, Material suppliers and construction subcontractors are usually
rated based on product or service quality, technological level, price, and financial reliability (Marco, 2011, p.143).

In fact, the procurement management involves conducting market research, which is critical to ensure that the right products are readily available, at the right price and the right time. To undertake a complete market research exercise, market conditions should be assessed such as knowing current market, political environment and technology trends, determination of opportunities or threats, identifying the suppliers in the market segment and their capabilities with determination to who dominates the market and why? Also, products availability should be evaluated in the market place to provide project stakeholders with confidence that there are potential solutions available to meet the project’s requirements (Westland, 2006, p.94).

3.4.1. Procurement Management Process

The first step in the procurement process is the planning for purchases and acquisitions, specifically the development of procurement plan that states what to procure, when, and how. This process includes the following (Kerzner, 2009, p.842):

- Defining the need for the project.
- Development of the procurement statement of work.
- Development of work specifications.
- Development of work breakdown structure and preparing a WBS dictionary.
- Performing a make or buy analysis.
- Laying out the major milestones and the timing/schedule.
- Determining if long lead procurement is necessary.
- Determining cost estimating, including life cycle costing.
- Determining whether qualified sellers exist.
– Identifying the source selection criteria.
– Preparing a listing of possible project/procurement risks.
– Developing a procurement plan.
– Obtaining authorization and approval for procurement plan to proceed.

Actually, the procurement management plan identifies the products to be procured from external suppliers and the timeframes and methods of procurement. Therefore, it should be created and documented for any project that involves the acquisition of products from an external supplier.

3.4.1.1. Source selection criteria

To select the suitable material or service supplier, buyer needs to prepare a request for proposal (RFP) identifying comprehensively and in detail, what is required. A good RFP allows contractors or a project team to understand what the customer expects so that they can prepare a complete proposal that will satisfy the customer’s requirements at a realistic price. RFPs may contain (Gido, and Clements, 2009, p.42):

– A statement of work.
– Customer requirements for physical or operational parameters, such as size, quantity, color, weight, and speed.
– Deliverables the customer expects the contractor to provide.
– A list of any customer-supplied items.
– Any approvals required by the customer.
– The type of contract the customer intends to use.
– The payment terms.
– The required schedule for completion of the project.
– Instructions for the format and content of the contractor proposals.
– The due date by which the customer expects potential contractors to submit proposals.
– Criteria by which the proposals will be evaluated.

Once the RFP has been prepared, the customer solicits proposals by notifying potential contractors that the RFP is available. Business customers and contractors consider the RFP process to be a competitive situation. Customers should be careful not to provide one or more contractors with information that is not provided to all interested contractors (Gido, and Clements, 2009, p.42).

One way for customers to solicit proposals is by identifying a selected group of contractors in advance and sending each of them a copy of the RFP. Another approach to soliciting potential contractors is for the customer to advertise in certain business newspapers and on websites that the RFP is available and give instructions on how interested contractors can obtain or download a copy (Gido, and Clements, 2009, pp.41-42).

On the other hand, the criteria that the customer will use to evaluate proposals from competing contractors in order to select the one to perform the project include the following (Gido, and Clements, 2009, pp.38-40):

– The contractor’s technical and management experience with similar projects. How recently has the contractor completed similar projects? Were they completed within budget and on schedule? Were the customers satisfied? The technical approach proposed by the contractor.
– The schedule. Will the contractor be able to meet or beat the required schedule?
– The costs. If the estimate is based on time and materials, are the costs reasonable? Have any items been left out? Does it appear that the contractor has submitted a low cost estimate but will add costs after the project is underway, resulting in final costs that are much higher than the original estimate?
3.4.1.2. Construction contract

After selecting the supplier and accepting his proposal, contract should be signed between the two parties. The contract is a formal agreement between two parties wherein one party (the contractor) obligates itself to perform a service and the other party (the client) obligates itself to do something in return, usually in the form of a payment to the contractor. In fact, the contract is more than just an agreement between parties. It is a codification of the private law, which governs the relationship between the parties to it. It defines the responsibilities, spells out the conditions of its operations, defines the rights of the parties, and grants remedies to a party if the other party breaches its obligations (Larson, and Clifford, 2011, p.447).

Actually, contract management is a key element of any project procurement managementsystem. There are essentially two different kinds of contracts. The first is the fixed price contract in which a price is agreed upon in advance and remains fixed as long as there are no changes to scope or provisions of the agreement. The second is a cost-plus contract in which the contractor is reimbursed for all or some of the expenses incurred during the contract (Larson, and Clifford, 2011, p.447).

These two main kinds of contracts are subdivided into many branches such as: fixed-price (FP), cost plus-fixed-fee (CPFF), or cost-plus-percentage-fee (CPPF), fixed-price-incentive-fee (FPIF), and cost-plus-incentive-fee (CPIF) contracts (Kerzner, 2009, p.852).

Under a fixed-price (FP) or lump sum agreement, the contractor agrees to perform all work specified in the contract at a fixed price. Clients are able to get a minimum price by putting out the contract to competitive bid. Advertising an invitation for bid (IFB) that lists customer requirements usually results in low bids. Prospective contractors can obtain IFB notices through various channels. With fixed-price contract bids, the contractor has to be very careful in estimating
target cost and completion schedule because once agreed upon, the price cannot be adjusted. If contractors overestimate the target cost in the bidding stage, they may lose the contract to a lower-priced competitor; if the estimate is too low, they may win the job but make little or no profit. In fact, fixed-price contracts are preferred by both owners and contractors when the scope of the project is well defined with predictable costs and low implementation risks. With fixed-price contracts, clients do not have to be concerned with project costs and can focus on monitoring work progress and performance specifications (Larson, and Clifford, 2011, p.448).

Moreover, in a fixed-price or lump sum contract, the contractor must carefully estimate the target cost. He is required to perform the work at the negotiated contract value. He may not be able to underbid the competitors if the expected cost is overestimated. Thus, the contractor assumes a large risk. This contract also provides maximum protection to the owner for the ultimate cost of the project, but has the disadvantage of requiring a long period for preparation and adjudications of bids (Kerzner, 2009, p.852).

On the other hand, contractors prefer fixed price contracts because the client is less likely to request changes or additions to the contract. Fewer potential changes reduce project uncertainty and allow the contractors to more efficiently manage their resources across multiple projects. The disadvantage of a fixed-price contract for owners is that it is more difficult and more costly to prepare. The primary disadvantage of a fixed-price contract for contractors is that they run the risk of underestimating. If the project gets into serious trouble, cost overruns may make the project unprofitable. To avoid this, contractors have to invest significant time and money to ensure that their estimates are accurate (Larson, and Clifford, 2011, p.448).

Traditionally, the cost-plus-fixed-fee contract has been employed when it was believed that accurate pricing could not be achieved any other way. In the
CPFF contract, the cost may vary but the fee remains firm. Because, in a cost-
plus contract, the contractor agrees only to use his best efforts to perform the
work, good performance and poor performance are, in effect, rewarded equally.
The fixed fee is usually a small percentage of the total or true cost. The cost-plus
contract requires that the company invoices be audited. With this form of
contract, the engineering-construction contractor bids a fixed fee or profit for the
services to be supplied by the contractor, with engineering, materials, and field
labor costs to be reimbursed at actual cost. This form of bid can be prepared
quickly at a minimal expense to contractor and is a simple bid for the owner to
evaluate (Kerzner, 2009, pp.852-853).

Under a cost-plus contract, the contractor is reimbursed for all direct
allowable costs plus an additional fee to cover overhead and profit. This fee is
negotiated in advance and usually involves a percentage of the total costs. On
small projects, this kind of contract the client agrees to reimburse the contractor
for labor cost and materials. Labor costs are based on an hourly or daily rate,
which includes direct and indirect costs as well as profit. The contractor is
responsible for documenting labor and materials costs. Unlike fixed-price
contracts, cost-plus contracts put the load of risk on the client. The contract does
not indicate what the project is going to cost until the end of the project.
Contractors are supposed to make the best effort to fulfill the specific technical
requirements of the contract but cannot be held accountable, in spite of their best
efforts, if the work is not produced within the estimated cost and time frame.
These contracts are often criticized because there is little formal incentive for the
contractors to control costs or finish on time because they get paid regardless of
the final cost. The major factor motivating contractors to control costs and
schedule is the effect overruns have on their reputation and their ability to secure

Cost plus contract has the advantage of establishing incentive to the
contractor for quick completion of the job. If it is a cost-plus-percentage-fee contract, it provides maximum flexibility to the owner and permits the owner and the contractor to work together cooperatively on all technical, commercial, and financial problems (Kerzner, 2009, p.853).

Fixed-price-incentive-fee contracts are the same as fixed-price contracts except that they have a provision for adjustment of the total profit by a formula that depends on the final total cost at completion of the project and that has been agreed upon in advance by both the owner and the contractor. To use this type of contract, the project or contract requirements must be firmly established. This contract provides an incentive to the contractor to reduce costs and therefore increase profit. Both the owner and contractor share the risk and savings. Cost-plus-incentive-fee contracts are the same as cost-plus contracts except that they have a provision for adjustment of the fee as determined by a formula that compares the total project costs to the target cost. This formula is agreed to in advance by both the owner and contractor. This contract is usually used for long-duration projects (Kerzner, 2009, p.853).

Another type of contract incentives is award fees. Whereas incentive fees are objectively determined, that is, based on objective calculations comparing actual cost to target costs, actual delivery to target delivery, or actual performance to target performance, award fees are more subjectively determined. Award fees are used when it is not feasible or effective to determine objective contract incentives. They are earned when the contractor meets higher levels of performance, quality, timeliness, or responsiveness in performing the contract effort. Award fee contracts include an award fee plan that explains the award fee evaluation criteria for any given time period, as well as the total amount of the award fee pool (Kerzner, 2009, p.854).

Typically, a contract award fee evaluation board convenes at the end of each award fee period to evaluate the contractor’s performance in relation to the
award fee criteria established in the award fee plan. The award fee determination official, either the project manager or a level above the project manager, makes the actual determination on the amount of award fee earned by the contractor for that specific period. Award fee provisions can be part of cost or fixed-priced contracts. For major services contracts, award term incentives are used as incentives for the contractor to achieve higher levels of performance, quality, timeliness, or responsiveness in performing the services contract effort. Actually, award term is similar to award fee, but instead of awarding the successful contractor additional fee, the contractor earns additional time on the service contract (Kerzner, 2009, p.854).

Regardless to the contract type the success of a contract in general depends on many factors such as good cost control of prime cost items; good site management; careful planning and programming; punctual release of information to site; timely deliveries of equipment and materials; elimination of late design changes; good labor relations and good relationship between contracting parties (Lester, 2006, p.73).
CHAPTER FOUR: PROJECT EXECUTING, CONTROLLING AND CLOSING PROCESS
CHAPTER FOUR PROJECT EXECUTING, CONTROLLING AND CLOSING PROCESS

SECTION ONE: DIRECTING AND MANAGING PROJECT EXECUTING

The majority of the time on the project is usually spent on execution, as in most of the project’s budget. Therefore, good project execution involves taking the actions necessary to insure that activities in the project plan are completed. It is the process of executing the work defined in the project management plan to achieve the project’s requirements defined in the project scope statement (Kloppenborg, 2009, p.376).

Moreover, Execution process project activities are integrated together to execute the project plan and to make changes to it. In execution process, the project manager is responsible for coordinating and integrating project activities across multiple and functional lines. He would also need to focus on leading the project team and managing stakeholder relationships to execute the project management plan successfully (Kerzner, 2009, p.12).

Moreover, in this portion of the project, project team will implement the components defined in the Work Breakdown Structure (WBS) and follow the sequence of activities in the Project Network Diagram (Project ND). Also, the contracts are developed, solicitation is performed, and the contracts are awarded and executed on a schedule designed to support the integrated project plan (Cleland, 2004, p.86).

4.1.1. Project Management Information System

Project Management Information Systems (PMIS) can support a strategy of providing specialized products or services that set the company apart from others in the industry. It can be and often are central to business strategy Project.
Project Management Information System (PMIS) can be collected through four information systems. Then, each information system can be updated and managed through the project management processes. It includes (Kerzner, 2009, p.960):

- Earned Value Measurement Information System.
- Risk Management Information System.
- Performance Failure Information System, and
- Lessons-Learned Information System.

The first system of Project Management Information System is the Earned Value Measurement Information System that provides sufficient information for project current status and its status at the end of project work completion. This system calculates the planned and actual value of the work, the actual costs, cost and schedule variances, the estimated cost at completion, the estimated time at completion, percent complete, and trends (Kerzner, 2009, p.960).

The second information system is Risk Management Information System, which includes risk identification documentation, quantitative and qualitative risk assessment documents, contract deliverables, and any other risk-related reports, it provides data on risk management. The Risk Management Information System also stores and allows retrieval of risk-related data. It provides data for creating reports for all current and historical information related to project risk (Kerzner, 2009, p.960).

The third system is Performance Failure Information System that identifies the causes of the failure and possible recommendations for the removal of these causes (Kerzner, 2009, p.960).

Finally, the fourth information system is Lessons-Learned. This information system includes what is right and wrong in the project and the recommendations for the future projects, and how, when and to whom should this information be sent during project execution and at the end of the project. All of
this information must be captured by Lessons-Learned information system for future use (Kerzner, 2009, p.961).

4.1.2. Perform Quality Assurance

Quality assurance (QA) is a term given to a set of documents that give evidence of how and when the different quality procedures and systems are actually being implemented. It is the process that ensures that adequate quality systems, processes and procedures are in place (Lester, 2006, p.76).

Moreover, Quality assurance is the process to perform the planned quality activities and to ensure that the project utilizes processes necessary to meet the quality standards and project requirements. Project quality reduces the risks related to features or performance of deliverables, and provides confidence that final product requirements will be met (Nicholas, and Steyn, 2008, pp.336-337).

Quality assurance is also the function that attempts to ensure that the project scope, cost, and time functions are fully integrated. A good quality assurance system will identify objectives and standards, be multifunctional and prevention oriented, plan for collection and use of data in a cycle of continuous improvement, plan for the establishment and maintenance of performance measures, and include quality audits (Kerzner, 2009, p.888).

Furthermore, quality assurance deals with using correct policies and convincing stakeholders that the project team is capable of producing good input. It is the application of planned, systematic quality activities to ensure that the project will employ all processes needed to meet requirements. This ensures that work is performed correctly and that key stakeholders are convinced that the work is performed correctly (Kloppenborg, 2009, p.384).

There are many techniques used for quality assurance. These techniques are the preventative steps taken to eliminate any variances in the quality of the deliverable produced from the quality targets set. Such of these techniques used
to assure the quality of deliverables include reviewing historical data, defining requirements and standards, recruiting skilled staff, and undertaking quality reviews (Westland, 2006, p.75).

Quality assurance is applied through two areas: quality audits and improving project processes. A quality audit is an independent evaluation performed to ensure that the project is conforming to the project’s quality requirements and is following the established quality procedures and policies. A good quality audit will ensure that the planned quality for the project will be met, the products are fit for use, all regulations are followed, proper corrective action is taken when required, and improvement opportunities are identified (Kerzner, 2009, p.888).

Moreover, project quality audit is a review of documented procedures and actual practice. They help to deliver good quality results and convince stakeholders that everything will be fine since proper procedures are being used. For an audit to be successful, the intent must be to improve the manner in which work is accomplished and not to punish people. Project quality audits can be source of lesson learned and, these lessons should be shared so that other project teams can benefit (Kloppenborg, 2009, p.384).

The second area of quality assurance is process improvement that is a set of interrelated actions and activities performed to achieve a specified set of products, results, or services. Processes can be measured for both efficiency and effectiveness. Efficiency is the ratio of outputs to inputs. A more efficient process uses fewer inputs to create the same amount of outputs. This could equate to less work hours or less money spent to create the same project deliverables. On the other hand, effectiveness is the extent to which a process is creating the desired deliverables. A more effective process is one that creates higher quality deliverables and that better pleases the stakeholders. Process improvement can deal with both efficiency and effectiveness (Kloppenborg, 2009, pp.84-385).
Performance quality assurance also include the costs of quality. Costs of quality is the cost of conformance plus the cost of nonconformance. Whereas conformance means delivering products that meet requirements and fitness for use, the cost of nonconformance means taking responsibility for failures or not meeting quality expectations. Commonly, costs of quality are classified as prevention, appraisal and control, and internal failure and external failure. While prevention costs include costs of quality training, design reviews, and other activities aimed at preventing errors, appraisal and control costs relate to the evaluation of products and processes, including product reviews, audits, tests, and inspections and, internal failure costs are costs associated with nonconformities discovered by the producer, such as the cost of scrap, rework, and retest (Nicholas, and Steyn, 2008, p.338).

The final cost of quality is the external failure costs that are costs incurred after delivery to a client and include costs for replacements, warranty repairs, liability, and lost sales as a result of a damaged reputation. All of these costs are associated with failures discovered by the customer (Nicholas, and Steyn, 2008, p.338).

