# A FRAMEWORK TO ASSESS POST-CONFLICT ENVIRONMENT IMPACT ON CONSTRUCTION ORGANIZATION PERFORMANCE

by

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*Dedicated to my family for their endless love and unconditional support. I want to thank my family for staying patient, without their sacrifices these two years of studying abroad would not be possible.*

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| | |
|---|---|
| AHP | Analytical Hierarchy Process |
| AISA | Afghanistan Investment Support Agency |
| APV | Average Percent of Validity |
| API | Average Percent of Invalidity |
| BSC | Balanced Scorecard |
| CI | Consistency Index |
| CR | Consistency Ratio |
| CSFs | Critical Success Factors |
| DETR | Department of the Environment, Transport, and the Regions |
| EFQM | European Foundation for Quality Management |
| KPIs | Key Performance Indicators |
| MLR | Multiple Linear Regression |
| NTP | Notice to proceed |
| PMS | Performance Measurement System |
| SWOT | Strength, Weaknesses, Opportunities, and Threat |

# ABSTRACT

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In the field of the construction industry, the research work has been widely focused on identifying key performance indicators and critical success factors without assessing the impact of conflict environment factors. This study focusses on the impact of post-conflict environment factors on local construction organization performance. This research presents a performance prediction model comprising the effect of post-conflict environment factors on construction organization performance. The proposed framework of this study has four stages: identify key performance indicators (KPIs), identify post-conflict environment impacting factors, determine critical success factors (CSFs), and formulate success strategy to improve performance. Analytical hierarchy process (AHP) and multiple linear regression (MLR) techniques are applied to analyze the data.

The study finding indicates that there is a significant relationship between the post-conflict condition impacting factors and local construction organization performance, which is insufficiently studied in previous research work. Thus, the developed framework will benefit academic scholars and industry practitioners to analyze and evaluate challenges and opportunities caused by different external environment conditions in the post-conflict construction industry.

# CHAPTER 1. INTRODUCTION

This chapter presents an overview of the research topic comprising the basic concepts of this study. This chapter includes the scope of the study, the significance of the research topic, terms definitions, and the study assumptions, limitations, and delimitations.

## 1.1 Problem Statement

The construction industry is shaped by the influence of various external environmental factors, and these factors are impacting construction organization performance in different forms. Notably, the post-conflict environment has a more significant impact on organizational performance because of its dynamism, uncertainties, and high dependency on international support where local resources are linked. In the field of construction management, researcher widely focused on identifying Key performance indicators and critical success factors to improve organizational performance without assessing the impact of post-conflict environment factors. Thus, the purpose of this study is to determine the effects of post-conflict condition impacting factors on local construction organization performance. This study presents a framework of how to improve local construction organization performance in a post-conflict condition. The proposed framework contains four stages: (1) identify key performance indicators (KPIs); (2) identify post-conflict condition impacting factors; (3) determine critical success factors (CSFs); and (4) formulate success strategy to improve organizational performance.

## 1.2 Research Question and Hypothesis

The research problem is defined from an extensive literature review, and it is stated in the form of the research question and hypothesis.

Q: What factors of the post-conflict environment are impacting local construction organization performance in Afghanistan?

$H_1$: The local construction organization performance in a post-conflict condition is significantly associated with the external environmental munificence, complexity, and dynamism.

$H_0$: There is no significant association between the local construction organization performance and the post-conflict environment munificence, complexity, and dynamism.

## 1.3 Scope

Construction organization profit and success are based on the impact of many factors. Identifying and determining these critical impacting factors help organizations to concentrate on the areas of performance that needs improvement (Elwakil et al., 2009). Therefore, the objective of this study is to develop a framework to improve construction organization performance and identify critical success factors (CSFs) considering the impact of the post-conflict environment on organization performance. Analytical hierarchy process (AHP) and multiple linear regression (MLR) modeling technic are applied to analyze quantitative and qualitative variables obtained from the literature and expert experiences. The survey questionnaire research method is used to collect the data for this study. The research data stets have been received from Afghan local construction companies initiated in 2001 to 2016, and headquartered in the five big cities, Kabul, Kandahar, Jalal-Abad, Herat, and Balkh province of Afghanistan. The developed framework will

benefit the academic researchers and industry practitioners to analyze and evaluate challenges and opportunities caused by different external environmental conditions in the post-conflict construction industry.

## 1.4 Significance

Construction organization performance assessment and performance benchmarking have received significant attention in recent years to meet the construction industry challenges and competency. Many researchers have developed performance prediction models and methodologies to help construction organization to achieve profit and success in the market. For instance, Abraham (2003), Elwakil et al. (2009), Horta et al. (2009), Inayat et al. (2013), and Elwakil (2017), have identified CSFs and developed performance improvement models for construction organizations. However, most of these developed performance improvement models and methodologies overlooked the impact of the external environment on organizational performance notably the impact of the post-conflict situation. Thus, this study presents a framework assessing the effect of the external environment of post-conflict condition on local construction organization performance. The purpose of this framework is to improve construction organization performance in a post-conflict situation. The proposed framework and the developed model will help academic scholars and industry practitioners to determine the post-conflict environment CSFs to formulate a competitive strategy based on the model to overcome post-conflict environment challenges and constraints.

## 1.5 Definitions

*Organization*: The best definition of an organization from its business perspective is "a company or a group of people that work together for a particular purpose." and, in a general term, the definition is "a group whose members work together for a shared purpose in a continuing way" (Cambridge dictionary, 2018).

*Performance*: The performance is best defined as " how successful an investment, company, etc. is and how much profit it makes" (Cambridge dictionary, 2018).

*Critical Success Factors*: Rockart (1979, p.85) defines the critical success factors (CSFs) as "the critical success factors are areas of performance that should receive constant and careful attention from management."

*Key Performance Indicators*: Key performance indicators (KPIs) are compilations of data measures used to assess the performance of a construction operation (Cox, Issa & Ahrens, 2003, p.142).

*External Environment*: The external environment is best defined as "*the conditions and events outside a company that affects the way it operates*" (Cambridge dictionary, 2018).

*Post-Conflict Environment*: Post-conflict countries are those that have suffered from the civil war or other internal conflicts which must embark for reconstruction and economic recovery, and on social and political reforms to provide the foundation for peace and democracy (Del Castillo; 2001, p.1969). The characteristics of the post-conflict environment are the

political and security instability, poor infrastructure, high inflation, weak financial system, small abnormal industry sector, undermined institutions, and as well as the financial support from donors (Haughton, 1998 p.30).

*Performance Measures*: Neely et al. (2005, p.1229) best define performance measurement as "the process of quantification of the efficiency and the effectiveness of action." Moreover, Neely et al. (2005) define a performance measure as "the matric used to quantify the efficiency and effectiveness of action." The terms effectiveness and efficiency are different in meaning, and the definition of these two terms are: the effectiveness means meeting the customer defined requirements, and efficiency means cost-effective resource utilization (Neely et al., 2005).

*Organization Performance*: The organization performance has been best defined as the degree to which a firm or a company achieve its objective (Elenkov, 2002; Lee et al., 2003).