### 4.1.3. Project Human Resources Executing

Managing complex project represents a challenge requiring skills in team building, leadership, conflict resolution, technical expertise, planning, organization, administration, management support, and the allocation of resources. A key factor to good project performance is the project manager’s ability to integrate personnel from many disciplines into an effective work team. To get results, the project manager must relate to the people to be managed, the task to be done, the tools available, the organizational structure, and the organizational environment(Kerzner, 2009, pp.148-149).

Thus, the project manager must be both socially and technically aware to understand how the organization functions and how these functions will affect the
project organization of the particular job to be done. In addition, the project manager must understand the culture and value system of the organization he works with (Kerzner, 2009, pp.148-149).

In fact, interpersonal skills are essential for a project manager. Such skills depend on good oral and written communication skills. He needs to establish clear expectations of members of the project team so that everyone knows the importance of his role in achieving the project objective. He can do so by involving the team in developing a project plan that shows which people are assigned to which tasks and how those tasks fit together. Furthermore, it is important that the project manager develop a relationship with each person on the project team (Gido, and Clements, 2009, pp.310-312).

Moreover, interpersonal skills provide power to the project manager in influencing the many professionals and managers with whom the project manager works. These skills also help project manager to develop and maintain a successful track record that gets people to work with the project manager that is a form of power in influencing. Actually, the ability to influence is directly related to how other perceives one’s expertise (Cleland, and Lewis, 2002, p.258).

One of the most important interpersonal skills is the leadership of project manager. Leadership is getting things done through others and it helps the project manager achieves results through the project team. Project leadership involves inspiring the people assigned to the project to work as a team to implement the plan and achieve the project objective successfully. In order to do this, the project manager needs to create for the team a vision of the result and benefits of the project. Then, when project team members can envision the results, they will be more motivated to work as a team to complete the project successfully (Gido, and Clements, 2009, p.304).

Indeed, leadership requires that the project manager provides direction and establishes the parameters and guidelines for what needs to be done, and the
project team members determine how to get it done. Actually, the effective manager does not tell people how to do their jobs. That means project leadership requires involvement and empowerment of the project team and let them have ownership and control of their own work (Gido, and Clements, 2009, p.304).

4.1.3.1. Empowerment and delegation

Usually, individuals want to have ownership and control of their own work. They want to show that they can accomplish goals and meet challenges. Therefore, the project manager should involve individuals in decisions affecting them and should empower them to make decisions within their assigned areas of responsibility. That means creating a project culture that empowers the project team is not only assigning responsibility for tasks to team members but also delegating the authority to make decisions regarding the accomplishment of those tasks. This lead the team members to embrace the responsibility for planning their work, decide how to accomplish their tasks, control the progress of their work, and solve problems that may impede progress. In addition, they will accept accountability for performing their work scope within budget and on schedule. In empowering individuals to make decisions affecting their work, the project manager should establish clear guidelines and, if appropriate, any limits (Gido, and Clements, 2009, pp.304-305).

On the other hand, sometimes project manager needs to delegate some tasks to his project team. Project Delegation involves empowering the project team to achieve the project objective and empowering each team member to accomplish the expected results for his or her area of responsibility. It is the act of allowing individuals to carry out assigned tasks successfully. Delegation implies more than just assigning tasks to specific members of the project team. It includes giving team members the responsibility to accomplish job objectives and the authority to make decisions and take actions to achieve the expected results, as well as accountability for accomplishing those results(Gido, and Clements, 2009,
In addition, in delegation, members of the project team plan their own methods for accomplishing the desired results, and they exercise control over the resources they need to do the work within available budget, and the allowable time frame or schedule for their assigned areas of responsibility (Gido, and Clements, 2009, p.317).

Moreover, delegation is considered as a part of the project manager’s responsibility for organizing the project. Effective delegation requires effective communication skills. The project team members need to realize that the job of implementing the project has been delegated to them. And if team members are to accomplish their tasks successfully, they need to be given the necessary resources and authority to exercise control over those resources. These resources can include people, money, and facilities (Gido, and Clements, 2009, pp.315-317).

Delegation, however, does provide an opportunity to give challenging assignments to individuals in order to develop and extend their expertise and skills. Therefore, when the project manager is delegating, he considers not only the person’s current capabilities, but also the person’s potential. Stretch assignments energize people to take on the challenge and show that they can meet the project manager’s expectations. When he empowers team members to make decisions associated with performing their work, he gives them freedom to take action to accomplish the work without interference(Gido, and Clements, 2009, pp.315-317).

Finally, effective delegation requires that the project manager has trust each member of the project team. When the project team is carrying out its tasks, the project manager should let team members do their jobs; however, he should be available to coach and advise individuals when needed. The project manager makes it known that delegation requires team members to be accountable for achieving the expected results, not just to keep busy(Gido, and Clements, 2009,
pp.315-317).

4.1.3.2. Building teamwork

Team building develops a group of individuals to accomplish the project objective. It is an ongoing process, and it is the responsibility of both the project manager and the project team. Team building helps to create an atmosphere of openness and trust. Moreover, members feel a sense of unity and a strong commitment to accomplishing the project objective. It is important that team members get to know one another on a personal basis, without any intrusion (Gido, and Clements, 2009, p.343).

Actually, teamwork can only be effective in an environment of honesty, trust, open communications, individual involvement, pride of workmanship, and commitment. It involves the following (Barkley, 2006, p.134):

- Trust.
- Effective communication, especially listening.
- Positive attitude.
- Motivation to perform and improve.
- Mentality Ownership of work with pride.
- Respect and consideration for others.
- Remaining focused on total customer satisfaction.

In order to build the cohesiveness and effectiveness of the team, it is important to pay particular attention to the mission, roles and responsibilities, group dynamics, and interpersonal relationships within the team. Therefore, the following are essential to build teamwork: identifying the team mission, establishing team roles and responsibilities, understanding team dynamics,
managing conflict, providing motivation, building individual self-esteem, and developing the team (Barkley, 2006, p.136).

A model for team building in the figure 4-1 below (Cleland, and Gareis, 2006, pp.5-6, 5-7) describes the factors which contribute to the overall team culture and project team performance, which is a derivative of many factors.

On the contrary, dysfunctional behavior among team members happen when the project manager and team do not have the same shared values that are the foundations for building productive and genuine working relationships. Shared values can make a difference, support strong feelings of personal effectiveness, promote high levels of company loyalty, encourage ethical behavior, reduce levels of job stress and tension, and encourage teamwork (Kerzner, 2009, pp.219-220).

The five most common dysfunctions of a team include (Kerzner, 2009, pp.217-219):

- Absence of trust.
- Fear of conflict.
- Lack of commitment.
- Avoidance of accountability, and
- Negligence results.

Tables below describe the difference between each of them.

**Table 4.1 Trust (Kerzner, 2009, p. 217)**

<table>
<thead>
<tr>
<th>Absence of Trust</th>
<th>Availability of Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Conceal their weakness and mistakes from one another</td>
<td>1. Admit weaknesses and mistakes</td>
</tr>
<tr>
<td>2. Hesitate to ask for help or provide constructive feedback</td>
<td>2. Ask for help</td>
</tr>
<tr>
<td>3. Hesitate to offer help outside their own area of responsibility</td>
<td>3. Accept questions and input about their areas of responsibility</td>
</tr>
<tr>
<td>4. Jump to conclusions about intentions and aptitudes of others without</td>
<td>4. Give one another the benefit of the doubt before arriving at a negative conclusion</td>
</tr>
<tr>
<td>5. Attempting to clarify them</td>
<td>5. Take risks in offering feedback and assistance</td>
</tr>
<tr>
<td>6. Failing to recognize and tap into another’s skills and experience</td>
<td>6. Appreciate and tap into one another’s skills and experiences</td>
</tr>
<tr>
<td>7. Waste time and energy managing their behaviors for effect.</td>
<td>7. Focus time and energy on important issues, not politics</td>
</tr>
</tbody>
</table>
8. Hold spite and fear meetings and find reasons to avoid spending time together.

8. Offer and accept apologies without hesitation, and look forward to meetings and their opportunities to work as a group.

Table 4.2 Conflict (Kerzner, 2009, p.218)

<table>
<thead>
<tr>
<th>Teams that fear conflict</th>
<th>Teams that engage in conflict</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. They have boring meetings</td>
<td>1. They have interesting meetings</td>
</tr>
<tr>
<td>2. Create environments where back-channel politics and personal attacks succeed</td>
<td>2. Extract and exploit the ideas of all team members</td>
</tr>
<tr>
<td>3. Ignore arguable topics that are critical to team success</td>
<td>3. Solve real problems quickly</td>
</tr>
<tr>
<td>4. Fail to tap into all the opinions and perspectives of team members</td>
<td>4. Minimize politics</td>
</tr>
<tr>
<td>5. Waste time and energy with carriage and interpersonal risk management</td>
<td>5. Put critical topics on the table for discussion.</td>
</tr>
</tbody>
</table>

Table 4.3 Team Commitment (Kerzner, 2009, p.218)

<table>
<thead>
<tr>
<th>Team that fails to commit</th>
<th>Team that commits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Creates ambiguity among the team about direction and priorities</td>
<td>1. Creates clarity around direction and priorities</td>
</tr>
<tr>
<td>2. Watches windows and opportunities closely due to excessive analysis and unnecessary delay</td>
<td>2. Aligns the entire team around common objectives</td>
</tr>
</tbody>
</table>
3. Breeds lack of confidence and fear of failure

4. Revisits discussions and decisions again and again

5. Encourages second-guessing among team members.

3. Develops an ability to learn from mistakes

4. Takes advantage of opportunities before competitors do

5. Moves forward without hesitation, changes direction without hesitation or guilt.

<table>
<thead>
<tr>
<th>Team that avoids accountability</th>
<th>Team that holds one another accountable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Creates resentment among team members who have different standard or performance</td>
<td>1. Ensures that poor performers feel pressure to improve</td>
</tr>
<tr>
<td>2. Encourages mediocrity</td>
<td>2. Identifies potential problems quickly by questioning one another's approaches without hesitation</td>
</tr>
<tr>
<td>3. Misses deadlines and key deliverables</td>
<td>3. Establishes respect among team members who are held to the same high standards</td>
</tr>
<tr>
<td>4. Places an undue burden on the team leader as the sole source of discipline.</td>
<td>4. Avoids excessive bureaucracy around performance management and corrective Action.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4.5 Focusing on Results (Kerzner, 2009, p.219)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Team that is not focused on results</strong></td>
</tr>
<tr>
<td>1. Fails to grow</td>
</tr>
<tr>
<td>2. Rarely defeats competitors</td>
</tr>
<tr>
<td>3. Loses achievement-oriented employees</td>
</tr>
<tr>
<td>4. Encourages team members to focus on their own careers and</td>
</tr>
<tr>
<td>Individual goals</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>5. Is easily distracted</td>
</tr>
</tbody>
</table>
4.1.3.3 Conflict on project

Differences of opinion are natural, and expected. Therefore, human resources issues often occur during project execution, especially conflicts. In the project environment, conflicts are unavoidable. However, conflicts and their resolution can be planned, understanding the determinants of conflicts is important to the project manager’s ability to deal with them effectively to improve overall project performance. Practically, when conflict becomes dysfunctional, it often results in poor project decision-making, lengthy delays over issues, and a disruption of the team’s efforts. However, conflict can be beneficial when it produces involvement and new information and enhances the competitive spirit(Kerzner, 2009, p.150).

To successfully resolve conflict, project managers must understand interaction of the organizational and behavioral elements in order to build an environment conducive to their team’s motivational needs. This will enhance active participation and minimize unproductive conflict(Kerzner, 2009, p.151).

In fact, conflict is not just for the project manager to resolve; conflict between team members should also be handled by the individuals involved. It stimulates discussion and requires individuals to clarify their views. It can force individuals to search for new approaches and enhance the problem-solving process. However, if conflict is not handled properly, it can have a negative impact on the project team, and it can destroy communication, and stop people from talking and sharing information. It can reduce team members’ willingness to listen to and respect others’ viewpoints. It can also break down team unity and reduce the level of trust and openness(Gido, and Clements, 2009, pp.354-355).

The most common types of conflicts involve(Kerzner, 2009, pp.150-151):

– Manpower resources.
– Equipment and facilities.
- Capital expenditures.
- Costs.
- Technical opinions.
- Priorities.
- Administrative procedures.
- Scheduling.
- Responsibilities, and
- Personality clashes.

Schedules are a major source of conflict throughout the project’s life. Priorities are the second source of conflict, particularly in the first two stages of the project’s life. Actually, parties to the conflict must be more interested in solving the problems at hand than they are about winning a victory for their side (Mantel et al. 2008, p.63).

On the other hand, many conflicts can be either reduced or eliminated by constant communication of the project objectives to the team members. This continual repetition may prevent individuals from going too far in the wrong direction.

4.1.3.4. Conflict resolution methods

The ability to handle and prevent conflicts requires an understanding of why they occur. To do these four main questions needs to be asked and answered. These questions are (Kerzner, 2009, p.296):

- What are the project objectives and are they in conflict with other projects?
- Why do conflicts occur?
- How are conflicts resolved?
- Is there any type of analysis that could identify possible conflicts before they occur?

Typically, there are six approaches that people use to handle conflict (Gido, and

- Avoiding or withdrawing.
- Competing or forcing,
- Accommodating or smoothing,
- Compromising.
- Collaborating, and
- Confronting or problem solving.

In the avoiding or withdrawing approach, individuals in conflict retreat from the situation to avoid an actual or potential disagreement. This approach can cause the conflict to faster and then escalate at a later time. While in the competing or forcing approach, conflict is viewed as a win-lose situation. The value placed on winning the conflict is higher than the value placed on the relationship between the individuals, and the individual who is in a position to handle the conflict by exerting power over the other individual. This approach to handling conflict can result in resentment and deterioration of the work climate (Gido, and Clements, 2009, pp.354-355).

The accommodating or smoothing approach emphasizes the search for areas of agreement within the conflict and minimizes the value of addressing differences. Topics that may cause hurt of feelings are not discussed. In this approach, the value placed on the relationship between the individuals is greater than the value placed on resolution of the issue. Although this approach may make a conflict situation livable, it does not resolve the issue (Gido, and Clements, 2009, pp.354-355).

In the compromising approach, team members search for an intermediate position. They focus on splitting the difference. They search for a solution that will bring some degree of satisfaction to each individual. The solution, however, may not be the optimal one (Gido, and Clements, 2009, pp.354-355).
In the collaborating, confronting, or problem-solving approach, team members confront the issue directly. They look for a win-win outcome. They place high value on both the outcome and the relationship between the individuals. Each person must approach the conflict with a constructive attitude and a willingness to work in good faith with the others to resolve the issue. There is an open exchange of information about the conflict as each sees it. Differences are explored and worked through to reach the best overall solution. Each individual is willing to abandon or redefine his or her position as new information is exchanged, in order to arrive at the optimal solution. For this approach to work, it is necessary to have a healthy project environment (Gido, and Clements, 2009, pp.354-355).

4.1.4. Communication Execution and Information Distribution

Getting project information to the right people at the right time and in useful format is just as important as developing the information in the first stage. Effective project managers communicate and share information in a variety of ways. They have meetings and informal conversations with the project team, the customer, and the company’s senior management to know customer’s expectations and needs and the ideas and concerns expressed by the project team (Gido, and Clements, 2009, p.308).

In order to keep the project manager and his team informed about the project’s status most projects have meetings and to exchange valuable and necessary information amongst them, one of the most important meetings is used. It is project review meetings that are necessary to show that progress is being made on a project. These meetings are flexible and should be called only if they will benefit the team (Kerzner, 2009, pp.242-243).

Beside project meetings, there are project reports used in project for
getting information. These reports are divided into four main types as follow (Kerzner, 2009, pp.678):

- Performance Reports: These reports indicate the physical progress to date. The report might also include information on material procurement, delivery, and usage.

- Status Reports: These reports identify where the project is today and use the information from the performance reports to calculate Schedule Variance (SV) and Cost Variance (CV).

- Projection Reports: These reports calculate Estimate At Completion (EAC), Estimate To Completion (ETC), Schedule Performance Index (SPI), and Cost Performance Index (CPI) as well as any other forward-looking projections. These reports emphasize where the project will end up.

- Exception Reports: These reports identify exceptions, problems, or situations that exceed the threshold limits on such items as variances, cash flow, resources assigned, and other such topics.

4.1.5. Conduct Procurement and Select Sellers

Procurement is referred to a set of activities designed and performed to assure regular flows of materials and services, according to the plan. It includes the purchasing activities performed to secure an agreement between the buyer and the seller, and the services that are needed for executing the project. It applies to all kind of supply, including construction materials and equipment, subcontract and professional services. The procurement process has to be carried throughout the project life cycle: the owner may need to procure design, consulting and project management services in the early stages, as well as the construction material (Marco, 2011, p.141).

The process of conducting the procurements includes (Kerzner, 2009, p.845):

- Evaluating and confirming specifications.
Confirming qualified sources.

Reviewing past performance of sources.

Reviewing of team or partnership agreements.

Producing the solicitation package that includes bid documents, listing of qualified vendors, proposal evaluation criteria, bidder conferences, how change requests will be managed, and supplier payment plan.

After potential contractors submit bids or proposals, the client company decides which contractor or contractors will be awarded the work. Select seller is the process of reviewing offers, choosing among potential sellers, and negotiating a written contract with the seller. The main goal of selecting suppliers is to award a contract to each selected seller that is a legal relationship between parties (Kloppenborg, 2009, p.322).

In fact, the project team needs to evaluate each prospective supplier individually, and take supplier selection decision based on alternatives under uncertainty. The outcome is concerned with both price and performance including delivery time. Evaluation criteria is used to rate proposals, and other supplier characteristics, it can be objective or subjective. Project team selects one or more sellers who are both qualified and acceptable as a seller by using many tools and techniques such as weighting system, independent estimated, screening system, seller rating system, expert judgment, and proposal evaluation techniques (Kloppenborg, 2009, pp.323-324).

SECTION TWO: MONITORING, CONTROLLING, AND CLOSING PROJECT WORK

4.2.1. Monitoring and Controlling Project Work

In project, planning will probably require less than 10% of the time on any project, while monitoring, controlling and execution will comprise over 90% of it. This is why ongoing monitoring and controlling is so important(Ghattas, and
Monitor means collecting project performance data with respect to plan, produce performance measures, and report performance information. While control means comparing actual performance with planned performance, analyzing variances, assessing trends to effect process improvements, evaluating possible alternatives, and recommending appropriate corrective action when needed. Monitoring and controlling project work includes those processes performed to measure and monitor project execution so that corrective action can be taken necessary to control the execution of the project and replanning to get back on track (Kloppenborg, 2009, p.376).

Practically, monitoring and controlling project process do not happen once; they need to happen continuously throughout the project. Their activities occur in parallel with project execution, and since their purpose is to be able to take corrective action, these activities need to be timely. The results of monitoring and controlling project work, schedule, budget, risks, or anything else can range from very minor to quite major depending on how close the actual progress is to the plan (Kloppenborg, 2009, p.376).

On the other hand, performance is the degree of achievement. It is measured with respect to predetermined specified targets or standards termed ‘performance base lines’. These base lines are devices used for measuring performance variations by comparing the originally planned performance with actual performance to determine the deviations from the planned path (Chitkara, 2007, p.397).

Equally important, parameters that define the goals to be achieved. They are not mutually exclusive. They are interrelated as well as interdependent. In construction project, the typical parameters that may be controlled are (Chitkara, 2007, p.397):
- Time progress control.
- Resource productivity and mobilization control.
- Cost and budget control.
- Work done and earned value control.

The first step in developing an accurate control process is to create project baselines against which progress can be measured. Project baselines consist of three main items: scope baseline, schedule performance baseline, and cost performance baseline (Pinto, 2007, p.419).

In fact, a project will be considered totally successful if it gets completed on time, within budget, performs exactly the designer’s specifications, and meets customer satisfaction. Some performance indicators used are: time over-run, cost over-run, productivity as performance indicator, and value as performance indicator. In addition to that, project control involves a regular comparison of performance against targets, a search for the causes of deviation and a commitment to check adverse variances. It serves two major functions: the first it ensures regular monitoring of performance and the second it motivates project personnel to strive for achieving project objectives. Therefore, effective control is critical for the realization of project objectives (Matheen, 2009, p.173).

One of the most significant challenges with running a project has to do with maintaining an accurate monitoring and control system for its implementation. Project monitoring and control are the principle mechanisms that allow the project team to stay on top of a project’s evolving status as it moves through the various life cycle stages toward completion (Pinto, 2007, p.410).

Generally, control process includes four components that can operate in a continuous cycle and can be represented as a wheel. These elements are (Pinto, 2007, p.411):

- Setting goals.
Measuring progress.
Comparing actual with planned performance where the smaller the gaps between planned and actual performance, the better the outcome, and
Taking action in some form of corrective action, correction actions or repair defects to minimize or remove the deviation from the planned performance.
After corrective action, the monitoring and control process begins again.

Moreover, the project control process involves regularly gathering data on project performance, comparing actual performance to planned performance, and taking corrective actions if actual performance is behind planned performance. This process must occur regularly throughout the project and a regular reporting period should be established for comparing actual progress with planned progress. Reporting may be daily, weekly, or monthly, depending on the complexity or overall duration of the project (Clements and Gido, 2006, p.200).

Actually, an efficient control system generates information that can improve the productivity of project team and materials; economize the employment of resources; enable understanding of time and cost behavior; provide early warning signals of ensuring dangers; update resources planning and costing norms; prevent frauds; and assist in formulating incentive schemes for motivating people (Chitkara, 2007, p.393).

Moreover, control systems are vital to ensure that any changes to the project baseline are conducted in a systematic and complete manner. There are a number of types of project control systems to track the status of projects including the following (Pinto, 2007, p.166):

- Configuration control includes procedures that monitor emerging project scope against the original baseline scope, and make sure that the project following its initial goals.
- Design control relates to systems for monitoring the project’s scope, schedule, and costs during the design stage.
- Trend monitoring is the process of tracking the estimated costs, schedules, and resources needed against those planned. Trend monitoring shows significant deviations from norms for any of these important project metrics.

- Document control would ensure that important documentation is complied and disseminated in an orderly and timely fashion.

- Acquisition control monitors systems used to acquire necessary project equipment, materials, or services needed for project development and implementation.

- Specification control ensures that project specifications are prepared clearly, communicated to all concerned parties, and changed only with proper authorization.

One of the most important monitor and control project tools is the project audit. Project audit is a thorough examination of the management of a project, its methodology and procedures, its records, properties, budgets, and progress. The project audit may deal with the whole or any part of the project (Mantel et al. 2008, p.275).

In addition, an audit in project determines what is going right and wrong, and why. It identifies forces and factors that have prevented or may prevent achievement of cost, schedule, and technical performance goals. It also evaluates the efficiency of existing project management strategy, including organizational support, policies, procedures, practices, techniques, guidelines, and action plans. To do so, the audits should be carried out at key points in the life cycle of a project (Cleland, and Lewis, 2002, pp.388-389).

4.2.1.1. Perform integrated change control and configuration management

Integrated change control is the process of reviewing all change requests, approving changes, and controlling changes to deliverables and organizational process assets throughout the project life cycle. Change control includes
identifying, documenting, approving or rejecting, and controlling changes, deciding whether to agree to the change, and then documenting and managing that change (Kloppenborg, 2009, p.378).

Other important part of integrated change control is configuration management. Configuration management is a system of procedures that monitors emerging project scope against the scope baseline. It requires documentation and management approval on any change to the baseline. It also ensures that descriptions of the project’s products are correct and complete.

Furthermore, configuration management is the systematic management and control of project change. It requires several iterations, adjustment, and corrections to get the project right. Configuration management works toward formalizing the change process as much as possible as early in the project’s life as possible, rather than leaving needed downstream changes to be done in an uncoordinated manner (Pinto, 2007, p.167).

4.2.1.2. Scope control and scope verification

The goal of scope control is to influence the factors that cause scope changes, assure changes are processed according to procedures developed as part of integrated change control, and manage changes when they occur. Normally, project managers and teams practice scope control in a proactive manner. Depending on scope baseline, they attempt to understand what might cause changes to either the product scope\(^1\) or the project scope\(^2\). Once the project team discovers something that may cause a need to change the scope, their first effort is typically to head it off. However, many times it is necessary to make a scope change that usually requires an adjustment to project cost or schedule. For this

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\(^1\)Product scope is the features and functions that characterize a product, service, or result. See PMI p. 552.
\(^2\)Project scope is the work performed to deliver a product, service, or result with the specified features and functions. See PMI p. 555.
reason, proposed scope changes are processed through the integrated change control system to determine what impact each might have on other aspects of the project (Kloppenborg, 2009, p.383).

It is difficult to create a good project scope statement and WBS for project. Even when the project scope is fairly well defined, many projects suffer from scope creep\(^1\). For this reason, it is very important to verify the project scope with customers throughout the life of the project and develop a process for controlling scope changes. The Scope verification is the process of formalizing acceptance of the completed project deliverables. It occurs throughout the project and with final deliverables near the end. When the stakeholders formally accept the final project deliverables, the project finishes the executing stage and proceeds into closing stage (Kloppenborg, 2009, p.413).

4.2.1.3. Schedule control

It is important for projects to have realistic schedule goals and for project managers to use discipline to help meet those goals. Once a project actually starts, it is necessary to monitor the progress to ensure that everything is going according to schedule. This involves measuring actual progress and comparing it to the schedule. If at any time during the project it is determined that the project is behind schedule, corrective action must be taken to get back on schedule. The key to effective project control is to measure actual progress and compare it to planned progress on a timely and regular basis and to take necessary corrective action immediately. Based on actual progress and consideration of other changes that may occur, it is possible to calculate an updated project schedule regularly and forecast whether the project will finish ahead of or behind its required completion time (Clements and Gido, 2006, p.214).

\(^1\)Scope creep is the uncontrolled expansion to product or project scope without adjustments to time, cost, and resources. See PMI p. 562.
The goal of schedule control is to know the status of the schedule, influence the factors that cause schedule changes, determine that the schedule has changed, and manage changes when they occur. In fact, it is not an independent activity, schedule has to be used as a basis for direction, communication, coordination and progress control or else there can no schedule control. There are two types of schedule control. The first type is preventive schedule control. In this type schedule control must start at the beginning of the work, it keeps a close watching on the areas which normally delay a project and takes all possible steps to make sure that delays do not occur (Matheen, 2009, pp.177-172).

This means that, project management can use past experiences of similar nature to act in advance instead of reacting to the forecast of completion dates of the current project. The second type of schedule control is predictive schedule control that starts with the forecast of project completion if the forecast indicates that the project completion requirements are going to be met, no action is initiated. This forecast is to be provided to the controlling authority in the form of the feedback report. If the forecast indicates that the project completion data may not be met, immediate investigations are ordered to find out the ways and means of bringing the project back to schedule (Matheen, 2009, pp.177-172).

Usually, schedule control involves four steps: analyzing the schedule to determine which areas may need corrective action, deciding what specific corrective action should be taken, revising the plan to incorporate the chosen corrective actions, and recalculating the schedule to evaluate the effects of the planned corrective actions (Clements and Gido, 2006, p.215).

4.2.1.4. Cost control

Project cost control includes monitoring cost performance, ensuring that only appropriate project changes are included in the revised cost baseline, and informing project stakeholders of authorized changes to the project that will affect costs. Cost control is analyzing the data in order to take corrective action if
needed. It must be performed by all personnel who incur costs. In fact, it is the cost, which reflects performance in all areas. Therefore, a well-managed project will incur lower cost than the one that is not. Actually, cost control must include cost estimation, company and project cash flow, cost accounting, direct labor costing, overhead rate costing, incentives, penalties and profit sharing (Matheen, 2009, pp. 172-173).

It is important to manage the cash flow on a project, which involves making sure that sufficient payments are received from the customer in time so the project manager has enough money to cover the costs of performing the project, employee payroll, charges for materials, invoices from contractors, and other expenses (Clements and Gido, 2006, p. 271).

Once the project starts, it is necessary to keep track of actual cost and committed cost so that they can be compared to the cumulative budget cost. In addition, it is also necessary to monitor the earned value of the work that has been performed. Cost performance index is other indicator of cost performance, which is a measure of the cost efficiency with which the project is being performed. Based on analysis of actual cost performance throughout the project, it is possible to forecast what the total costs will be at the completion of the project or work package (Clements and Gido, 2006, p. 275).

Figure 4-2 below (Lester, 2006, p. 233) shows how cost is being controlled and estimated in specific timing period in the project by using numbers of parameters and factors.
Figure 4.2 Cost performance index

ECTC  IS Estimated Cost to Complete
BAC  Is Budget At Competition (current) (budget)
BCWS  Is Budget Cost of Work Scheduled (current) (planned)
BCWP  Is Budget Cost of Work Performed (actual)
ACWP  Is Actual Cost of Work Performed (actual)
OD  Is Original Duration Planned for the work to date
ATE  Is the Actual Time Expended for the work to date
PTPT  Is the Planned Total Project Time
EAC  Is Estimated Cost at Completion
ETPT  Is Estimated Project Time
CPI  Is Cost Performance Index= BCWP/ACWP = Efficiency
SPI  Is Scheduled Performance = BCWP/BCWS
4.2.1.5. Earned value management

One of the most useful performance measurement methods used in project monitoring and control is earned value management. It is the method necessary to jointly consider the impact of scope, time, cost, and project performance on any analysis of project status. It also allows the project team to make future projections of project status based on its current state. Earned value management connects many parameters such as planned value, earned value, actual cost of work performed, schedule performance index, cost performance index and budget cost at completion by specific equations, and at any point in the project’s development, earned value management could calculate both schedule and budget efficiency factors. Then, those values could be used to make future projections about estimated cost and schedule to project completion (Pinto, 2007, pp.417-418). Figure 4.3 below (Pinto, 2007, p.422) demonstrates earned value milestones.

Figure 4.3 Earned value milestones

Moreover, earned value management is a management methodology for integrating scope, schedule, and resources, and for objectively measuring project performance and progress. It is used as decision-making tools. And, based on baseline plan, it allows project team to understand their project’s progress in
terms of cost and schedule as well as to make predictions concerning the project’s schedule and cost control until the project’s conclusion. In addition, the earned value data allows a project manager to decide on the status of his project at a given point in time (Kloppenborg, 2009, p.393).

### 4.2.1.6. Quality control

Quality control deals with comparing specific project measurements with their standards. The purpose of quality control on projects is to reduce the number of defects and inefficiencies as well as to improve the project process and outputs. It monitors the project to ensure that everything is proceeding to plan. It also determines and eliminates root causes of problem. Actually, it repairs defects and provides recommendations for corrective and preventive actions (Kloppenborg, 2009, p.385).

Generally, project managers use quality control to focus on project inputs, processes, and outputs. When considering inputs, he wants to ensure that workers assigned are capable of doing their work. He also work with suppliers to ensure that the materials, information, and other inputs provided, meet the required specifications and will work satisfactorily. When considering the project process, the manager wants to minimize rework since that wastes time and money, which are in short supply on most projects. Rework also often has negative impacts on both worker morale and stakeholder relations. When considering outputs, a project manager may use internal inspection to ensure the deliverables work before they are sent to the customer. External inspection may also be required to prove to the customer that the deliverables are correct (Kloppenborg, 2009, p.385).

A variety of quality control tools can be used effectively on projects. Some of the most common project quality control tools and their primary uses on projects are flow chart, check sheet, Pareto chart, cause and effect diagram, histogram, run chart, control chart (Kloppenborg, 2009, p.388).
4.2.1.7. Project log and project reports

Project log can be the most important control tools. Its purpose is to document anything that would affect the outcome of the project from the original contract. Any change or discussions relating to the project should be noted in the project log with a date posted. In project log, many items could be included such as meetings with dates and people present, limitations of availability of raw materials or resources as they occur, corrective actions, schedule on-times, late or early completions, which is very helpful for planning future projects (Ghattas, and Mckee, 2003, p.248).

In addition to project log, an important tool for monitoring and controlling the project is performance reports, which includes collecting and distributing performance information. This includes status reporting, progress measurement and forecasting. Performance reporting includes meetings, reports, feedback received, and documentation. Detailed progress can be reported frequently within the project team and to functional managers who control resources, while more general progress may be reported on frequent basis to sponsors, senior management, and clients (Kloppenborg, 2009, p.382).

Progress reporting within the project team and functional managers who control resources is often done in the form of meetings. Each team member can report for each deliverable for which he is responsible: the target date, current status, and what other work or information on which progress depends. Once all of the deliverables have been reported, the project team can update the risk register and issue log. Recommended changes that are within the project manager’s discretion are either approved or rejected and then documented. On the other hand, recommended changes beyond the project manager’s discretion are formally sent to change control board for consideration. Then, approved changes become part of the project plan with activities, responsibilities, and timing assigned. Finally, progress-reporting meetings documented all lessons learned for the project (Kloppenborg, 2009, p.382).
4.2.1.8. Risk control

The monitoring and control risk process systematically tracks and evaluates the effectiveness of risk response actions against established metrics. Monitoring results may also provide a basis for developing additional risk response strategies, or updating existing risk response strategies, and reanalyzing known risks. In some cases, monitoring results may also be used to identify new risks and revise some aspects of risk planning. Risk monitoring and control is not a problem-solving technique but rather a proactive technique to obtain objective information on the progress to date in reducing risks to acceptable levels. Some techniques suitable for risk monitoring and control that can be used in a project-wide indicator system such as (Kerzner, 2009, p.788):

- **Earned Value (EV):** This uses standard cost/schedule data to evaluate a project’s cost performance and provide an indicator of schedule performance in an integrated fashion. As such, it provides a basis to determine if risk response actions are achieving their forecasted results (Kerzner, 2009, p. 788).