From the presented definitions of terms, the organizational performance definition is synthesized as the level of achievement of the objective of an organization through the association of productive assets, including humans, physical and capital resources.

## 1.6 Assumptions

The following assumptions establish the basis of this study:

- The participants of this survey are experts within the post-conflict construction industry, and the provided answers are based on their knowledge and experiences within that industry.

- The selected sample and the received responses sample are large enough that represent post-conflict construction industry in Afghanistan.
- There are no significant differences in the responses of participants according to their organization type, size, structure, and the participant functional role.
- The participants understand the survey questions and the meaning of utilized scales.
- The provided answers are from the respective surveyed companies are based on their experiences and records.

## 1.7 Limitations

The limitations of this study are:

- The study does not count the differentiation between the organizations' type, structure and participant functional role. However, the perception of the survey questions may differ according to the organization type, structure, size and participant functional role.
- Lack of recorded data of local construction organization performance and insecurity in the target location resulted in obtaining the data only from the organizations that are headquartered in big cities.
- Lack of access to the organization financial performance data such as profitability, return on investment, sales growth, earning per share instead focussing on alternative measures that represent organization financial and non-financial performance.

## 1.8 Delimitations

This study delimitation acknowledgment is as follows:

- Because of the time limitation for this study, This study only includes the local construction companies registered with the Afghanistan investment support agency

(AISA) from 2001 to 2016. International construction companies and unregistered local construction firms are excluded from this study.

- From a comprehensive literature review and construction industry expert opinions, post-conflict environment impacting factors are generalized into twenty-nine potential impacting factors.
- From an extensive literature review and construction industry expert opinions, construction organization performance is modeled and examined through five performance measures of the identified KPIs.
- Based on the expert opinions and previous studies, Survey questionnaire method is selected as the research tool to collect the data, and Likert scale is utilized for this study to determine the impact of post-conflict environment on organization performance examining quantitative and qualitative variables.

## 1.9 Summary

This chapter identified the basic concepts of this study to describe the research topic. The content of this chapter includes a brief description of the study objective and its context. In addition, it provides definitions of the essential terms of this study.

# CHAPTER 2. REVIEW OF THE RELEVANT LITERATURE

This chapter presents a review of the relevant literature to define and clarify the research problem, and summarize what has been done in the area of the subject of interest to identify the existing gap in the literature. Also, this chapter reviews scientific approaches of research which is appropriate to the proposed of this study.

## 2.1 Introduction

The construction industry is shaped by the influence of various external environmental factors, and these factors affect organization performance in different forms. Notably, the post-conflict environment has a more significant impact on organizational performance because of its dynamism, uncertainties, and high dependency on international support. In the field of construction management, the research work has been widely focused on identifying key performance indicators (KPIs) and critical success factors (CSFs) without assessing the impact of conflict environment factors. Thus, this literature review investigated the literature about the available approaches and methods of modeling and measuring the effect of external environment post-conflict condition on organization performance.

## 2.2 Previous Studies of External Environment Impact on Organization Performance

Environmental uncertainty and constraints have the potential to affect any organization performance (Grewal& Tansuhaj, 2001; Murgor, 2014). The external environment provides the organizations with the inputs, which influence the internal process of an organization, and these external impacting factors are not in direct control of the organization management team (Farmer& Richman 1964). The external environment is a source of constraints, opportunities, uncertainties,

and a problem, which affect the organization performance concerning its business form at the environment (Khandwalla, 1977; Bourgeois, 1980). External environment can be best defined as" *the conditions and events outside a company that affects the way its operations*" (Cambridge Business dictionary, 2018). External environment constraints, opportunities, and uncertainties are the central concepts of organization relationship to its environment. The external environment affecting forces has an essential influence on organization structure and productivity (Osborn & Hunt, 1974).

The external environment influence and impact on organization structure, size, and performance have been the focus of organization management literature for a long time. Romanelli and Tushman (1986) examined the impact of the external environment and the influence of company execution team on the organization operation and evolution over time. They have identified three simple organization evolution models. First the strategic management model: in this model, the senior management team is choosing the domain and patterns of competitive activities. Second, an inertial model suggests that the external environment determines the size and structure of an organization in the early stage of initiating it and that later poses constraints on the organization future evolution. Third, an external control model which propose that changes in the external environment result in changes in the organization activities and structure. In all these three models, the external environment has a crucial role since changes in the external environment deriving changes in the organization activities, structure, and performance. For that reason, organization operations and performance are profoundly impacted by these external environmental factors.

Moreover, Milliken (1987) has studied the implication of external environment uncertainty on the organization management team behavior. External environment uncertainty is a

fundamental problem for an organization that the management team must deal with (Thompson, 1967, p. 159).

Milliken (1987) identified three types of environmental (state, effect, and response) uncertainties that can affect organizational behavior. First, the state of environmental uncertainty is described as an inability of the management team to predict how components of the external environment will change where the organization operates. The state of environmental uncertainty is a function of environmental complexity, volatility, and heterogeneity. The more volatile, complex, and heterogeneous environment components are less predictable to know what impact it will have on the organization performance (Milliken, 1987). Second, the effect of environmental uncertainty is defined as the inability of the management team in predicting the impact of uncertainty on the organizational behavior, and third, the response of environmental uncertainty is explained as the inability of the management team to know what the response to the environmental uncertainty impact would be. Thus, the Milliken (1987) study described the external environment impact on the organization regarding its uncertainty which impacts and influences organization top management team behavior and prediction.

In addition to that, Dess and Beard (1984) have studied organization and external environment relationship to examine the directness of interaction between the organization and the elements of its environment through the resource's transaction. The study argued that many external environment variables are impacting organizational operations and these variables can be generalized under three dimensions: dynamism, munificence, and complexity. Dess and Beard (1984) define the concept of munificence as the availability of resources in the environment for organization growth. The concept of dynamism is defined as the volatility of the environment, which results in an inability to predict stability and instability of the industry; the term complexity

is described as the consideration of homogeneity and heterogeneity of external environment elements, which affect the organization. Dess and Beard (1984) suggest that these three identified external environment dimensions dynamism, munificence, and complexity are viable operational factors of organization task environment that can be applied to characterize the organization external environment.

However, Keats and Hitt (1988) have criticized past research work that many researchers have studied external environment related to the organization structure, size, behavior, and performance in segregated form, just a few have examined the linkage between these variables in integration and a systematic manner. Keats and Hitt (1988) studied the organization environmental dimensions, organization structure, firm size and diversification strategy associated with the organization performance outcome. Keats and Hitt (1988) study findings suggest that external environment dimensions such as complexity, dynamism, and munificence have a critical impact on organization performance. Therefore, this can be concluded from the organization management and strategic management literature that the external environment has a vital effect on the organization structure, size, behavior, and performance.

These impacting variables vary in different environments and have a disparate impact on organizations. The exclusiveness of the construction industry and its more significant exposure to the external environment than other types of sectors make this affect more crucial (Yates, 2014). The available construction project work in any construction sector is affected by environmental factors such as government legislation, natural disaster, change in demand, economic fluctuations, materials cost and availability of materials, skilled workforce, interest rate, and industries supported by the construction industry (Yates, 2014, p.33).