- **Project Metrics:** These are formal, periodic performance assessments of the selected development processes, evaluating how well the development process is achieving its objective. This technique can be used to monitor corrective actions that emerged from an assessment of critical project processes (Kerzner, 2009, p. 788).

- **Schedule Performance Monitoring:** This is the use of project schedule data to evaluate how well the project is progressing to completion (Kerzner, 2009, p. 788).

- **Technical Performance Measurement:** It is a product design assessment that estimates, through engineering analysis and tests, the values of essential technical performance parameters of the current design as affected by risk response actions (Kerzner, 2009, p. 788).
**4.2.1.9. Contract administration**

administration of the contract is the process of managing the contract and the relationship between the buyer and seller, reviewing and documenting how a seller is performing or has performed to establish required corrective actions and provide for future relationships with the seller, manage contract related changes and, when appropriate, managing the contractual relationship with the outside buyer of the project (Kloppenborg, 2009, p.327).

In addition, both buyers and sellers administer contracts to make sure that the obligations set forth in the contract are met and to make sure neither has any legal liability. Both must perform according to the contract terms. In fact, contract administration processes include performance reporting, quality control, integrated change control, and risk monitoring and control (Kloppenborg, 2009, p.328).

**4.2.2. Project Closing Process**

Projects often start with great enthusiasm. They serve as vehicles to accomplish important organizational objectives. Many things happen during the course of a project that may impact its success. One of the unique characteristics of projects, as opposed to other ongoing organizational activities or processes, is that they are created with a finite life; in effect, when planning the project, there is also planning for its end (Pinto, 2007, p.445).

The fifth and final phase of the project life cycle is closing the project. This phase involves finalizing all project activities. It is important to follow good procedures to ensure that all project activities are completed and that project sponsor accepts delivery of the final product, services, or results of the project. In addition, it involves bringing the project or project phase to an end. It starts after the project work has been completed, and includes various actions to close out the project properly. It is defined as its termination. Project termination consists of all activities consistent with closing out the project. It is a process that provides for
acceptance of the project by the project’s sponsor, completion of various project records, final revision and issue of documentation to reflect its final condition, and the retention of essential project documentation. Practically, projects may be terminated for a variety of reasons (Pinto, 2007, p.445). Figure 4.4 illustrates the project life cycle showing closing phase.

In fact, termination for cause often results from a problem with the project’s cost, schedule, performance or changing of sponsor priorities. On the other hand, a buyer can also decide to terminate a project early because he has lost confidence in the contractor who is performing the project. Therefore, good project management practices consistently applied throughout the project can lessen the chance of early termination for cause by managing stakeholder expectations and by delivering what customers want on specifications, on time, and on budget (Kloppenborg, 2009, p.412).

Moreover, project may be cancelled completely because it may become irrelevant over time to sponsor’s objectives or it may become technologically obsolete due to a significant breakthrough by the competition. It may also fail through a lack of top management support, organizational changes, or strategic priority shifts. On the other hand, project can be cancelled for the convenience of the buyer. This can happen through no fault of the contractor. Sometimes, the
buyer faces unexpected difficulties or changing priorities, if a customer’s needs change, they might decide that the resources assigned to a project could be more profitably applied to different project (Kloppenborg, 2009, p.412).

In fact, the best reason for terminating the project is the case where a project has been successfully completed and all project closeout activities are conducted to reflect a job that is well done (Pinto, 2007, p.445).

Generally, in project closing process project managers need to ensure that all work on their project has been successfully completed. They can refer back to the charter, scope statement, WBS, schedule, and all communications plans to verify that everything they said they would do is actually done (Kloppenborg, 2009, p.417).

Typically, many organizations have formal procedures for closeout reports and archiving project records. The closeout report usually includes a summary status of the project that can be gleaned from progress reports. The closeout report also normally includes lessons learned. Finally, the close report often contains a review of the project’s original justification (Kloppenborg, 2009, p.419).

In general, the purpose of properly terminating a project is to learn from the experience gained on the project in order to improve performance on future projects. Therefore, the activities associated with terminating the project should be identified and included in the project’s baseline plan; they should not be done merely as spontaneous afterthoughts (Gido, and Clements, 2009, p.96).

These activities are necessary to close the project successfully and they are (Pinto, 2007, p.446):
- Finishing the work.
- Handling over the project and transferring it to its intended user.
- Gaining acceptance for the project.
- Harvesting the benefits of the project.
- Reviewing how it all went.
- Documenting and recording all processes.
- Closing phases and procurement process.
- Closing accounts and seeing all bills are paid.
- Capturing and sharing lessons learned.
- Performing administrative closure.
- Providing ongoing support.
- Shutting down resources and releasing to new uses.
- Creating a final report.
- Celebrating success and finally,
- Releasing project team.

One of the important activities that must be performed during the closing phase is assuring that all payments have been collected from the customer. In fact, many contracts include a progress payment clause, which states that the customer will make the final payment at the completion of the project. Once all payments have been received and made, the project accounting records can be closed, and a financial analysis of the project can be made, in which actual costs are compared to the project budget. In addition to all these, during the project termination phase, the project manager should prepare a written performance evaluation of each member of the project team and mention how each has expanded her or his knowledge as a result of the project assignment, as well as what areas he needs to develop further (Gido, and Clements, 2009, p.96).

Another important activity during the closing phase is holding post project evaluation meetings. These meetings should be conducted internally, within the organization that performed the project, as well as with the customer. The purpose of such meetings is to evaluate performance of the project, to determine whether the anticipated benefits from the project were actually achieved, and to identify what can be done to improve performance on future projects (Gido, and Clements, 2009, p.96).

Moreover, in closing process Lessons learned must be done. They are
learning gained from the process of performing the project and they may be identified at any point. Lessons can include what worked well that the project team members think should be adapted for use on future work. They can also include areas for which a different method may yield better results (Kloppenborg, 2009, p.415).

In addition, project-closing process includes administrative closure of the project entails, ensuring that all work has been accomplished, all resources have been reassigned, and all documentation is complete. It is important for project teams and other stakeholders to develop and follow a step-by-step process for closing projects. The customer feedback and scope verification should also be reviewed to verify that the customers thought everything was accomplished. In particular, administrative closure procedures should define the approval process for all project deliverables (Kloppenborg, 2009, p.417).

Moreover, one of the important activities that must be performed during the termination phase is contract closure procedures that are legally binding agreements. Contract closure procedures describe the methodology for making sure the contract has been completed, including resolution of any open items, closing each subcontract, delivery of goods and services and payment for them. Actually, closing the contracts includes verifying that all deliverables were accepted; and accounted for; all property has been returned, and all money has been properly distributed. A formal procurement audit is also conducted during contract closure to ensure that money is spent correctly (Kloppenborg, 2009, p.420).

Finally, to close the project effectively and successfully, the successful conclusion of a project should be celebrated. Celebration after finishing the project is very important for many reasons. For example: firstly, when people are reminded of their recent accomplishments, they realize they just met a large challenge and are motivated to undertake new challenges. Secondly, the team members are frequently energized to finish the last few administrative chores so they are done. Thirdly, by recognizing their accomplishments, they are now ready
to say the project is over. Fourthly, the team members exert themselves to finish the last few items. Fifthly, celebrations are excellent times to recognize and acknowledge both effort and results. Finally, celebrations mark transitional points as people leave one project and move on to another. Moreover, one of the benefits of celebrations of success is to ease the stress of working hard for an extend period of time trying to accomplish a project (Kloppenborg, 2009, p.420).
PART THREE: EMPIRICAL FRAMEWORK

CHAPTER FIVE: RESEARCH METHODOLOGY
PART THREE: EMPIRICAL FRAMEWORK

CHAPTER FIVE: RESEARCH METHODOLOGY AND PROCEDURE

The preceding chapters and sections have described in some detail the concepts and the practices of project management. This chapter provides the information about research strategy, research design, target population and sample size. It also described the data collection procedure adapted for this research. The chapter also discussed some of the practical problems encountered. In addition, a detailed methodology and tools used are described.

SECTION ONE: GENERAL BACKGROUND

Although project management applies to many different industries and types of projects, this research focused on applying project management to construction projects and provided framework for using it.

Actually, today’s project management involves much more than completing project’ scope in time within the project budget, people in every industry and every country manage projects. The statistics below demonstrate the significance of project management in today’s society, especially for construction projects. The world as awhile spends nearly $10 trillion of its $40.7 trillion gross product on projects of all kinds, and more than 16 million people regard project management as their profession. The construction industry accounts for 6-9% of the Gross Domestic Product (GDP) of many countries and constitutes more than half of the fixed capital formation as infrastructure and public utilities capital works required for economic development (Schwalbe, 2009, p.3).

The construction industry is a project-based industry since contractors survive and grow based on the success they achieve in their projects. Each construction project is unique but the managerial process is normally uniform across projects in a company.

In fact, management of construction projects is relatively difficult process...
and more complicated than traditional functional type management due to the risks, uncertainties and complexities that face construction project implementation. In addition, management of a construction project mission involve multidirectional interaction of dynamic forces represented by its time, resources constraints and the changing costs which increase the risks and uncertainties in construction projects (Chitkara, 2007, p.13).

Globally, the construction industry is divided into four categories; residential construction, building construction, heavy engineering construction and industrial construction.

SECTION TWO: CONSTRUCTION INDUSTRY IN SUDAN

The construction industry, particularly the building industry in Sudan is considered as the largest industrial sector after agricultural and industry sectors that have direct effect on the national economy. During the last twenty three years this sector faced larger number of difficulties and obstacles internally and/ or externally such as international economic sanctions, unstable market conditions, particularly in the last two years, lack of construction project management skills, problems resulting from the workers and their culture, experiences and productivity, poor performance of construction projects, high frequency of Sudanese pound-dollar exchange rate fluctuations increase in all construction material costs, and finally South Sudan separation.

Actually, Sudan’s economy has been struggling since South Sudan separated in 2011. Upon separating from Sudan, South Sudan took three quarters of the country’s oil wealth but the pipelines, refineries and ports to export the oil are all located in the north. After drawn-out negotiations and flare-up of fighting along the border, the two nations came to an agreement on how to divide revenue in 2013.

According to the Central Bank of Sudan annual report for the year 2010 the Sudanese construction sector is accounting for 3.3% of the Sudanese country’s
GDP. Moreover, construction sector divided into main three types. The first type is residential buildings that normally do not exceed 3 floors that represent the most types of modern buildings in Sudan and are carried out by engineers or contractors. The second type is specialized buildings such as schools, hotels, banks, hospitals, factories, warehouses, and the third types of building is infrastructure projects such as Roads, bridges, dams and reservoirs.

On the other hand, Sudanese Contractors Association classifies contractors into the following categories:

- Construction contractors.
- Mechanical contractors.
- Electrical contractors, and
- Air conditioning system contactors

In Khartoum state, usually contractors working in the construction sector are of different social and educational backgrounds and experiences. Contractor team may consists mainly of project managers, construction managers, site engineers, civil, mechanical, electrical engineers, technicians, skilled workers, semi-skilled workers, accountants and lawyers.

SECTION THREE: RESEARCH METHODOLOGY

Research Methodology Design

The methodology of this study used both qualitative and quantitative method through utilizing the information gathered from related studies about using of project management tools and techniques, managerial and environmental factors that affect the effectiveness of construction project performance.

The research was conducted using semi-structured interviews to have set questions, observations and survey research methods to test the study’s

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1www.sudanesecontractors.org
hypothesis. In particular, a questionnaire was developed for data gathering and some statistical methods were used for data analysis. In addition, interviews with experts in project management were conducted to assist in questionnaire development and to validate the research results, and finally observations were used during construction projects executions to give more detail information about project management practices.

This study intended to use two dimensions to measure project effectiveness as dependent variables; achieving customer’s objectives and improving effectiveness of project performance. On the other side, the study divided the independent Variables into three main group and twelve sub factors that were identified as factors affecting the Sudanese construction projects effectiveness. The first group was managerial group that contained six sub factors. The second group was project management practices and tools that included a list of the most twenty four project management tools and techniques used in construction sector, and the third group was ethics of work and environmental group that consisted of five factors. The study investigated and studied the relationship between all these variables to reach its results.

The questions of using project management tools and techniques group focused on project management applications and the most project management tools and techniques used in construction projects and their impact on and correlation with project effectiveness. While managerial factor group questions focused on factors related to managerial group such as the role of top management and managerial skills of project manager and their influence on project effectiveness. In environmental factor group, the questions focused on the impact of external and internal environmental factors such as project team culture, relation between them, the financial corruption inside the project and weather changing on project effectiveness.

According to the literature of the research and previous researches, four
hypotheses have been proposed for this study to construct the theoretical framework that was constructed to find the relationship between the project management application, managerial factors, environmental factors, and practices of work ethics factors on one side and project effectiveness on the other.

The framework that is clear in appendix A formed the relationship between dependent variables and independent variables.

To reach findings of this study SPSS package was used. Moreover, comparative analysis and quantitative methods such as graphs, tables, and correlation analysis were used in this analysis.

**Research Population and Sampling**

Construction firms in Khartoum state were selected for investigation due to the state’s position as the center of construction firms in Sudan. The sample was restricted to construction companies in Khartoum state including building, heavy engineering construction, industrial, and infrastructure projects. Based on approximately three hundred active construction companies registered in Sudanese Contractor Association directory sample of seventy construction companies were selected randomly to participate in this study by given each organization a specific number and let someone select a random number from the numbers group. A total of seventy questionnaires were distributed personally and through emails after calling the participant about the study objectives. Sixty two questionnaires were returned and analyzed.

Based on statistic expert’s advice and previous studies in the same field, 10 to 13 % of population size as a sample size is accepted. For more reliability and increasing the accuracy of the results, the researcher took 22% of the registered companies working in Khartoum state as the target sample. Out of seventy target sample, sixty two usable responses were received representing an88.6% response rate.
Data Collection

Data collection is considered as the crucial stage in gathering all required information from the fundamental sources in achieving the main objectives of the study. The data and all the information is divided into two types of information, the primary and secondary data that both were used in this study.

The tools used in this research for collecting the information were the questionnaire, literature review, interviews, observations, internet, and phone calls. The questionnaire is designed in a tabular format and its questions are derived from the research questions to satisfy the objectives of the research.

After receiving a call describing the objective of the study, each participant was inquired about their willingness to participate in the study and requesting a face-to-face interview with a project manager of the company. Then each participant was sent questionnaire with covering letter that included instructions on how to complete the questionnaire, information on confidentiality of the data; and expectations in terms of feedback. The letter also identified the type of research, sponsoring organization, and the researcher’s name. Moreover, it indicated the objectives of the research and explained to the participants that the results of the questionnaire would be used to improve the ability of contractors to identify, analyze and estimate the project management factors impact on the construction project effectiveness.

Subjects were given four weeks to complete the questionnaire. Reminder notices were sent out at two weeks and three weeks to encourage participation. Contact details of researcher were encouraged to communicate with the researcher about any questions, queries or concerns participants had. The participants were also informed that their personal information was not going to be used for any other purpose and their privacy would be protected at all times.
Research questionnaire design

The questionnaire was developed to collect data on project management applications and project effectiveness and for testing the study’s hypotheses. It was conducted in two stages: in the first stage, data was gathered by conducting formal interviews with project managers from ten contracting organizations, confined in construction sector introducing the concept of different types of project effectiveness and to identify whether the questions agreed with the scope of the items and the extent to which these items reflect the concept of the research problem.

In the second stage and to make sure of study validity and that the questionnaire was designed well enough to provide relations and test between variables, this set of questions was circulated to number of assessors and experts whom from academic, consulting, and construction industry who have deep knowledge about project management practices and construction projects. The study took advantages of these experts in assisting selection of most used project management tools and techniques, questionnaire development and validation of the research results. This was done by sending pilot questionnaire to them for evaluation and then getting the questionnaires back to do the proper modifications and then presented them back again to the experts to make sure the modifications required were done. This process was done three times until reaching the final format of the questionnaire. As a result, good comments regarding the shape and the factors were taken into consideration to reflect the nature of construction industry in Khartoum.

The final questionnaire consisted of six pages of questions and a one-page cover letter including questions covering issues surrounding project management methodologies, process, tools and techniques, organization, metrics, culture, accomplishment of project goals, and background information of the respondents such as their role, their education level, and experience level in construction and
project management area. Also, questions classified the companies by years of experience in project management, type of customers, number of project managers with whom has certificate in project management field, number of employees working in project management department, and size of projects executed by the organization. The questionnaire namely divided into four sections:

- Respondent’s background that included twenty six questions about the respondent and his organization.
- Project management methodology that handled information about using project management methods and project management processes. There were four questions in this section.
- Environmental Factors: this part comprised the questions about managerial, environmental, and ethics of work factors. There were twenty four questions in this section.
- Project management tools and techniques: this part comprised the most twenty four tools and techniques used in construction project.