The characteristics that segregate the construction industry from the manufacturing industry are that the construction project work must be performed wherever the project site is located, project designs are mostly unique, and the construction project is completed rapidly using sequenced activity where project delays causing additional cost. In addition, many projects are in remote areas, and these projects involve large assemblies which require specific technology and safety measures (Yates, 2014, p.31-32). Thus, from these differences and external environment impacting factors on organization output and structure, it can be concluded that the construction organization performance is an ultimate depending variable in different environmental situations. Moreover, this requires much attention from the academic scholars and the industry practitioners to consider all impacting environmental factors very cautiously while identifying and determining critical success factors and organization success strategy.

## 2.3 Performance Improvement Framework and Methodology

Construction organization performance assessment and measurement have received significant attention in the past two decades to meet the construction industry challenges and competency. Many researchers have developed performance prediction models and methodologies to help construction organization to achieve profit and success in the market. For instance: Abraham (2003) has studied top 400 U.S. companies to identify the critical success factors methodology to enhance construction organization success, Chan and Chan (2004) have studied construction companies in Hong-Kong to develop a set of key performance indicators for the construction industry success. Moreover, Luu et al. (2008) have developed a model using balanced scorecard (BSC) and strength, weaknesses, opportunities, and threat (SWOT) matrix to measure construction organization performance in a developing country. Likewise, Horta, Camanho and Da Costa (2009) have studied Portuguese companies to develop a framework of how to assess

construction organization performance, and Elwakil et al. (2009) have determined 18 critical success factors (CSFs) for the organization performance assessment in industrialized and developing countries such as the USA, Canada, and Egypt. In addition, recent researchers have continued applying critical success factors approach to identify performance improvement strategy. Inayat et al. (2013) have determined different critical success factors for different types of construction organization based on their organizational background in developed and developing countries such as the USA, Canda, UK, UAE, Sudi Arabia, and Elwakil (2017) has developed performance improvement models considering the management team functional role while identifying organization critical success factors.

However, questions can be probed that are these performance improvement frameworks and critical success factors identified in a non-conflict environment are applicable to a different environment? Likewise, are these developed strategies, and identified factors have the same essentiality in another environment on the organizational performance, for instance, what would be the impact of these developed success strategies on organizations performance in a post-conflict environment?

The post-conflict country environment is significantly different from developed countries or developing countries environment. However, many researchers have studied and modeled construction organization performance in developed countries or developing countries and determined different success strategies and frameworks in that environment considering the impact of the non-conflict environment factors on organizational performance. Insufficient research has been done to study the construction organization performance in a post-conflict situation. Therefore, this is important to know what impact a post-conflict condition has on the construction organization and its performance.

## 2.4 Post-Conflict Environment

Post-conflict countries are those that have suffered from the civil war or other internal conflicts which must embark for reconstruction and economic recovery, and on social and political reforms to establish the foundation for peace and democracy (Del Castillo, 2001). Post-conflict countries are different in terms of their needs and challenges. However, there are some unique challenges to all post-conflict countries, such as weak political and legal system, inadequate workforce, need for international organizations support in the form of financial aid and reconstruction of the institutions, need for the United Nation involvement in peace restoration and reconciliation process (Del Castillo, 2001).

In addition to the political and security instability, there are ubiquitous features of the post-conflict environment economies which differentiates it from the non-conflict environment. For example, some of the post-conflict environment features are as poor infrastructure, high inflation, weak financial system, small abnormal industry sector, undermined institutions, and on the other hand, there are financial aids to help the post-conflict country reconstruction and the diaspora technical support and investment for the country development (Haughton, 1998; World Bank, 2009). Subsequently, there is a high level of uncertainty, various constraints, and some unstable opportunities in the post-conflict environment (Haughton, 1998; World Bank, 2009). Political and economic instability, a weak judicial and legal system, unclear tax regulation, lack of access to finance, unequal access to land and capital, inadequately skilled workforce, and poor infrastructure are the elements which impact international and local firms' activities and management team decision-making process (World Bank, 2005). All these features and aspects are resulting in numerous critical factors that impact organizational performance. It also makes the organizational management team perceive performance indicator differently in such an environment than the non-

conflict environment. The World Bank report (2005) describes local firms in a post-conflict situation that are lacking management strategy, lack of technical capability with the unskilled workforce, and access to small capital for investment.

On the other hand, there is inadequate research has been done on how to improve local organization performance and formulate competent strategy specifically the lack of research is more apparent about the construction industry in a post-conflict environment than other types of industries. Hence, there is an essential need to develop a framework to determine the impact of a post-conflict environment on the construction organization performance to improve organizations profitability and viability in the market.

According to the World Bank surveys which were conducted in 2005 and 2008 in Afghanistan to evaluate the investment environment for construction and non-construction firms (manufacturing and retail), the survey finding revealed that in overall eighteen constraints have a significant impact on the organizational performance. Afghanistan is one of the post-conflicts and severely war-torn countries in the world (Haughton, 1998; World Bank, 2009). The world bank finding summarized impacting factors (constraints) as government policy enforcement, electricity, crime, theft, and disorder, corruption, access to land, access to finance, telecommunications, tax rates, transport, business licensing and permits, practices of competition in the informal sector, inadequately skilled workforce, courts, tax administration, labor regulations, anticompetitive behavior, limited access to skilled labor (World Bank, 2005; World Bank, 2009).

However, besides these constraints, the report states that there were investing and business growth opportunities, support from the donors, multilateral institutions of financial aid, educated diaspora pool for the country development, market entering easy criteria (Haughton, 1998; World Bank, 2005). Meanwhile, it is also worth to mention that post-conflict countries experienced a

short period of construction industry boom and then a drop-down in the spending after the initial growth of the expenditure in construction projects which changes the business opportunities for construction firms after a while (World Bank, 2005).

## 2.5 Critical Success Factors

From the organization management literature, the organization top management team and executives regularly examined various approaches to attain organizational goals and success. These approaches are centered on the need for information to determine what necessary actions are required and on how to respond to the arisen problems to accomplish organizational goals. Rockart, (1979) generalized some of the executives approaches of the required information to achieve organizational objectives and goals in four primary methods: (1) the Byproduct technique, (2) the Null technique, (3) Total study method, and (4) the Critical indicator system. First, the byproduct technic provides entire operational system process reports and paperwork to the executives. The byproduct technic is heavily focused on the day-to-day information delivery to the executives that are not indeed needed to them. Second, the null approach is more relied on providing dynamic information and oral communication to the organization executive to take the required action and provide responses to the arisen problems. The third approach is the key indicator system which comprising three steps: (1) identifying the performance indicators, (2) reporting those indicators to the managers where a significant difference exists between planned and current performance area of improvement, and (3) simplifying indicators visualization and presentation for better implementation. This technic is more focused on the organization financial performance improvement. The fourth approach is the Total study process method. In this method, the existing information system is compared to the managers total information need. The purpose

is to find a gap between the system in place and needed information for the organization to achieve its objectives.

In addition to the techniques above, for the first time, Rockart (1979) introduced the critical success factors approach to gauge the organization performance to help the organization to improve organization performance and to achieve success. The CSFs approach is implemented in three steps, (1) identify factors that underlie the organization objectives and goals, (2) to determine significant impacting factors, and (3) to get the agreement and summaries the CSFs that are affecting organization performance. This method is widely utilized in recent decades to improve organization profit, and success compares to other traditional approach. For instance, Elwakil et al., (2009) described the CSFs method an essential strategy that helps organizations to concentrate on the areas of performance that needs improvement. For that reason, to achieve long-term success, organizations must understand critical success factors and their impact on the different divisions of an organization (Kaplan & Norton 1995). Rockart, (1979) defines the critical success factors (CSFs) as "*the critical success factors are areas of performance that should receive constant and careful attention from management*." CSFs are applicable to any organization operating in an industry, and there are four primary sources of the critical success factors CSF (Rockart, 1979): (1) structure-based organization characteristics, (2) the competitive strategy of an organization, (3) the effect of environmental factors, (4) temporal elements according to the organizational priorities. The external environment is one of these four prime CSFs sources, and it has a significant impact on the organization when economy fluctuates, and political factors change (Rockart, 1979). Therefore, the effect of critical success factors on the organization performance in an environment with political and economic factors instability such as the post-conflict condition needs careful

monitoring since there is a high level of uncertainties, various constraints, and some unstable opportunities exist within that environment (Haughton, 1998).

From a comprehensive literature review, post-conflict environment impacting factors are shortlisted and presented in chapter 3 to improve construction organization profitability and achieve success in a post-conflict situation, it is crucial to consider the effect of post-conflict condition on organization performance.

## 2.6 Performance Measurement System and Key Performance Indicators

The traditional project and organization performance success approach in construction industry emphasized more on the success and profit of the construction project. Companies with the track record of project completion within the predicted time and predicted budget, as well as within the desired quality had been considered successful which often leads to less attention to the organization future success and growth (Abraham, 2003).

Organization performance is the ultimate variable of interest in management (Richard, Devinney, Yip & Johnson, 2009). Several studies have been conducted on the organization performance measurement, for instance, Venkatraman, and Ramanujam (1986), Neely et al. (1995), Richard et al. (2009), and Ali et al. (2013) have studied organization performance measurement methods. Organization performance is dependent on the quantification of different measures relevant to different types of industry and disciplines which means various measure should be quantified to answer research questions appropriate to the specific field of study (Hofer, 1983). Venkatraman et al. (1986) developed a two-dimensional organizational performance measurement system. The designed system provides ten approaches of organization performance measurement, considering the financial and non-financial measures on the first dimension, and primary and

secondary data sources on the second dimension of the measurement system. In this study, the domain of the organization performance is described in three layers. The first circumscribe of domain focus on financial performance such as profitability, return on investment, sales growth, earning per share, which reflects the achievement of the financial goal. The second circumscription of performance domain is concentrating on the organization long-term growth and success, and third, in addition to the financial performance indicators, it measures nonfinancial performance such as new product introduction, product quality, and marketing effectiveness.

Measuring financial and critical nonfinancial indicators of an organization determines business long-term success and profit in the market (Venkatraman et al., 1986). The organization effectiveness is a broader domain of organization performance, and that can be determined through the quantification of the critical financial and critical nonfinancial performance measures (Venkatraman et al., 1986). Therefore, organization profit and success are essential indicators of organization performance effectiveness.

Furthermore, for continuous organizational effectiveness improvement and achievement of the desired efficiency, there is a need for an integrated performance measurement system and the requirement for establishing a baseline to measure organization performance continuously against it. The past two decades witnessed the advent of many performance measures with integrated practical and methodological development (Richard et al., 2009). Performance measurement and benchmarking of performance are significant elements for the organizational effectiveness improvement and achieving efficiency in construction management. Neely, Gregory, and Platts (1995) described performance measurement as the process of quantifying an action where measurement is the procedure of quantification and the action results in performance. From the marketing perspective, performance measurement is achieving the goal of what an organization

performs through satisfying their costumer with greater effectiveness and efficiency than their competitive (Kotler, 1984). Neely et al. (1995) best define performance measurement as "*the process of quantification of the efficiency and the effectiveness of action*." and define a performance measure as "*the metric used to quantify the efficiency and effectiveness of action*." The terms effectiveness and efficiency best defined as; the effectiveness means meeting the customer defined requirement, and efficiency means cost-effective resource utilization.

To measure organization performance, we need to have metrics to quantify the efficiency and effectiveness of actions happening within the organization. The set of parameters used to quantify efficiency and effectiveness is a performance measurement system. From the literature, the examination of the performance measurement system taking place within three levels. (1) The individual performance measure for quantification of action; (2) the set of performance measures to quantify action; (3) the relationship between the performance measurement system and its operational environment to determine the correlation between operational environment and measures to assess whether the measure reinforces the firm strategy or whether the measure matches the organization culture (Richard et al., 2009). The literature on performance measure is diverse, and it depends on the industry focus and author goal (Kotler, 1984).

The traditional approach to organizational performance measurement heavily focused on financial measures to assess organizational performance. For instance, the return on investment, return on assets, and earnings per share to evaluate organization financial success and failure (Brignall and Ballantine, 1996). Financial measures help the organization to increase short-term profit in the cost of the product, staff training, and development but it can adversely impact organization long-term effectiveness since financial measures provide limited direction for future success. Instead, these measures focused on cost reduction (Langfield-Smith et al., 2012).

Therefore, to achieve profit and long-term success, many researchers suggest the organization must use performance measurement system, which comprises of financial and non-financial measures (Richard et al., 2009).

According to Kaplan and Norton (1992), a mixed financial and non-financial performance measures enable an organization to assess its performance from multiple dimension that is the most appropriate approach to achieve organizational effectiveness. Different performance measurement models are developed by encompassing financial and non-financial measures. These models differ from each other according to their complexity, focus, and components of performance measures. Kaplan and Norton (1996) developed the Balanced Scorecard model (BSC) to measure organization performance; the model assesses the organizational performance from four perspectives, (1) financial, (2) customer, (3) learning & growth and (4) internal processes. This model is simple and easy to use and assess organizational performance. Another model is the Malcolm Baldrige model, which is developed to offer an excellent quality standard and to help the organization to achieve a high level of performance (Garvin, 1991).

European foundation for quality management (EFQM) is one of the complete models, which have been designed to help the organization to achieve its continuing goals and success through identified key performance indicators (KPIs). The EFQM Model is a framework for attaining good results. The model is formed from three components, (1) the concept of excellence model, (2) the model criteria's, and (3) the RADAR logic process improvements which is a dynamic assessment framework and a management tool that provides a structured approach to questioning the performance of an organization. The EFQM model has five enablers' that any organization should consider it to formulate a competitive strategy and achieve success. The enablers are (1) leadership, (2) strategy, (3) people, (4) partnership & resources, process, and (5)

product & services (Ivanov & Avasilcăi, 2014). The EFQM model result is presented in four areas customer result, people result, society result, and the business result (Ivanov & Avasilcăi, 2014). The selection of that which performance framework or model is more suitable for the organization performance measurement to achieve success depends on what critical success factors and potential performance indicators are the focus of the organization and to what extent organizational performance should be scrutinized.