For the interesting of the research to help participant to read and answer the questions, get more accurate results, and because most of the target population are not familiar with the English language and project management terminology, the questionnaire was prepared in Arabic language appendix B, then it translated into English language appendix C. Also the researcher tried to keep the format of the questionnaire attractive, organized the questions in a scientific way, kept the sentences short and simple to minimize confusion and ambiguity, and minimized the biased and leading questions. Moreover, the researcher tried to keep the questionnaire as short as possible, but comprehensive enough so that it could be completed within 15 – 25 minutes, and used close-ended and open-ended questions in the questionnaire to get more details and information.
Data Analysis

Analysis is an interactive process by which answers to be examined to see whether these results support the hypothesis underlying each question. The main rule of any form of analysis whether it is qualitative or quantitative data, is to move from raw data to meaningful understanding. In this study, the applied statistical analysis was used for questionnaire. The statistical analyses was divided into two main sections: the descriptive and the inferential analysis. Descriptive statistics were used to describe and summarize the basic features of the data in the study, and were used to provide quantitative descriptions in a manageable and intelligible form. Descriptive statistics measured the means and the dispersion standard variations. On the other hand, the inferential statistics was used to draw conclusions that extend beyond the immediate data by using Statistical Package for Social Sciences (SPSS), subsequent calculations and statistical evaluation techniques. The following statistical analysis steps were done:

- Data processing
- Coding and defining each variable.
- Summarizing the data on recording scheme.
- Entering data to a work sheet.
- Checking and cleaning data.
- SPSS software was used.
- Using descriptive statistics including frequency distribution tables with pie and bar charts.
- Finding mean and rank of each cause by using Likert scales.
- Cronbach’s alpha reliability coefficient was done to measure reliability and validity for the study.
- Chi square test was done to test the study’s hypotheses, the independency between two variables, and the difference answers of contractors regarding to variables.
Multi-comparison test was also done when there is a significant difference. Using spearman correlation coefficient to find the correlation between the variables.

**Validity of research**

Validity refers to the degree to which an instrument measures what it is supposed to be measuring. High validity is the absence of the systematic errors in the measuring instrument. When an instrument is valid, it truly reflects the concept it is supposed to measure. Validity of the study was achieved based on the arbitrator advices and the square root of Cronbach alpha coefficient value.

**Reliability of research**

Reliability test was performed on all variables to ensure that the items measuring each variable were in the same group and successfully measuring what they were intended to measure. Reliability test was also performed to test the consistency of respondents’ answers to all the items in measure. Cronbach’s alpha was observed and all the variables were accepted based on the alpha value more than 0.60. Table 5-1 shows the reliability test summary for questions relating to

1. Using project management tools and techniques factors.
2. Administration and managerial factors.
3. Environmental and practicing of work ethics factors

<table>
<thead>
<tr>
<th>Table 5.1 Reliability test for variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>variables</td>
</tr>
<tr>
<td>Using project management tools and techniques factors.</td>
</tr>
<tr>
<td>Administration and managerial factors.</td>
</tr>
<tr>
<td>Environmental and practicing of work ethics factors</td>
</tr>
</tbody>
</table>

From the table 5-1 it is found that reliability of using project management tools and techniques factor is high, with the Cronbach alpha value of 0.946. Also,
the reliability of administration and managerial and environmental and practicing of work ethics factors are also very high with Cronbach alpha values of 0.940 and 0.903 respectively and that means the strong reliability of the questionnaire’s items.

**Study hypotheses testing**

This section discusses the hypothesis, in total. Four hypotheses are tested against the findings from the research instrument. The chi square test is used to test the hypothesis, and determine, if there are any significant differences between the five variables namely project management application, managerial factors, environmental factors, and practices of work ethics, and project effectiveness. The results of the test suggest there is no significant difference between all of the groups. There is huge consensus of opinion with regards to the prevalence of X and the relationship between the prevalence of X and the overall X. The results show compelling evidence of congruency with 95% confidence level, that the interval contains the population mean are significant, indicating that the null hypothesis H01, H02, H03 and H04 are not accepted.

For hypotheses testing, chi square test and correlation analysis were carried out to test the relationship between variables under research. First, Chi square test was used to test whether or not there are statistically significant differences among the study variables by using the null and alternative hypotheses. The null hypothesis said: there are significant differences between observed values and expected values of each class of data. While alternative hypothesis said: there are no significant differences between observed values and expected values of each class of data. If the value of P associated with Chi Square statistic is less than 0.05 (Asymp.Sig. < 0.05) the null hypothesis will be rejected for the level of significance of 5% and acceptance the alternative hypothesis.

Second, if the alternative hypothesis was accepted the next step was performing weighted averages and correlation analyses to analyze the impact and
influence of independents variables on dependents variables. The correlation technique is used to describe the strength and direction of the linear relationship of one variable to another. It generates correlation coefficients, which highlights the association between the measured variables.

Based on the four study hypotheses, the dependent variables were the project effectiveness measures and the independent variables were the uses of project management application factors, administration and managerial factors, environmental and practicing of work ethics factors.
CHAPTER SIX RESULTS AND DISCUSSION
CHAPTER SIX: RESULTS AND DISCUSSION

This chapter presents and discusses the results both from descriptive statistics and hypothesis testing. It discusses the results within the context of the research questions underlying the study. Additionally, the chapter presents discussions concerning the impact of the project management methodology on project effectiveness by studying the influence of project management, managerial, environmental and work ethics factors, and the correlation between using of project management tools and techniques and project effectiveness. It also handles the descriptive and inferential statistics of the dependent variables and study factors. Then, for each hypothesis, the results of the statistical analyses are presented and discussed.

Respondents’ Demographic Profile

From the total of 70 questionnaires distributed, 62 questionnaires were returned on time for analysis. This represents an average response rate of 89%. As shown in table 6-1 and figure 6-1 the majority of the respondents were bachelor degree holders accounting to 61.3%, followed by master degree holders with 37.1% and finally PhD degree holders with 1.6%.

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor</td>
<td>38</td>
<td>61.3</td>
<td>61.3</td>
<td>61.3</td>
</tr>
<tr>
<td>Masters</td>
<td>23</td>
<td>37.1</td>
<td>37.1</td>
<td>98.4</td>
</tr>
<tr>
<td>Doctorate</td>
<td>1</td>
<td>1.6</td>
<td>1.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Figure 6.1 Respondents’ qualification

Table 6.2 and figure 6.2 show that the majority of the respondents joined their companies during the last five years that present 41.9%, followed by whom joined the company more than 10 years with 32.3% and finally whom joined the company between 5 to 10 years with 25.8%.

<table>
<thead>
<tr>
<th>Years of joining the company</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 5 years</td>
<td>26</td>
<td>41.9</td>
<td>41.9</td>
<td>41.9</td>
</tr>
<tr>
<td>5 - 10</td>
<td>16</td>
<td>25.8</td>
<td>25.8</td>
<td>67.7</td>
</tr>
<tr>
<td>10 - more</td>
<td>20</td>
<td>32.3</td>
<td>32.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6.2 Respondents’ joining years to company
The table 6-3 and figure 6-3 show the position held by respondents in their company classified into three main roles. These positions included project managers, engineers, and others. Most of the respondents are project managers 80.6%, followed by engineers with 14.5% and others with 4.8%.

Table 6.3 Respondents’ role

<table>
<thead>
<tr>
<th>Current role</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager</td>
<td>50</td>
<td>80.6</td>
<td>80.6</td>
<td>80.6</td>
</tr>
<tr>
<td>Engineer</td>
<td>9</td>
<td>14.5</td>
<td>14.5</td>
<td>95.2</td>
</tr>
<tr>
<td>other</td>
<td>3</td>
<td>4.8</td>
<td>4.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6.3 Respondents’ role

Experience in construction field of respondents are shown in table 6-4 and figure 6-4, it ranged from less than 5 to more than 10 years. The majority of the respondents have more than 10 years’ experience in construction field with 50%, followed by 25.8% have experience less than 5 years, and 24.2% between 5 to 10 years.

Table 6.4 Respondents’ experience years in construction field

<table>
<thead>
<tr>
<th>experience year in construction field</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 5</td>
<td>16</td>
<td>25.8</td>
<td>25.8</td>
<td>25.8</td>
</tr>
<tr>
<td>5 - 10</td>
<td>15</td>
<td>24.2</td>
<td>24.2</td>
<td>50.0</td>
</tr>
<tr>
<td>more than 10 years</td>
<td>31</td>
<td>50.0</td>
<td>50.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Figure 6.4 Respondents’ experience years in construction field

Table 6-5 and figure 6-5 show the experience in project management field of respondents that ranged from less than 5 to more than 10 years. Most of them have less than 5 years’ experience in project management with 38.7%, 33.9% more than 10 years and 27.4% between 5 to 10 years.

<table>
<thead>
<tr>
<th>Years of experience in project management</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 5</td>
<td>24</td>
<td>38.7</td>
<td>38.7</td>
<td>38.7</td>
</tr>
<tr>
<td>5 - 10</td>
<td>17</td>
<td>27.4</td>
<td>27.4</td>
<td>66.1</td>
</tr>
<tr>
<td>more than 10 years</td>
<td>21</td>
<td>33.9</td>
<td>33.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
The majority of respondents did not take any training courses in project management during the past five years with scored ratio 51.6%. While only 48.4% of them did. This described in table 6-6 and figure 6-6below.

<table>
<thead>
<tr>
<th>Receiving training courses within the last 5 years in project management</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>32</td>
<td>51.6</td>
<td>51.6</td>
<td>51.6</td>
</tr>
<tr>
<td>Yes</td>
<td>30</td>
<td>48.4</td>
<td>48.4</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
40.3% of whom that took training courses in project management took it in PMP, 6.5% in FIDIC, and 1.6% in risk management. These data are shown in table 6-7 and figure 6-7.

### Table 6.7 Training course name done by respondents

<table>
<thead>
<tr>
<th>Receiving course name</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMP</td>
<td>25</td>
<td>40.3</td>
<td>83.3</td>
<td>83.3</td>
</tr>
<tr>
<td>Risk management</td>
<td>1</td>
<td>1.6</td>
<td>3.3</td>
<td>86.7</td>
</tr>
<tr>
<td>FIDIC</td>
<td>4</td>
<td>6.5</td>
<td>13.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>48.4</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>System</td>
<td>32</td>
<td>51.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Most of respondents did not have approved certificate in project management with scored ratio 71%. While only 29% of respondents have as shown in table 6-8 and figure 6-8.

<table>
<thead>
<tr>
<th>Respondents hold project management certificate</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>44</td>
<td>71.0</td>
<td>71.0</td>
<td>71.0</td>
</tr>
<tr>
<td>Yes</td>
<td>18</td>
<td>29.0</td>
<td>29.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
The majority of whom hold project management certificate was in project management proficiency (PMP) with ratio 21% as shown in table 6-9 and figure 6-9.

Table 6.9 Type of project management certificate

<table>
<thead>
<tr>
<th>Name of project management certificate</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>(PMP) Project Management Professional</td>
<td>13</td>
<td>21.0</td>
<td>72.2</td>
<td>72.2</td>
</tr>
<tr>
<td>(CAPM) Certified Associate Project Management</td>
<td>1</td>
<td>1.6</td>
<td>5.6</td>
<td>77.8</td>
</tr>
<tr>
<td>(PRINCE2) Project in Control Environment</td>
<td>1</td>
<td>1.6</td>
<td>5.6</td>
<td>83.3</td>
</tr>
<tr>
<td>(CPM) Certified Project Manager</td>
<td>1</td>
<td>1.6</td>
<td>5.6</td>
<td>88.9</td>
</tr>
<tr>
<td>others</td>
<td>1</td>
<td>1.6</td>
<td>5.6</td>
<td>94.4</td>
</tr>
<tr>
<td>doctorate in PM</td>
<td>1</td>
<td>1.6</td>
<td>5.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>29.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

System                                   | 44    | 71.0    |               |                   |

Total                                    | 62    | 100.0   |               |                   |

Figure 6.9 Type of project management certificate

Project performance

In this part, the information was obtained about the construction
projects performance of the respondents’ previous project to measure and give guidelines of the performance and using extent of project management methodology of construction projects in Sudan.

Respondents have been asked about the performance of the last project they were involved in based on its schedule, variation between actual and planned project execution time, budget, cost variation, and which project management tools they used to complete the project. Project execution time period was divided into three main periods; less than 6 months, 6 months to 3 years, and more than 3 years. Most of the project execution time period respondents involved in was within the period of 6 months to 3 years with 79.0%, followed by period less than 6 months with 16.1%, and thirdly the period more than 3 years with 4.8%. Table 6-10 and figure 6-10 below present these results.

<table>
<thead>
<tr>
<th>Project execution planned schedule</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 6 Month</td>
<td>10</td>
<td>16.1</td>
<td>16.1</td>
<td>16.1</td>
</tr>
<tr>
<td>6 month - 3 years</td>
<td>49</td>
<td>79.0</td>
<td>79.0</td>
<td>95.2</td>
</tr>
<tr>
<td>more than 3 years</td>
<td>3</td>
<td>4.8</td>
<td>4.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6.10 Planned schedule of project execution

Regarding project execution, planned schedule variations were divided into five scales: less than 3%, between 3 and 5%, between 6 to 10%, between
11 to 25%, and more than 25%. Most of the projects did not meet their completion date and the time variation was more than 25% variation with 30.6%. This presented by the table 6-11 and figure below 6-11.

<table>
<thead>
<tr>
<th>Time variation</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 3%</td>
<td>4</td>
<td>6.5</td>
<td>6.5</td>
<td>6.5</td>
</tr>
<tr>
<td>3% - 5%</td>
<td>13</td>
<td>21.0</td>
<td>21.0</td>
<td>27.4</td>
</tr>
<tr>
<td>6% - 10%</td>
<td>13</td>
<td>21.0</td>
<td>21.0</td>
<td>48.4</td>
</tr>
<tr>
<td>11% - 25%</td>
<td>13</td>
<td>21.0</td>
<td>21.0</td>
<td>69.4</td>
</tr>
<tr>
<td>more than 25%</td>
<td>19</td>
<td>30.6</td>
<td>30.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Regarding project budget, it was divided into five main categories; less than 250,000 thousand USD, between 250,000 thousand - 500,000 thousand USD, between $ 1,000,000 - $ 5,000,000 USD, and more than $ 5,000,000 USD. The majority of the project’s budget was more than $ 5,000,000 USD with 33.9%of the total respondents as shown in the table 6-12 and figure 6-12 below.

<table>
<thead>
<tr>
<th>Project budget</th>
</tr>
</thead>
</table>
The variation between budget and actual spent cost measured based on five measures; less than 3%, between 3 and 5%, between 6 to 10%, between 11 to 25%, and more than 25%. Most of the projects have budget variations between 3 to 5% and 11 to 25% with same ratio of 24.2% as shown in the table 6-13 and figure 6-13 below.
Cost variation | Frequency | Percent | Valid Percent | Cumulative Percent |
---|---|---|---|---|
less than 3% | 3 | 4.8 | 5.3 | 5.3 |
3% - 5% | 15 | 24.2 | 26.3 | 31.6 |
6% - 10% | 11 | 17.7 | 19.3 | 50.9 |
11% - 25% | 15 | 24.2 | 26.3 | 77.2 |
more than 25% | 13 | 21.0 | 22.8 | 100.0 |
Total | 57 | 91.9 | 100.0 |
System | 5 | 8.1 |
Total | 62 | 100.0 |

Figure 6.13 Variation between project budget and actual spent cost

Respondents have been asked if they used any of project management tools and techniques during the execution of the project. Based on Table 6.14 and Figure 6.14 below, 77.4% used project management tools while 22.6% did not.

Table 6.14 Using extent of project management tools

| Frequency | Percent | Valid Percent | Cumulative Percent |
---|---|---|---|
No | 14 | 22.6 | 22.6 |
Yes | 48 | 77.4 | 100.0 |
Total | 62 | 100.0 | 100.0 |
Figure 6.14 Using extent of project management tools

As shown in the table 6-15 and figure 6-15 below the project management tools used in the project were all of the tools mentioned with ratio of 67.7%. And the most used one was project schedule with ratio 6.5%.

Table 6.15 The most project management tools used

<table>
<thead>
<tr>
<th>Tools</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project schedule</td>
<td>4</td>
<td>6.5</td>
<td>8.3</td>
<td>8.3</td>
</tr>
<tr>
<td>Cash flow</td>
<td>1</td>
<td>1.6</td>
<td>2.1</td>
<td>10.4</td>
</tr>
<tr>
<td>The project charter</td>
<td>1</td>
<td>1.6</td>
<td>2.1</td>
<td>12.5</td>
</tr>
<tr>
<td>All above</td>
<td>42</td>
<td>67.7</td>
<td>87.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>77.4</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>System</td>
<td>14</td>
<td>22.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Company profile

Experience of the respondents’ company in project management was split into three sections; experience less than 5 years, between 5 to 10 years,
and more than 10 years. The majority of the companies have more than 10 years’ experience in project management scope with ratio 53.2% as presented in table 6-16 and figure 6-16 below. Therefore, it can take advantage of their answers that are in support of the study because the person at this stage have a high level of expertise and knowledge of the culture and the aspects of the study.

Table 6.16 Company’s experience in project management

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 years</td>
<td>15</td>
<td>24.2</td>
<td>24.2</td>
<td>24.2</td>
</tr>
<tr>
<td>Between 5-10 years</td>
<td>14</td>
<td>22.6</td>
<td>22.6</td>
<td>46.8</td>
</tr>
<tr>
<td>more than 10 years</td>
<td>33</td>
<td>53.2</td>
<td>53.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6.16 Company’s experience in project management

Organization customer types is divided into three sectors: government sector, private sector, and individuals. As shown in table 6-17 and figure 6-17 below the majority of companies’ customer are all the types of customer sectors that included government, private, and individual sectors with ratio 59.7%.

Table 6.17 Type of company’s customer

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
</table>

185
Regarding the total number of company’s employees, it was divided into three main categories; less than 50 employees, between 50 to 150 employees, and more than 150. The majority of the companies have number of employees between 50 to 100 with ration 29.0% as shown in table 6-18 and figure 6-18 below.

Table 6.18 Company’s employees’ number

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 50</td>
<td>29</td>
<td>46.8</td>
<td>46.8</td>
</tr>
<tr>
<td>50 - 150</td>
<td>18</td>
<td>29.0</td>
<td>75.8</td>
</tr>
<tr>
<td>more than 150</td>
<td>15</td>
<td>24.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Also, the total number of company’s employees working in project management department was divided into three main categories; less than 5 employees, between 5 to 15 employees, and more than 15. The majority of the companies have number of employees working in project management department less than 5 employees with ratio 75.8% as shown in table 6.19 and figure 6.18 below.

Table 6.19: Organization’s employees working in PM dept.

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 5</td>
<td>47</td>
<td>75.8</td>
<td>75.8</td>
<td>75.8</td>
</tr>
<tr>
<td>5 - 15</td>
<td>11</td>
<td>17.7</td>
<td>17.7</td>
<td>93.5</td>
</tr>
<tr>
<td>more than 15</td>
<td>4</td>
<td>6.5</td>
<td>6.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Regarding the total number of project managers in the company and who have a certificate in project management, they were divided into three main categories: less than 5 project managers, between 5 to 20 project managers, and more than 20. The majority of the companies have less than 5 project managers with a ratio of 64.5%. This is shown in Table 6.20 and Figure 6.20.

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 5</td>
<td>40</td>
<td>64.5</td>
<td>64.5</td>
<td>64.5</td>
</tr>
<tr>
<td>5 - 20</td>
<td>21</td>
<td>33.9</td>
<td>33.9</td>
<td>98.4</td>
</tr>
<tr>
<td>more than 20</td>
<td>1</td>
<td>1.6</td>
<td>1.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
The most companies have less than 5 project managers have certificate in project management with ratio 93.5%. Table 6.21 and figure 6.21 show these statistics.

### Table 6.21 Organization’s project managers holding PM certificate

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 5</td>
<td>58</td>
<td>93.5</td>
<td>93.5</td>
<td>93.5</td>
</tr>
<tr>
<td>5 - 20</td>
<td>4</td>
<td>6.5</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>more than 20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Regarding the total number of projects currently under construction by the company and that have been completed during the last five years, was divided into three main categories; less than 5 projects, between 5 to 10 projects, and more than 10. The majority of the companies have less than 5 projects under construction with ratio 54.8%. This is shown in table 6-22 and figure 6-22.

Table 6.22 Number of projects under construction

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 5</td>
<td>34</td>
<td>54.8</td>
<td>55.7</td>
<td>55.7</td>
</tr>
<tr>
<td>5 - 10</td>
<td>19</td>
<td>30.6</td>
<td>31.1</td>
<td>86.9</td>
</tr>
<tr>
<td>more than 10</td>
<td>8</td>
<td>12.9</td>
<td>13.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>98.4</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Most companies have completed more than 10 projects in the last 5 years with ratio 45.2%. This is shown in table 6-23 and figure 6-23 below.

Table 6.23 Completed projects during the last five years

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 5</td>
<td>21</td>
<td>33.9</td>
<td>33.9</td>
</tr>
<tr>
<td>5 - 10</td>
<td>13</td>
<td>21.0</td>
<td>21.0</td>
</tr>
<tr>
<td>more than 10</td>
<td>28</td>
<td>45.2</td>
<td>45.2</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 6.22 Number of projects under construction

Figure 6.23 Completed projects during the last five years
Company financial capability measured by the project volume in terms of USD. The project finance volume was divided into five main categories; less than 250,000 USD, between 250,000 to 500,000 USD, between 500,000 to 1,000,000, between 1,000,000 to 5,000,000, and finally more than 5,000,000 USD. Table 6.24 and figure 6.24 below present that the majority of the companies see that the project will be considered big if its value exceed 5,000,000 USD.

Table 6.24 Project financial size

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 250,000 USD</td>
<td>6</td>
<td>9.7</td>
<td>9.7</td>
<td>9.7</td>
</tr>
<tr>
<td>From 250,000 to 500,000 USD</td>
<td>11</td>
<td>17.7</td>
<td>17.7</td>
<td>27.4</td>
</tr>
<tr>
<td>From 500,000 to 1,000,000 USD</td>
<td>8</td>
<td>12.9</td>
<td>12.9</td>
<td>40.3</td>
</tr>
<tr>
<td>From 1,000,000 to 5,000,000 USD</td>
<td>12</td>
<td>19.4</td>
<td>19.4</td>
<td>59.7</td>
</tr>
<tr>
<td>More than $5,000,000 USD</td>
<td>25</td>
<td>40.3</td>
<td>40.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6.24 Project financial size

To measure the level of project management maturity and at which level project management method is used in respondents’ organization, participants have been asked if they use any of project management methods in their organizations such as project management institute (PMI) model,
international project management association (IPMA) model or international standard organization (ISO) model. Also, they have been asked if project management tools and techniques have an impact on project effectiveness.

Table 6-25 and figure 6-25 below illustrate awareness levels of using project management model in organizations. They show that only about 45 percent of respondents use project management models. On the other hand, 54 percent do not. That means there is a lack of using project management models in construction companies in Sudan.

<table>
<thead>
<tr>
<th>Table 6.25 The extent of using level of project management model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

The majority of respondent use Project Management Institute (PMI) models with ratio 60.7%, followed by International Standard Organization with 25.0% as shown in table 6-26 and figure 6-26 below. That means the most project management models are used in construction company is Project Management Body of Knowledge.
Table 6.26 Type of project management model used in organization

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Management Body of knowledge PMBOK</td>
<td>17</td>
<td>27.4</td>
<td>60.7</td>
<td>60.7</td>
</tr>
<tr>
<td>Project In Controlled Environment PRINCE2</td>
<td>2</td>
<td>3.2</td>
<td>7.1</td>
<td>67.9</td>
</tr>
<tr>
<td>International Standard Organization ISO 9000</td>
<td>7</td>
<td>11.3</td>
<td>25.0</td>
<td>92.9</td>
</tr>
<tr>
<td>other</td>
<td>2</td>
<td>3.2</td>
<td>7.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>45.2</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>System</td>
<td>34</td>
<td>54.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 6.26 Type of project management model used in organization

Project Management Tools and Techniques (PMTT) Related Factors

This section is intended to measure the level of use of project management applications by examining the range of using the concept of project management tools and techniques in general. In specific, measuring the impact of using the most 24 used project management tools and techniques in construction projects on project effectiveness dimensions in respondents’ organization.
The respondents were asked to rate the relationship between using project management tools and techniques and project effectiveness dimensions on a scale of 5, where 5 was never present and 1 was always present. After the factor analysis, the score of each of the phrase was computed by taking out the mean of the items falling under each factor.

It is clear from the table 6-27 most of the study sample agreed that using project management tools and techniques concept often leads to achieve customer’s objectives and improve project performance effectiveness with means 1.95 and 1.82 with standard deviation .845 and .866 respectively.

<table>
<thead>
<tr>
<th>Sort. No.</th>
<th>Statement</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Using project management tools and techniques leads to achieve customer’s satisfaction</td>
<td>61</td>
<td>1.95</td>
<td>.845</td>
<td>Often</td>
</tr>
<tr>
<td>2</td>
<td>Using project management tools leads to improve project performance effectiveness</td>
<td>61</td>
<td>1.82</td>
<td>.866</td>
<td>Often</td>
</tr>
</tbody>
</table>

The table 6-28below shows the most 24 project management tools and techniques that are used by the members of the study sample based on the previous studies, interviews with expert in project management and project managers with regard to the condition of construction field in Sudan. These tools included all project life cycle starting from initiating process through planning, executing, monitoring and controlling, and ending with closing process.

<table>
<thead>
<tr>
<th>Project Charter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Schedule</td>
</tr>
<tr>
<td>Work Breakdown Structure (WBS)</td>
</tr>
<tr>
<td>Activity List</td>
</tr>
<tr>
<td>Project Statement of Work</td>
</tr>
</tbody>
</table>
Table 6-29 below shows the most frequent 4 project management tools and techniques often used by study respondents. They are project charter, project schedule, work breakdown structure, and activity list. On other hand,
Table 6.29 The extent of using project management tools & techniques

<table>
<thead>
<tr>
<th>Project Management Tools &amp; techniques Name</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Charter</td>
<td>62</td>
<td>2.6</td>
<td>1.684</td>
<td>Often</td>
</tr>
<tr>
<td>Project Schedule</td>
<td>61</td>
<td>2.05</td>
<td>1.431</td>
<td>Often</td>
</tr>
<tr>
<td>Work Breakdown Structure (WBS)</td>
<td>62</td>
<td>2.42</td>
<td>1.574</td>
<td>Often</td>
</tr>
<tr>
<td>Activity List</td>
<td>62</td>
<td>2.44</td>
<td>1.616</td>
<td>Often</td>
</tr>
</tbody>
</table>

Table 6.30 The extent of using project management tools & techniques

<table>
<thead>
<tr>
<th>Project Management Tools &amp; techniques Name</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Statement of Work</td>
<td>62</td>
<td>2.9</td>
<td>1.647</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Claim Administration</td>
<td>61</td>
<td>2.93</td>
<td>1.721</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Flowcharting</td>
<td>62</td>
<td>2.97</td>
<td>1.659</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Proposal evaluation techniques</td>
<td>60</td>
<td>2.97</td>
<td>1.646</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Critical path Methodology (CPM)</td>
<td>62</td>
<td>3.05</td>
<td>1.644</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Quality Checklists</td>
<td>62</td>
<td>3.11</td>
<td>1.7</td>
<td>Sometimes</td>
</tr>
<tr>
<td>stakeholder register</td>
<td>62</td>
<td>3.24</td>
<td>1.586</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Project selection methods</td>
<td>62</td>
<td>3.31</td>
<td>1.574</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Work Authorization System</td>
<td>62</td>
<td>3.37</td>
<td>1.591</td>
<td>Sometimes</td>
</tr>
</tbody>
</table>

Table 6.30 The extent of using project management tools & techniques

Table 6.30 The extent of using project management tools & techniques

<table>
<thead>
<tr>
<th>Project Management Tools &amp; techniques Name</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Statement of Work</td>
<td>62</td>
<td>2.9</td>
<td>1.647</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Claim Administration</td>
<td>61</td>
<td>2.93</td>
<td>1.721</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Flowcharting</td>
<td>62</td>
<td>2.97</td>
<td>1.659</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Proposal evaluation techniques</td>
<td>60</td>
<td>2.97</td>
<td>1.646</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Critical path Methodology (CPM)</td>
<td>62</td>
<td>3.05</td>
<td>1.644</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Quality Checklists</td>
<td>62</td>
<td>3.11</td>
<td>1.7</td>
<td>Sometimes</td>
</tr>
<tr>
<td>stakeholder register</td>
<td>62</td>
<td>3.24</td>
<td>1.586</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Project selection methods</td>
<td>62</td>
<td>3.31</td>
<td>1.574</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Work Authorization System</td>
<td>62</td>
<td>3.37</td>
<td>1.591</td>
<td>Sometimes</td>
</tr>
</tbody>
</table>
On the other hand, the members of the study sample rarely use methods and project management tools shown in the table 6-31 below.

### Table 6.31 The extent of using project management tools & techniques

<table>
<thead>
<tr>
<th>Project Management Tools &amp; techniques Name</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>fast tracking techniques</td>
<td>62</td>
<td>3.42</td>
<td>1.574</td>
<td>Rarely</td>
</tr>
<tr>
<td>Change control System</td>
<td>61</td>
<td>3.46</td>
<td>1.608</td>
<td>Rarely</td>
</tr>
<tr>
<td>Responsibility Assignment Matrix (RAM)</td>
<td>61</td>
<td>3.54</td>
<td>1.598</td>
<td>Rarely</td>
</tr>
<tr>
<td>Conflict Resolving Techniques</td>
<td>62</td>
<td>3.56</td>
<td>1.616</td>
<td>Rarely</td>
</tr>
<tr>
<td>Risk Register</td>
<td>61</td>
<td>3.56</td>
<td>1.511</td>
<td>Rarely</td>
</tr>
<tr>
<td>Project Management Information System PMIS</td>
<td>61</td>
<td>3.57</td>
<td>1.477</td>
<td>Rarely</td>
</tr>
<tr>
<td>Earned value Technique (EVT)</td>
<td>62</td>
<td>3.6</td>
<td>1.541</td>
<td>Rarely</td>
</tr>
<tr>
<td>Lessons Learned Records</td>
<td>61</td>
<td>3.62</td>
<td>1.474</td>
<td>Rarely</td>
</tr>
<tr>
<td>Performance measurement baseline</td>
<td>61</td>
<td>3.64</td>
<td>1.581</td>
<td>Rarely</td>
</tr>
<tr>
<td>Gantt chart</td>
<td>62</td>
<td>3.65</td>
<td>1.559</td>
<td>Rarely</td>
</tr>
<tr>
<td>SWOT Analysis</td>
<td>61</td>
<td>3.74</td>
<td>1.493</td>
<td>Rarely</td>
</tr>
</tbody>
</table>

**The Project Management Tools and Techniques (PMTT) and Achieving Customer’s Satisfaction Relationship**

The impact of using project management tools and techniques on project effectiveness in terms of achieving customer’s satisfaction is shown in table 6-32 below. It shows that 77.05% of the respondents agreed that using project schedule significantly contributes to achieve customer’s satisfaction that was the highest rate of agreement between the project management tools and techniques, followed by proposal evaluation techniques with ratio 70.0%.
then quality checklist with ratio 68.9%. On the other hand, 14.75%, 15.0%, and 23.0% of the respondents did not agree that project schedule, proposal evaluation techniques, and quality checklist respectively could lead to achieve customer satisfaction. 8.2%, 15.0%, and 8.2% of respondents did not know if project schedule, proposal evaluation techniques, and quality checklist respectively could lead to achieve customer satisfaction or not.

<table>
<thead>
<tr>
<th>PMTT Name</th>
<th>Can lead to achieve customer satisfaction</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
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<tr>
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<tr>
<td>Quality Checklist</td>
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<tr>
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<td>Risk Register</td>
<td>38</td>
<td>13</td>
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<tr>
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<td>37</td>
<td>13</td>
</tr>
<tr>
<td>Project Flowcharting</td>
<td>37</td>
<td>13</td>
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<tr>
<td>Performance Measurement Baseline</td>
<td>37</td>
<td>13</td>
</tr>
<tr>
<td>Work Breakdown Structure</td>
<td>38</td>
<td>19</td>
</tr>
<tr>
<td>Critical Path Method</td>
<td>38</td>
<td>16</td>
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<tr>
<td>Change Control System</td>
<td>37</td>
<td>15</td>
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<tr>
<td>Earned Value Technique</td>
<td>37</td>
<td>13</td>
</tr>
<tr>
<td>Claim Administration</td>
<td>36</td>
<td>18</td>
</tr>
<tr>
<td>Project Selection Methods</td>
<td>35</td>
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</table>
Table 6.33 shows that the P value associated with the statistical Pearson Chi-Square less than 0.05. Therefore, the null hypothesis has been rejected and the alternative hypothesis has been accepted for the 5% level of significance and that is project charter leads to achieve customer objectives.