Key Performance Indicators KPIs enable measurement of the construction project and organizational performance (The KPI Working Group, 2000). The KPIs are general indicators of performance concentrating on output or outcome (Collin, 2002). Construction management literature shows a significant number of studies determined KPIs at the organization level for instance department of the environment, transport, and the regions (DETR) (2000) determined performance indicators such as client satisfaction, planning period, staff experience, communication, safety, closeness to budget, profitability, payment, claims. Thus, based on the available construction performance measurement models and literature, essential KPIs for this study are classified in the following four perspectives based on the balanced scorecard model approach (BSC): financial, internal process, customer, learning & growth. The recommended KPIs measures for this study are presented in chapter 3.

## 2.7 Summary

This chapter scanned and evaluated literature about the recent approaches and methods of modeling and measuring the impact of external environment on organization performance. In the literature search, twenty-nine factors have been discovered that impact construction organization performance in a post-conflict condition. Previous studies have been analyzed and evaluated to identify essential performance indicators and critical success factors. This review indicates that the

impact of the post-conflict condition factors on construction organization performance is not enough studied in previous studies. The literature review suggests that there is a gap in the literature on assessing the impact of the post-conflict environment factors on organization performance. Moreover, existing research indicates that the CSFs and the KPIs are vital elements of an organization performance measurement and benchmarking process since they enable organization management team to develop a competent success strategy and continuously improve organization efficiency and effectiveness.

# CHAPTER 3. FRAMEWORK AND METHODOLOGY

This chapter outlines the methodology and research framework. In addition, this chapter describes the method of the data collection, the study variables, employed research technique and method of the data analysis and evaluation.

## 3.1 Framework

Construction organization performance assessment and measurement have received significant attention in the past two decades to meet the construction industry challenges and competency. Many researchers have developed performance prediction models and methodologies applying CSFs strategy to determine the areas of project and construction organization that needs careful attention to achieve profit and success in the market. The CSFs method is increasingly utilized in the past two decades in the construction industry to increase organizational efficiency, and effectiveness compares to other traditional approaches. For instance, Inayat et al. (2013) have determined different critical success factors for different types of construction organization based on their organizational background in developed and developing countries such as the USA, Canda, UK, UAE, Sudi Arabia. Elwakil et al. (2009) have determined 18 critical success factors (CSFs) for the organization performance assessment in developed and developing countries such as the USA, Canada, and Egypt. In addition, Abraham (2003) has studied top 400 U.S. companies to identify the critical success factors methodology to enhance construction organization success. Rockart in (1979) for the first time identified critical success factors (CSFs) approach to achieve organizational goal.

The CSF applies to any organization operating in an industry, and there are four prime critical success factors sources of achieving organizational goals (Rockart, 1979, p.86):

- Structure-based organization characteristics;
- The competitive strategy of the organization;
- The effect of environmental factors; and
- Temporal elements according to the organizational priorities.

These prime CSFs sources are correlated with each other and need to be studied in a hierarchy since the external environment provides the organizations with the inputs which impact the internal process of an organization, and these external impacting factors are not in direct control of the organization management team (Farmer & Richman, 1 964). The external environment is a broader context of organizational performance, and it is the primary source of the other three branches of CSFs. The external environment encompasses all these sources of CSFs of an organization.

However, many researchers have developed performance improvement frameworks without assessing the CSFs sources hierarchy and the impact of different conditions of the external environment importantly when political and economic factors fluctuate in a situation such as in the post-conflict state. Moreover, the exclusion of post-conflict condition factors from the performance improvement models limited the applicability of these developed models in a post-conflict situation of the external environment. Therefore, the identified gap in construction management literature leads to the following research question and hypothesis:

Q1. What factors of the post-conflict condition of the external environment are affecting a local construction organization performance in Afghanistan?

H1. The local construction organization performance in a post-conflict situation is significantly associated with post-conflict condition munificence, complexity, and dynamism.

This study presents a framework for improving construction organization performance in a post-conflict condition of the external environment. The proposed framework consists of four stages: (1) determine key performance indicators (KPIs), (2) identify post-conflict environment impacting factors, (3) determine critical success factors (CSFs), and (4) formulate success strategy to improve organizational performance. The purpose of developing this framework is to determine critical success factors in a post-conflict situation of the external environment and to formulate a competent performance improvement strategy. This framework helps academic scholars and industry practitioners to analyze and evaluate challenges and opportunities that are causing by different external environmental factors in a post-conflict condition to the construction industry.

## 3.2 Research Method

The construction management research literature shows that researchers in the construction management area significantly relied on the quantitative methods assessing organization financial performance (Knight& Ruddock, 2009, p.5-10). Excluding the social and the quality aspect of construction organization performance from the performance improvement strategy results to merely focus on short-term project profit improvement strategy instead to formulate a long-term success strategy. This study utilizes mix-method research technique to assess potential qualitative and quantitative variables. Mix-method research provides deep insight to understand the impact of external environment on construction organization performance since it comprises qualitative and quantitative variables.

The primary objective of this research is to develop a framework to model construction organization performance in a post-conflict condition of the external environment to formulate success strategy based on the developed model.

The study objective can be achieved through the following phases as shown in Figure 1:

- Identify post-conflict environment impacting factors;
- Identify organization key performance indicators (KPIs) in a post-conflict situation;
- Model construction organization performance considering the post-conflict impacting factors;
- Determine critical success factors (CSFs); and
- Formulate success strategy based on the identified CSFs.