### Table 6.33 Effect of PM tools on customer satisfaction

<table>
<thead>
<tr>
<th>PMTT Name</th>
<th>Value</th>
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<tbody>
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</tr>
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<td>Pearson Chi-Square</td>
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</tr>
<tr>
<td>N of Valid Cases</td>
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<td></td>
</tr>
<tr>
<td><strong>Activity List</strong></td>
<td>Pearson Chi-Square</td>
<td>48.194*</td>
<td>8</td>
</tr>
<tr>
<td>N of Valid Cases</td>
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</tr>
<tr>
<td><strong>Work Breakdown Structure</strong></td>
<td>Pearson Chi-Square</td>
<td>45.542*</td>
<td>8</td>
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<td>N of Valid Cases</td>
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</tr>
<tr>
<td><strong>Project Selection Methods</strong></td>
<td>Pearson Chi-Square</td>
<td>45.999*</td>
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<td>N of Valid Cases</td>
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<td></td>
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<tr>
<td><strong>Responsibility Assignment matrix</strong></td>
<td>Pearson Chi-Square</td>
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<td></td>
</tr>
<tr>
<td><strong>SWOT Analysis</strong></td>
<td>Pearson Chi-Square</td>
<td>37.061*</td>
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<tr>
<td>N of Valid Cases</td>
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**Table 6-33**

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<th>Total</th>
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<td>4</td>
<td>62</td>
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<tr>
<td>Responsibility Assignment matrix</td>
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<td>7</td>
<td>60</td>
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<td>Work Authorization System</td>
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<td>22</td>
<td>7</td>
<td>62</td>
</tr>
<tr>
<td>Stakeholder Register</td>
<td>32</td>
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<td>4</td>
<td>62</td>
</tr>
<tr>
<td>Lessons Learned Records</td>
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<td>24</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>Gantt Chart</td>
<td>30</td>
<td>18</td>
<td>13</td>
<td>61</td>
</tr>
<tr>
<td>SWOT Analysis</td>
<td>29</td>
<td>24</td>
<td>7</td>
<td>60</td>
</tr>
<tr>
<td>Fast Tracking Technique</td>
<td>28</td>
<td>26</td>
<td>8</td>
<td>62</td>
</tr>
</tbody>
</table>

---

Table shows the P value associated with the statistical Pearson Chi-Square less than 0.05. Therefore, the null hypothesis has been rejected and the alternative hypothesis has been accepted for the 5% level of significance and that is project charter leads to achieve customer objectives.
As Spearman correlation between using project management tools and techniques and achieving customer satisfaction under discussion is very high, it indicates that achieving customer satisfaction is highly depends on using project management tools and techniques as shown in table 6-34. For example, the value of Spearman correlation for using project charter is 0.815 that is near to 1 and the value of P associated with statistically Spearman Correlation is less than 0.05. That means there is strong positive correlation between using project charter and achieving customer satisfaction. Also, there is strong positive correlation between using critical path method and achieving

<table>
<thead>
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<th>Stakeholder Register</th>
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<th>N of Valid Cases</th>
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<tbody>
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<td>Claim Administration</td>
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<tr>
<td>Change Control System</td>
<td>44.151a</td>
<td>61</td>
</tr>
<tr>
<td>Project Statement of Work</td>
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<td>61</td>
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<tr>
<td>Fast Tracking Technique</td>
<td>34.414*</td>
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<td>Quality Checklist</td>
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</tr>
<tr>
<td>Work Authorization System</td>
<td>33.371*</td>
<td>62</td>
</tr>
<tr>
<td>Conflict Resolving Technique</td>
<td>35.338*</td>
<td>61</td>
</tr>
<tr>
<td>Earned Value Technique</td>
<td>35.086*</td>
<td>62</td>
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<tr>
<td>Performance Measurement Baseline</td>
<td>30.894*</td>
<td>60</td>
</tr>
<tr>
<td>Risk Register</td>
<td>31.763*</td>
<td>61</td>
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<tr>
<td>Lessons Learned Records</td>
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<td>60</td>
</tr>
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<td>Project Flowcharting</td>
<td>30.437*</td>
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<tr>
<td>Gantt Chart</td>
<td>35.234*</td>
<td>61</td>
</tr>
<tr>
<td>Project Management Information System</td>
<td>26.698*</td>
<td>60</td>
</tr>
<tr>
<td>Project Schedule</td>
<td>35.568*</td>
<td>61</td>
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</table>
customer satisfaction because the Spearman value is 0.791 that is fairly close to 1 and the value of P associated with it is less than 0.05.

Table 6.34 Customer satisfaction & PM tools correlation

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<tr>
<th>PMTT Name</th>
<th>PM Type</th>
<th>Value</th>
<th>Symp. Std. Error*</th>
<th>Approx. T*</th>
<th>Approx. Sig.</th>
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</thead>
<tbody>
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<td>Project Charter</td>
<td>Ordinal by Ordinal</td>
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<td>.044</td>
<td>10.892</td>
<td>.000³</td>
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<td>Critical Path Method</td>
<td>Ordinal by Ordinal</td>
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<td>.046</td>
<td>10.024</td>
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<tr>
<td>Activity List</td>
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<td>.055</td>
<td>9.903</td>
<td>.000³</td>
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<td>Ordinal by Ordinal</td>
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<td>.053</td>
<td>9.479</td>
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<td>.062</td>
<td>8.613</td>
<td>.000³</td>
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<td>.059</td>
<td>8.438</td>
<td>.000³</td>
</tr>
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<td>Ordinal by Ordinal</td>
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<td>.061</td>
<td>8.301</td>
<td>.000³</td>
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<tr>
<td>Stakeholder Register</td>
<td>Ordinal by Ordinal</td>
<td>.727</td>
<td>.068</td>
<td>8.203</td>
<td>.000³</td>
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<td>.058</td>
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<td>.000³</td>
</tr>
<tr>
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<td>7.734</td>
<td>.000³</td>
</tr>
<tr>
<td>Fast Tracking Technique</td>
<td>Ordinal by Ordinal</td>
<td>.698</td>
<td>.059</td>
<td>7.485</td>
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<td>.067</td>
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<td>.000³</td>
</tr>
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<td>Work Authorization System</td>
<td>Ordinal by Ordinal</td>
<td>.693</td>
<td>.067</td>
<td>7.439</td>
<td>.000³</td>
</tr>
</tbody>
</table>
The Project Management Tools and Techniques and Improving Project Performance Effectiveness Relationship

The impact of using project management tools and techniques on project effectiveness in terms of improving project performance effectiveness is shown in table 6-35 below. It shows that 81.97 percent of the respondents agreed that using project schedule significantly contributes to improve project performance effectiveness that was the highest rate of agreement between the project management tools and techniques, followed by activity list with ratio 75.81 percent, then project charter with ratio 74.19 percent. On the other hand, for project schedule, activity list, and project charter with ratios 11.4%, 17.74%, and 19.35% respectively did not. While 6.56%, 6.45%, and 13.33% did not know the impact of using the tools on project performance effects.
effectiveness.

<table>
<thead>
<tr>
<th>PMTT Name</th>
<th>Can lead to improve project performance effectiveness</th>
<th>Total</th>
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<td>75.81%</td>
<td>17.74%</td>
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<tr>
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<tr>
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<td>74.19%</td>
<td>19.35%</td>
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<td>13.33%</td>
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<td>19.35%</td>
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<td>19.67%</td>
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<td>17.74%</td>
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<td>26.67%</td>
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<td>62.30%</td>
<td>22.95%</td>
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<tr>
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<td>16</td>
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<td></td>
<td>61.29%</td>
<td>5.81%</td>
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Table 6-36 shows that the P value associated with the statistical Pearson Chi-Square less than 0.05. Therefore, the null hypothesis has been rejected and the alternative hypothesis has been accepted for the 5% level of significance and that is project charter leads to achieve customer objectives.

Table 6.36 Effect of using PM tools on project performance effectiveness

<table>
<thead>
<tr>
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<th>Value</th>
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<tr>
<td>N of Valid Cases</td>
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</table>
All project management tools and techniques shown in table 6-37 below are correlated positively with the project performance effectiveness such as project selection methods, project charter, project flowcharting, and stakeholder register with Spearman correlation value (0.763, 0.756, 0.733, and 0.727 respectively).

### Table 6.37 Project performance effectiveness & PM tools correlation

<table>
<thead>
<tr>
<th>PMTT Name</th>
<th>Value</th>
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<th>Approx. T</th>
<th>approx. Sig.</th>
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<td>Spearman Correlation</td>
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<td>.056</td>
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<td>Project Flowcharting</td>
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<td>Spearman Correlation</td>
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<td>.053</td>
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<tr>
<td>Stakeholder Register</td>
<td>Ordinal by Ordinal</td>
<td>Spearman Correlation</td>
<td>.727</td>
<td>.075</td>
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<tr>
<td>Title</td>
<td>Method</td>
<td>N of Valid Cases</td>
<td>Correlation Coefficient</td>
<td>Significance Level</td>
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<td>62</td>
<td>.699</td>
<td>.080</td>
</tr>
<tr>
<td>Critical Path Method</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.694</td>
<td>.078</td>
</tr>
<tr>
<td>Work Breakdown Structure</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.689</td>
<td>.083</td>
</tr>
<tr>
<td>Activity List</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.684</td>
<td>.060</td>
</tr>
<tr>
<td>Proposal Evaluation Techniques</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.680</td>
<td>.083</td>
</tr>
<tr>
<td>Earned Value Technique</td>
<td>Ordinal by Ordinal</td>
<td>60</td>
<td>.666</td>
<td>.099</td>
</tr>
<tr>
<td>Fast Tracking Technique</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.654</td>
<td>.072</td>
</tr>
<tr>
<td>Lessons Learned Records</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.626</td>
<td>.077</td>
</tr>
<tr>
<td>Quality Checklist</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.623</td>
<td>.085</td>
</tr>
<tr>
<td>Gantt Chart</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.614</td>
<td>.098</td>
</tr>
<tr>
<td>Change Control System</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.612</td>
<td>.087</td>
</tr>
<tr>
<td>Responsibility Assignment matrix</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.581</td>
<td>.092</td>
</tr>
<tr>
<td>Performance Measurement Baseline</td>
<td>Ordinal by Ordinal</td>
<td>60</td>
<td>.572</td>
<td>.080</td>
</tr>
<tr>
<td>Work Authorization System</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.568</td>
<td>.088</td>
</tr>
<tr>
<td>Project Management Information System</td>
<td>Ordinal by Ordinal</td>
<td>62</td>
<td>.503</td>
<td>.097</td>
</tr>
<tr>
<td>SWOT Analysis</td>
<td>Ordinal by Ordinal</td>
<td>60</td>
<td>.493</td>
<td>.109</td>
</tr>
</tbody>
</table>
Managerial Related Factors

Results from table 6-38 below indicated that managerial factors contributes to the project effectiveness measures: customer satisfaction and improving project performance effectiveness. They showed that always managerial skills of project manager positively impact the two project effectiveness measures. While Determine project’s objectives before starting the project factor has always positive impact on customer satisfaction. On the other hand, both ability to identify project’s objectives and availability of transparency in information exchanging among project team members factors have a positive impact on project performance effectiveness.

Table 6.38 Ranking managerial factors affecting project effectiveness

<table>
<thead>
<tr>
<th>Sorting No.</th>
<th>Statement</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>approval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Determine project’s objectives before starting the project helps to achieve the customer’s satisfaction.</td>
<td>60</td>
<td>1.55</td>
<td>.675</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>Ability to identify project’s objectives leads to good effectiveness of the project performance.</td>
<td>61</td>
<td>1.64</td>
<td>.708</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>Improving of project performance effectiveness is effected by managerial skills of project manager.</td>
<td>61</td>
<td>1.67</td>
<td>.724</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>Achieving of customer’s satisfaction depends on managerial skills of project manager.</td>
<td>61</td>
<td>1.70</td>
<td>.715</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>Availability of transparency in information exchanging among project team members improve project performance effectiveness</td>
<td>61</td>
<td>1.75</td>
<td>.809</td>
<td>Always</td>
</tr>
</tbody>
</table>

Table 6-39 below shows managerial factors often affecting project effectiveness measures. It shows that ability of top management to prioritize the priorities, top management support, and good knowledge in project management techniques factors all often impact positively on the two project
effectiveness dimensions while only availability of transparency in information exchanging among project team members often impact positively on customer satisfaction.

Table 6.39 Ranking managerial factors affecting project effectiveness

<table>
<thead>
<tr>
<th>Sorting No.</th>
<th>Statement</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ability of top management to determine the priorities improve project performance effectiveness</td>
<td>61</td>
<td>1.85</td>
<td>.749</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>Prioritization by top management leads to achieve customer satisfaction</td>
<td>61</td>
<td>1.90</td>
<td>.810</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>Availability of transparency in information exchange among project team members helps to achieve customer satisfaction.</td>
<td>61</td>
<td>1.90</td>
<td>.790</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>Top management support plays main role in improving project performance effectiveness</td>
<td>61</td>
<td>1.92</td>
<td>.918</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>Top management support plays main role in achieving customer satisfaction</td>
<td>61</td>
<td>1.95</td>
<td>1.040</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>Good knowledge in project management techniques improve project performance effectiveness.</td>
<td>60</td>
<td>2.02</td>
<td>.911</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>One of the reasons for achieving customer satisfaction is good knowledge in project management techniques.</td>
<td>60</td>
<td>2.10</td>
<td>.915</td>
<td>Often</td>
</tr>
</tbody>
</table>

**Environmental and Work Ethics Related Factors**

Results from table 6-40 below found that environmental and work ethics practice contributes to the project effectiveness measures: customer satisfaction and improving project performance effectiveness. They show that availability of trust among project team members and employees’ culture often positively impact project performance effectiveness. While the existence of financial corruption within the project often negatively impact the both project effectiveness measures. While only availability of trust among project team
members often positively impact customer satisfaction.

Table 6.40 Ranking environmental & work ethics affecting project effectiveness

<table>
<thead>
<tr>
<th>Sorting No.</th>
<th>Statement</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>approval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Availability of trust among project team members improves project</td>
<td>61</td>
<td>1.84</td>
<td>0.82</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>performance effectiveness.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The existence of financial corruption within the project impact on</td>
<td>61</td>
<td>1.84</td>
<td>0.898</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>project performance effectiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The existence of financial corruption within the project reduce from</td>
<td>61</td>
<td>1.89</td>
<td>0.95</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>achieving customer satisfaction.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Availability of trust among project team members leads to achieve</td>
<td>61</td>
<td>2.05</td>
<td>0.825</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>customer’s satisfaction.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improving project performance effectiveness depends on its employees’</td>
<td>61</td>
<td>2.57</td>
<td>0.846</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>culture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In table 6.41 below results found that social relations among the project team members and weather conditions sometimes affect both project effectiveness. While only project employees culture sometimes impact customer satisfaction.

Table 6.41 Ranking environmental & work ethics affecting project effectiveness

<table>
<thead>
<tr>
<th>Sorting No.</th>
<th>Statement</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>approval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Social relations among the project team members affect project</td>
<td>61</td>
<td>2.61</td>
<td>1.005</td>
<td>Sometimes</td>
</tr>
<tr>
<td></td>
<td>performance effectiveness.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weather conditions affect the project performance effectiveness.</td>
<td>61</td>
<td>2.79</td>
<td>0.878</td>
<td>Sometimes</td>
</tr>
<tr>
<td></td>
<td>Achieving customer’s satisfaction depends on project employees’ culture</td>
<td>61</td>
<td>2.85</td>
<td>1.062</td>
<td>Sometimes</td>
</tr>
<tr>
<td></td>
<td>Changing in weather conditions affect the</td>
<td>61</td>
<td>2.93</td>
<td>0.892</td>
<td>Sometimes</td>
</tr>
<tr>
<td></td>
<td>achievement of customer satisfaction.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social relations among the project team members affect the achievement of</td>
<td>61</td>
<td>2.98</td>
<td>1.133</td>
<td>Sometimes</td>
</tr>
<tr>
<td></td>
<td>customer satisfaction.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Factors Influencing the Achievement of Customer Satisfaction

This part presents the results of factor analysis of the eleven items of
factors that influence the achievement of customer objectives in construction projects and their ranking as a whole. These factors include project management tools and techniques factors, managerial factors, and environmental and work ethics practice factors.

According to table 6.42 below, determine the goals of the project before starting the implementation of the project was ranked as the first and the most important factor to achieve customer satisfaction in construction projects, followed by prioritizing the project priorities by top management as the second factor then the managerial capacity of project manager, top management support for the project, transparent exchange of information between the project team respectively. While the use of project management techniques was ranked as sixth factor. On the other hand, less important factors were the social environment of the project, weather condition, and the different cultures of the members of the project team respectively.