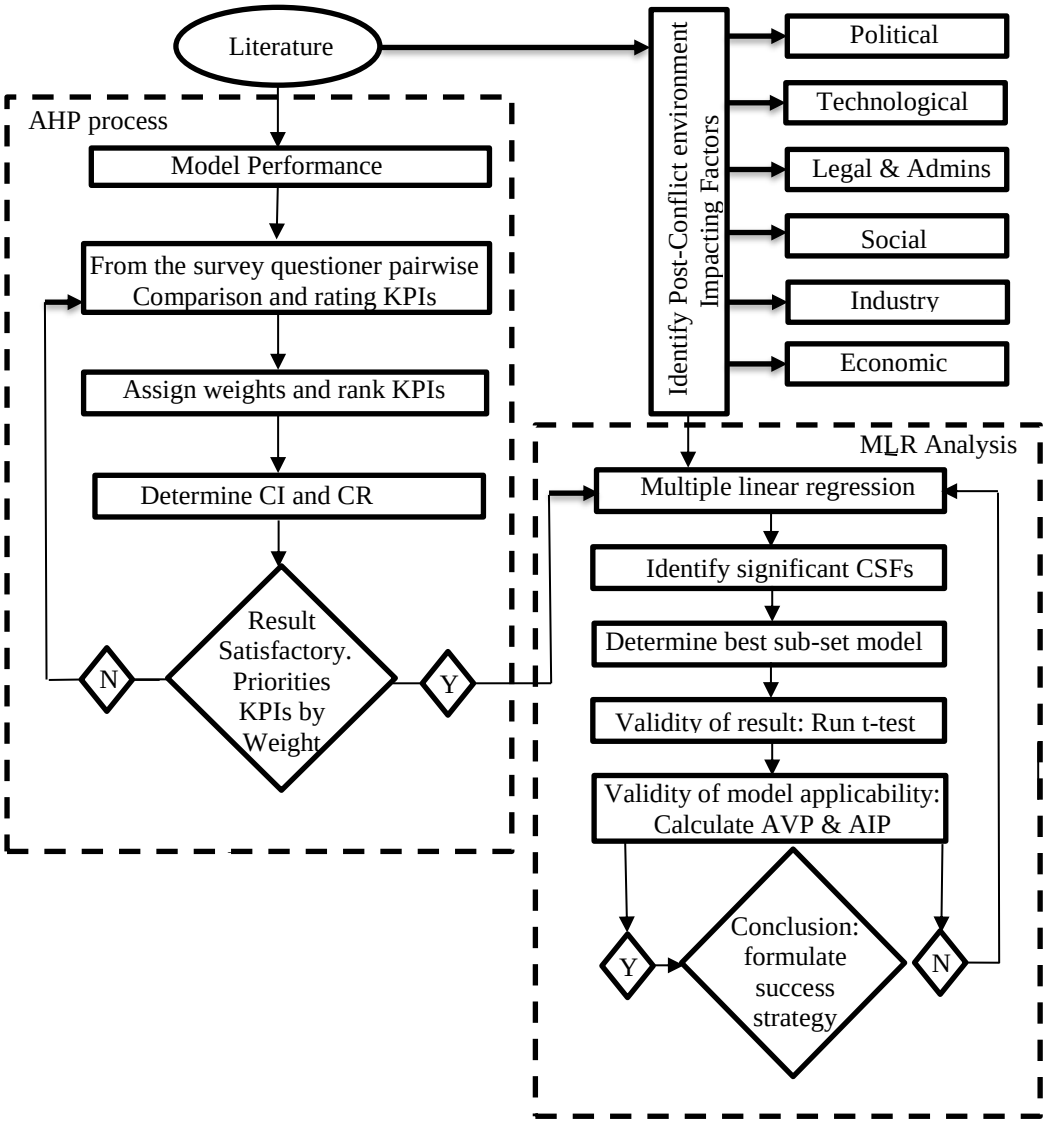



Figure 3.1 Research Framework

## 3.3 Study Variables

From a comprehensive literature review, inclusive twenty-nine post-conflict environment impacting factors are generalized shown in table 3.1, and five key performance measures are determined based on the Balanced Scorecard performance measurement system. The balanced scorecard measurement system comprises financial and non-financial measures to describe the

organization strategic objective into a concise set of measures. Selected measures are presented in table 3.2.

## 3.4 Independent Variables

The post-conflict environment impacting factors are examined as independent variables of this study. Total twenty-nine impacting factors are generalized from the literature review which is presented in table 3.1. These identified factors are used to determine critical success factors to improve organizational effectiveness and efficiency. Organizations must understand critical success factors and their impact on the different divisions of an organization to achieve long-term success, (Kaplan & Norton 1995). CSFs apply to any organization in an industry (Rockart, 1979). Also, Rockart, (1979) best defines the critical success factors (CSFs) as "*the critical success factors are areas of performance that should receive constant and careful attention from management*."

Table 3.1 Post-Conflict Environment Impacting Factors

| Description of the factor |
| --- |
| Anticompetitive behavior |
| Monitory uncertainty |
| Not being paid |
| Lack of regulatory policy |
| Project & warranty failure (instability) |
| Corruption |
| Theft and crime |
| Overall security -conflict |
| Lack of access to finance (banking) |
| Tax-administration, the tax rate |
| Lack of legal & judicial system |
| Lack of skilled & educated workforce |
| Lack of access to land |
| Poor-infrastructure |
| Government financial aid dependency |
| Lack of internet and technology |
| Market structure & competition |
| Local expenditure of international agencies |
| Government & nongovernment training |
| Government investment support |
| Lack of construction materials availability |
| Lack of admins technical capabilities |
| Bureaucratic process |
| International co-investment |
| Diaspora investment and tech support |
| Uncompetitive quality and price |
| The rate of return on investment |
| Lack of government risk reduction policy |

## 3.5 Dependent Variables

Key Performance Indicators (KPIs) are examined as dependent variables to determine the impact of critical success factors on local construction organization performance. Identified KPIs are shown in table 3.2. Understanding what parameter or key performance indicator (KPIs) must be monitored and gauged is crucial, since, the KPIs are general indicators of performance concentrating on output or outcome (Collin, 2002). The KPI working group (2000) describes KPIs as the enabler of measurement of the construction project and organizational performance. Therefore, it is essential to know what metrics or KPIs to be selected to analyze and evaluate the impact of CSFs on it.

Table 3.2 Key Performance Indicators (KPIs)

| Measure | Definition |
|---|---|
| Cost predictability | The prediction of construction project cost plus associated cost (administrative cost, indirect cost). |
| Time predictability | The prediction of the project performance period plus the associated time required for NTP, invoice payment, project handover. |
| Work growth rate | Company gross annual contract amount growth. |
| Contractor satisfaction | Contractor satisfaction in the bidding process, contract award, bid security, change order, payment warranty. |
| Bid growth | Firm annual growth in the number of biding projects. |

## 3.6 Sample and Population

Simple random sampling (SRS) technique has been applied in this study to select a sample from the target population in Afghanistan. The survey questionnaire was sent to more than 500 local construction companies which are selected from the list of 20013 registered companies with Afghanistan Investment Support-Agency (AISA) across the country from 2001 to August 2016 in Afghanistan. Most of these registered companies are headquartered in Afghanistan five big cities, Kabul, Kandahar, Jalal-Abad, Herat, and Balkh. The target group of this study was local construction companies working within Afghanistan.

## 3.7 Survey Questionnaire and Data Collection

The survey questionnaire research method is applied to collect the data for this study. Once the rough draft of the survey questionnaire was designed, then it was sent to ten construction industry experts having at least five years of experiences within the industry to validate the survey questionnaire. After making the required changes to the survey questionnaire structure, the survey questionnaire was sent to more than 500 local construction companies, and a total of 85 questionnaires were returned from which 51 filled survey questionnaires were usable.

In this study, the survey questionnaire was designed in two major sections. In the first section of the questionnaire, participants were requested to pairwise compare the five shortlisted KPIs amongst each other and rate them by Likert five-degree scale. In the second section of the survey, participants were questioned about measuring the impact of identified factors on the shortlisted KPIs using the seven-degree scale ranged from -3 to +3. The industry experts recommended the applied scales to get the participants agreement and disagreement with the questions based on this scale.

## 3.8 Data Analyzing Method

To analyze the obtained data, Analytic hierarchy process (AHP) decision-making technic is applied to weigh the selected KPIs. Saaty (2008) describes the analytic hierarchy process (AHP) a non-complicated tool for human decision-making. In addition, AHP is a fixable multi-criteria decision-making process, which can be easily integrated with other modeling technics such as multiple linear regression, fuzzy logic, artificial neural network and others (Elwakil, 2017). The Likert scale is a suitable tool to rate the importance of KIPs for the AHP process. First, from the AHP process analysis, the Eigen Victor has been calculated to weigh and priorities the performance measures. Once the weighted KPIs are determined and prioritized, then the prioritized KPIs are used as the coefficient of measure to each developed model. Consistency index (CI) and consistency ratio (CR) are calculated to verify the validity of the measures pairwise compression statistically.

The multiple linear regression (MLR) modeling techniques are used to determine the relationship between the dependent and independent variables. In MLR approach, multiple independent variables are predicting the response variable. The MLR technique is a handy tool, which is applicable to the construction management research studies to develop prediction models and determine the relationship between variables. Thus, the multiple linear regression (MLR) modeling technics is utilized in this study to determine the impact of critical success factors on the identified KPIs to develop a performance prediction model of the local construction organization.

The MLR determines that how well the impacting factors work together to predict construction organization performance (the best subset of CSF) and in the same time the MLR technique makes it possible to determine which factors contribute more to predict construction organization performance (CSFs). The backward elimination process is applied to the selected best subset factors to identify the most contributing factors of performance prediction.

The rated impacting factors are analyzed to develop a performance prediction model for each measure. The best subset (the minimum number of predicting variables with the highest percent of predictability) is multiplied by the prioritized measure coefficient value to determine the final total number of critical success factors.

The t-test is applied to evaluate the result significance statistically. From the similar studies in construction management, the applicability and validly of the developed model is checked by calculating the average percentage of accuracy (APA) and average percent of error (APE). For instance, one of these studies that applied the APA and APE approach is conducted by Elwakil (2017) to develop a performance improvement model considering the management team functional role. 10% of the test data is utilized to validate the developed model applicability. Figure 3.1 shows the objectives of this study in the graphical representation.

## 3.9 Summary

This chapter drafted the research methodology phases and techniques based on which the obtained data is analyzed and evaluated in the next sections. This chapter includes a description of collecting data, study variables, employed research techniques and the method adopted of data analysis and evaluation.

# CHAPTER 4. DATA ANALYSIS AND MODEL BUILDING

This chapter presents an analysis and evaluation of the collected data applying the proposed mythology approaches and techniques. The content of this chapter includes assessing and cleaning the obtained data set, building the research model, sensitivity analysis of the study results and validation of the developed model to summaries and conclude the research findings.

## 4.1 Assessing and Clearing the Data Set

The survey questionnaire research method is used to collect the data for this study. The survey questionnaires were sent to more than 500 local construction companies, and a total of 51 observations were collected for each performance measures. Some observations were missing that required to be predicted before analyzing the data set. The missing data points for five depending variables and twenty-nine independent variables were completed using expectation maximization technique. To predict missing observation, the expectation maximization technique is used since this technique is fast and reliable for normally distributed observations when the data set is missing a small percent of observations. The SPSS software was used to predict the missing observations, and the Minitab software was to assess the obtained dataset normality. The data set distribution for both dependents, and independent variables were almost normal with small skewness, and also there were no obvious significant outliers in the dataset shown in figure 4.1 to 4.5. Thus, the regression modeling technique and the analytical hierarchy process (AHP) is suitable to be applied to analyze the data. The mean value of the perceived performance measures is used to build the model.

- Cost Prediction is 1.51 times as important as work growth
- Time prediction is 2.48 times as important as contractor satisfaction

- Bid Growth is 1.03 times as important as contractor satisfaction
- Work Growth is three times important as bid growth

From the obtained data, the twenty-nine predictors are used to build the regression model, and to determine critical success factors.