<table>
<thead>
<tr>
<th>Factor name</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine the goals of the project before starting the implementation</td>
<td>59</td>
<td>1</td>
<td>7</td>
<td>2.8305</td>
<td>1.9753</td>
</tr>
<tr>
<td>of the project</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prioritize the priorities by top management</td>
<td>59</td>
<td>1</td>
<td>11</td>
<td>3.5254</td>
<td>2.09561</td>
</tr>
<tr>
<td>The managerial capacity of project manager</td>
<td>59</td>
<td>1</td>
<td>8</td>
<td>3.678</td>
<td>1.86104</td>
</tr>
<tr>
<td>Top management support for the project</td>
<td>59</td>
<td>1</td>
<td>11</td>
<td>4.5593</td>
<td>2.84224</td>
</tr>
<tr>
<td>Transparent exchange of information between the project team</td>
<td>58</td>
<td>2</td>
<td>11</td>
<td>6.1207</td>
<td>2.36997</td>
</tr>
<tr>
<td>The use of project management techniques</td>
<td>59</td>
<td>1</td>
<td>11</td>
<td>6.4576</td>
<td>2.93799</td>
</tr>
<tr>
<td>Financial corruption within the project</td>
<td>59</td>
<td>1</td>
<td>11</td>
<td>6.7966</td>
<td>3.02734</td>
</tr>
<tr>
<td>Providing trust among the members of the project</td>
<td>59</td>
<td>2</td>
<td>10</td>
<td>7.1017</td>
<td>2.13101</td>
</tr>
<tr>
<td>The social environment of the project</td>
<td>59</td>
<td>2</td>
<td>11</td>
<td>7.6271</td>
<td>2.53865</td>
</tr>
<tr>
<td>Weather</td>
<td>59</td>
<td>1</td>
<td>11</td>
<td>8.0169</td>
<td>3.24033</td>
</tr>
<tr>
<td>The different cultures of the members of the project team</td>
<td>59</td>
<td>2</td>
<td>11</td>
<td>8.9492</td>
<td>2.14495</td>
</tr>
</tbody>
</table>

Factors Influencing the Improvement of Project Performance Effectiveness

This part presents the results of factor analysis of the eleven items of
factors that influence the improvement of project performance effectiveness in construction projects and their ranking as a whole. These factors are the same factors used to measure customer satisfactions. From the table 6.43 it was clear that determine the goals of the project before starting the implementation of the project ranked by the respondents as one of the most important factors that has an impact on project performance effectiveness in construction project.

The managerial capacity of project manager seem to be the second ranked factor that improve project performance effectiveness. While prioritize the priorities by top management and top management support for the project factors were ranked third and fourth respectively, the use of project management techniques was ranked fifth followed by the transparent exchange of information between the project team as the sixth ranked factor.

Table 6.43 Ranking of Factors influencing the improvement of project performance effectiveness

<table>
<thead>
<tr>
<th>Factor name</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine the goals of the project before starting the</td>
<td>57</td>
<td>1</td>
<td>7</td>
<td>3.0702</td>
<td>2.0776</td>
</tr>
<tr>
<td>implementation of the project</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The managerial capacity of project manager</td>
<td>58</td>
<td>1</td>
<td>8</td>
<td>3.4138</td>
<td>1.90138</td>
</tr>
<tr>
<td>Prioritize the priorities by top management</td>
<td>58</td>
<td>1</td>
<td>11</td>
<td>3.6897</td>
<td>2.14564</td>
</tr>
<tr>
<td>Top management support for the project</td>
<td>58</td>
<td>1</td>
<td>22</td>
<td>4.6034</td>
<td>3.46886</td>
</tr>
<tr>
<td>The use of project management techniques</td>
<td>58</td>
<td>1</td>
<td>11</td>
<td>6.1552</td>
<td>3.0825</td>
</tr>
<tr>
<td>Transparent exchange of information between the project team</td>
<td>58</td>
<td>1</td>
<td>21</td>
<td>6.6379</td>
<td>3.17721</td>
</tr>
<tr>
<td>Financial corruption within the project</td>
<td>58</td>
<td>1</td>
<td>11</td>
<td>6.7931</td>
<td>3.03638</td>
</tr>
<tr>
<td>Weather</td>
<td>58</td>
<td>1</td>
<td>11</td>
<td>8.1034</td>
<td>3.04175</td>
</tr>
<tr>
<td>Providing trust among the members of the project team</td>
<td>58</td>
<td>2</td>
<td>77</td>
<td>8.2759</td>
<td>9.44568</td>
</tr>
</tbody>
</table>
Study Hypotheses

Results from correlation analysis for hypothesis H₁

- (H₁): There is statistically significant correlation between project management application and project effectiveness.
  
a. The correlation between using project management tools and techniques and achieving customer satisfaction.

  Observation from table 6-34 showed that all project management tools and techniques used in the study had significant positive relationship with achieving customer satisfaction. For example, project charter had significant positive relationship with achieving customer satisfaction at 5% significance level and the relationship was positive (r = +0.815, p < 0.05) which support the first section of the first hypothesis of the study.

b. The correlation between using project management tools and techniques and improving project performance effectiveness.

  Observation from table 6-37 showed that all project management tools and techniques used had significant positive relationship with improving project performance effectiveness. For example, project selection methods at 5% significance level and the relationship was positive (r = +0.763, p < 0.05) which support the second section of the first hypothesis of the study.

Results from relationship analysis for hypothesis H₂

- (H₂): There is a relationship between managerial factors and project
effectiveness.

Observation from table 6-44 showed that managerial factors axis in this study had always significant positive impact on the two measures of project effectiveness that support the second hypothesis of the study.

<table>
<thead>
<tr>
<th>The study Axis Name</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project management application factors</td>
<td>61</td>
<td>1.8525</td>
<td>.80168</td>
<td>Often</td>
</tr>
<tr>
<td>Managerial factors</td>
<td>61</td>
<td>1.7939</td>
<td>.58165</td>
<td>Always</td>
</tr>
<tr>
<td>Environmental factors</td>
<td>61</td>
<td>1.8989</td>
<td>.75294</td>
<td>Often</td>
</tr>
<tr>
<td>Work ethics practice factors</td>
<td>61</td>
<td>1.8989</td>
<td>.75294</td>
<td>Often</td>
</tr>
</tbody>
</table>

**Results from relationship analysis for hypothesis H₃**

- (H₃): There is relationship between environmental factors and project effectiveness.

Referring to table 6-44above, the observations showed that environmental and work ethics practice axis had often impact on project effectiveness. Therefore, the third hypothesis of the study was supported.

**Results from relationship analysis for hypothesis H₄**

- (H₄): There is relationship between practices of work ethics factors and project effectiveness.

The table 6-44 showed that practices of work ethics factors had often impact on achieving customer satisfaction and improving project performance effectiveness where (p<0.05, level of significance of 5%) and the mean = 1.89, Std. D.= 0.752. Therefore, the practices of work ethics factors often affect the two dimensions of project effectiveness and the fourth hypothesis of the study was supported.
CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS
CHAPTER SEVEN CONCLUSIONS AND RECOMMENDATIONS

Introduction

Construction industries around the world and in particular those in Sudan suffer from poor performance, customer dissatisfactions and problems, in particular those associated with the construction project management process. There is therefore the need to ensure that the problems are eliminated or mitigated by effective use of project management tools and techniques in order for the projects to be successful and effective.

This study considered how application of project management methodology impacts project effectiveness measures, and clarified the current use of project management tools, techniques, based on the empirical study for construction organizations in private sector. Second, it also studied the project management environmental, managerial, and work ethics factors influence project effectiveness to know the situation of project management concept and the maturity of its practices in construction field in Sudan.

Two measures have been used to measure project effectiveness: achieving of customer satisfaction and improving of project performance. While the independent variables studied have been divided into three main groups: managerial factors, project management practices factors, and environmental and work ethics factors.

Conclusions

A number of conclusions have been obtained from this research with regard to the critical factors affecting the performance of construction projects and their customer satisfaction.

The survey results demonstrated that using project management tools and techniques factors have an impact on project effectiveness and can be as critical as the managerial, environmental and work ethics practice factors,
although the impact of these tools on the two dimensions of the project varies between them based on situation and process of the project and the purpose in which the tools are used for.

From this study, it may be concluded that the top five factors influencing project effectiveness of Sudanese construction projects from contractor point of view were: determine the goals of the project before starting the implementation of the project, determine the priorities by top management, project manager managerial skills, top management support for the project, the application of project management tools and techniques.

The statistical results demonstrated that determine the project objectives before executing the project is the first most important factor related to both project effectiveness dimensions. Also the results found that managerial skills of project manager was ranked as the second most important factor for improving project performance effectiveness. While prioritize the priorities by top management was ranked as the second most important factor for achieving customer satisfaction.

Regarding using project management tools and techniques, the findings showed that using project management tools and techniques is the fifth factor related to improving project performance effectiveness while it is the sixth for achieving customer satisfaction. Also, the results demonstrated that the transparency of information exchange between project team ranked the sixth factor leading to improve project performance effectiveness while it ranked the fifth factor leading to achieve customer satisfaction.

The surprised results were that the study found the difference in cultures of project team members was ranked as the last factor affecting both project effectiveness dimensions and regarding project social environment, it was ranked the tenth factor affecting project performance and the ninth for achieving customer satisfaction. This is contradicts with the research done by Belassi and Tukel (1996, pp.141-151) who pointed out that environmental factors are important and significant because their influence the project
success. In their study, they confirmed that environmental factors take the lead in construction projects.

Also one of the strange results that found is that the financial corruption related to internal environmental of the project was ranked as a seventh factor for both project effectiveness measures, which actually should be within the first 5 most important factors affecting project effectiveness measures. Also the findings showed that the trust between project team members is not important which was ranked the ninth for project performance dimension and eighth for achieving customer satisfaction dimension, which is also surprising results.

From the descriptive analysis, results showed that majority of respondents do not use specific project management methodologies (54.8%). The majority of those who use specific project management methodology were using the methodology related to Project Management Institute with ratio 27.4% that is Project Management Body of Knowledge (PMBOK).

Although 54.8% of respondents’ organizations do not have specific project management methodology, the study findings showed there are statistically significant correlations between the using of project management tools and techniques and different project effectiveness measures which is in line with the findings of Patanakul, and Milosevic, (2010, pp.44-64) stated that a project is likely to be effective if project management tools and techniques are used in a proper way, in the correct phases and process during project life cycle.

Based on the findings, the study interprets that its hypotheses H1, H2, H3, and H4 are rational and hence it substantiates them. It provided evidence about the importance of using project management methodology to manage the construction projects. Moreover, the study determined the most critical managerial and environmental factors influencing project effectiveness within
project management environment.

**General Recommendations**

After realizing the goals and objectives of the study, the study recommends the following general recommendations:

1. Project management methodology has become the standard way of doing things in today’s global and competitive world therefore educational institutions must set the agenda for project management training.
2. Contacting organizations need to increase the investment in time, money and resources to build organizational project management expertise and improve project management methodology maturity levels.
3. Increasing the practical experience in project management methodology and correlating it with the scientific experience.
4. There should be a consideration of all critical success factors correlated to project effectiveness to ensure that construction project effectiveness rate increases significantly.
5. Periodic workshops, seminars and conferences should be organized to exchange the lessons learned from completed projects and rotate the knowledge and experiences in project management field. In addition, train project managers and project team members with the right project management methodologies, knowledge, skills set and competence.
6. Lessons learned and records from completed projects should be well documented to build up the organization process assets to use it in future projects to increase effectiveness for future projects.
7. All contracting organizations should focus on customer satisfactions and think with win-win theory when executing their projects.
8. Adequate project management training should be given to employee in charge of projects, this would increase the knowledge of employees about different project management tools and techniques available for appropriate choice.
9. Selecting of project managers should be based on their qualifications and
experiences in project management.

10. Increasing trust amongst all project stakeholders.

11. Improving the transparency of information exchange amongst project team members.

12. In creating an effective methodology, it needs to be tailored to the specific environment and adaptable to the dynamic nature of projects and stakeholder demands. The methodology must be flexible, it should provide guidelines that leverage on both best practices and past experiences to ensure the project goals are achieved.

13. Providing all project management sources and references needed for further studies related to project management.

**Recommendations for construction sector**

Based on the findings and discussion of the study, the study revealed that the implementation of project management methodology in construction industry requires further attention. To address this issue, this study suggested the following recommendations:

1. Organizations should step up their commitment in applying project management tools and techniques in their projects and put more effort into application of them.

2. Organizations should establish a scientific and practical project management methodology for each project need to be managed, executed, and controlled before project starting, this includes selecting the suitable project management tools and techniques to manage their construction projects.

3. Contracting organizations in construction sector need to increase the project management concept awareness amongst their project managers, construction project managers, supervisors, and project engineers by training them in how to use project management tools and techniques in effective way and how to select the proper tools that match the
characteristics of project phases and which are significant contributors to project effectiveness measures.

4. Ensuring that the project has clear objectives before initiating it.

5. Establishing committee by Sudanese Contractors Association to assess the current situation of project management methodology in construction sector in private contacting organizations.

6. Construction organizations must actively work to shape mature project management practices and integrate it across all levels of the organization and align their project management strategies directly with their strategic business goals by creating formal project management offices PMO.

7. A project manager should be appointed early enough in the project life cycle to handle the management from inception to completion.

8. Enhancing free and open communication process and sharing all project data between project team members. This transparency in information gives executives a high-level view of project status and helps the senior management team and project management team members to meet all project stakeholder satisfaction and achieve project success.

**Recommendations for further researches**

This study emphasized the importance of understanding of using project management tools and techniques and knew their ranking among managerial, project environmental, and work ethics practice factors. It hopes to improve project performance, increase customer satisfaction, and facilitate the effective use of project management techniques by project team in construction field.

The study opens opportunities for further research. First, expanding the study model to cover factors that were not discussed within model and studying the impact of using project management methodology on other
project effectiveness measures such as safety and quality. Also, exploring the extent to establishing a common list of project management tools and techniques. Identifying and analyzing the level of awareness for project management methodology application in current use in other fields and other situational factors instead of construction sector such as information technology and manufacturing sector. Also further studies could be conducted for public sector instead of private sector with other perspectives such as consultant or client. Also similar study can be performed in other countries instated of Sudan.

Finally, more research is needed to fully understand the project management practices, processes and their significance and importance for managing construction project more thoroughly to achieve a true project-driven organization environment in the business world.
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APPENDICES

Appendix A: Study theoretical framework
Appendix B: Study questionnaire in Arabic language
Appendix C: Study questionnaire in English language
Appendix D: Study Interview
Appendix A: Study theoretical framework

By: Mohammed Abbas

FRAMEWORK ILLUSTRATES THE RELATIONSHIP BETWEEN PROJECT MANAGEMENT APPLICATIONS, MANAGERIAL, ENVIRONMENTAL, AND CODE OF WORK ETHICS FACTORS AND PROJECT EFFECTIVENESS

Managerial factors
- Top Management Support
- Managerial skills of project manager
- Knowledge in project management practices
- Project objectives definition
- Setting priorities by top management
- Transparency in communication between project team

Project Management Practices & Tools Factors
- Project initiating tools
- Project planning tools
- Project executing tools
- Project controlling tools
- Project closing tools

Ethics of work & Environmental Factors
- Social relationships between project team
- Project team Cultural background
- Weather
- Trust between Project Team
- Financial Corruption in Project

Overall project (Effectiveness)
1. Achievement of customer’s satisfaction.
2. Improvement of project performance effectiveness.
Appendix B: Study questionnaire in Arabic language

جامعة السودان للعلوم والتكنولوجيا
كلية الدراسات العليا والبحث العلمي
كلية الدراسات التجارية
دكتوراه إداره أعمال

استبيان عن استخدام منهجية إداره المشاريع واثراكها على فاعليه المشاريع الهندسيه بالتركيز
علي شركات الإنشاءات بالقطاع الخاص بولاية الخرطوم

السيد / المحرر

السلام عليكم ورحمه الله تعالى وبياته

وبعد

إشارة إلى الموضوع أعلاه فإني أقوم بدراسة تحليلية ليل درجه الدكتوراه في إداره
الأعمال والتي تتطلب عمل مسح ميداني واستبان لمعرفه وواقع استخدام منهجيه إداره المشاريع
واثراكها على أداء المشاريع الهندسيه بالسودان بالتركيز على الشركتات العامة في القطاع
الإنشاءات بالقطاع الخاص بولاية الخرطوم. إذا أرجو تعاقتكم معي لإكمال هذا البحث والتكريم
بالرد على جميع الأسئلة الواردة في هذه الاستبانه بمصداقية ودقة كاملتين بالوصول إلى
نتائج تسهم في تزويد المهتمين والباحثين في هذا المجال بمعلومات وبيانات في المستقبل
تساعد في تطوير واعدء صوره أوضح عناستخدام منهجية إداره المشاريع بالسودان.

ملاحظة

تستخدم هذه البيانات لأغراض الدراسة فقط وتعتبر صحة النتائج على مدى تعاقتكم التام على
الإجابه على جميع الأسئلة بمصداقية تامه ، ونحن نثق بكل إجاباتكم التي ستظل في غاية
السرية التامه وسوف نستخدم لأغراض هذا البحث فقط.

لكل مني فائق التقدير والاحترام

الباحث/ محمد عباس موسى

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