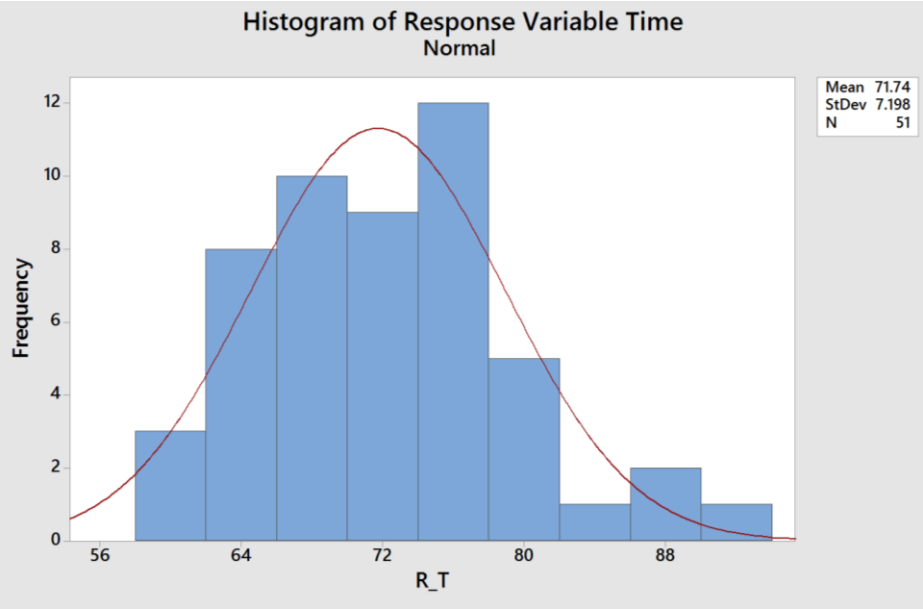



Figure 4.3 Response Variable Observations Distribution for Time

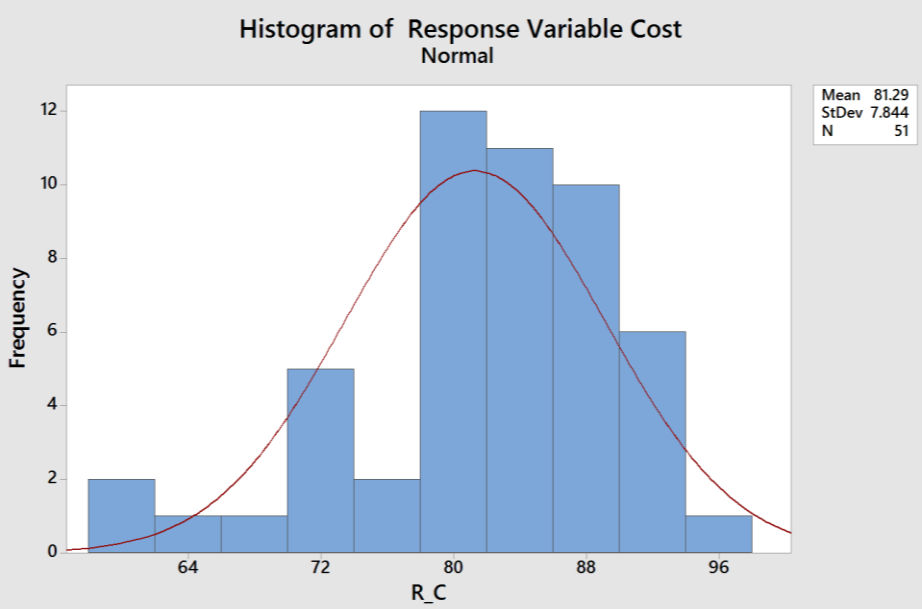



Figure 4.2 Response Variable Observations Distribution for Cost

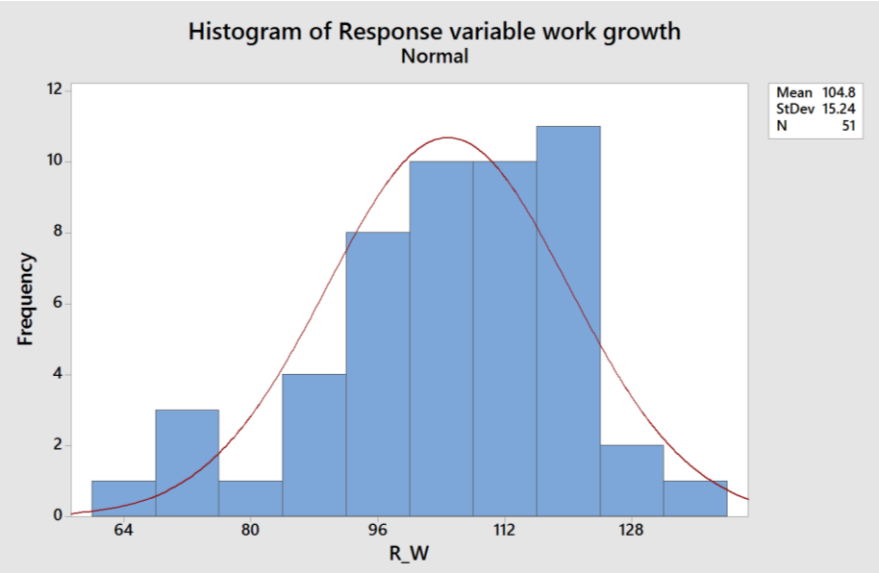



Figure 4.4 Response Variable Observations Distribution for Work Growth

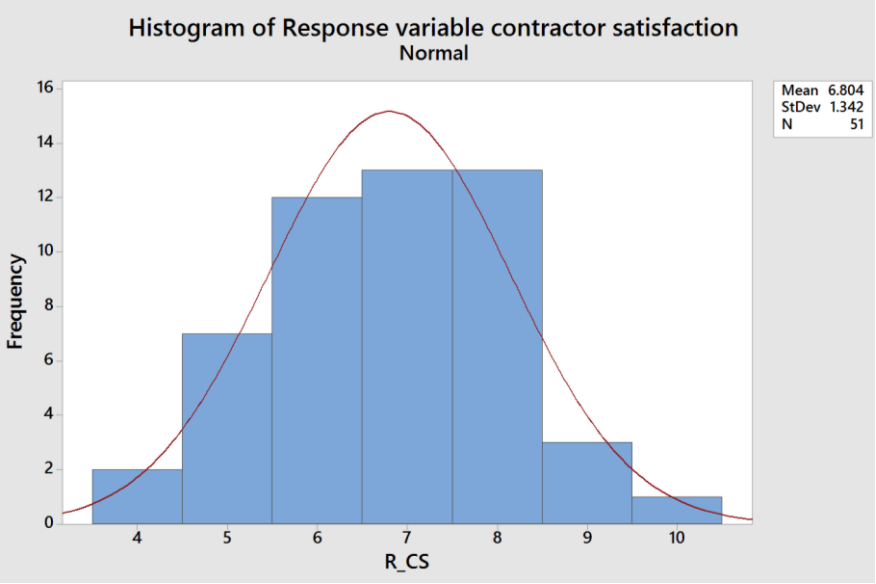



Figure 4.5 Response Variable Observations Distribution for Contractor Satisfaction

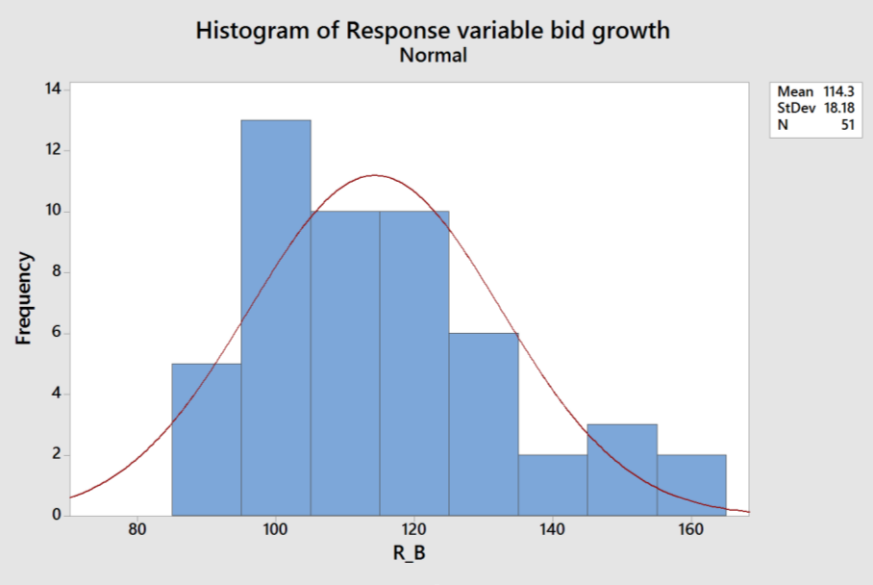



Figure 4.6 Response Variable Observations Distribution for Bid Growth

## 4.2 Model Building

To build the performance prediction model, Analytic hierarchy process (AHP) decision-making technique is applied to weigh the selected KPIs. The KPIs are general indicators of performance concentrating output or outcome (Collin, 2002). The KPI working group (2000) describes KPIs as the enabler of measurement of the construction project and organizational performance. Therefore, it is essential to know what metrics or KPIs to be selected to analyze and evaluate the impact of post-conflict condition factors on it.

The multiple linear regression (MLR) modeling technique is applied to determine the relationship between the dependent and independent variables. In MLR approach, multiple independent variables are predicting the response variable. The MLR technic is a handy tool that can be employed to determine the relationship between variables.

The MLR determines that how well the impacting factors work together to predict construction organization performance (the best subset of CSF) and in the same time the MLR

technique makes it possible to determine which impacting factors contribute more to predict construction organization performance. The backward elimination process is applied to the selected best subset factors to identify the most contributing factors. The impacting factors are analyzed to develop a performance prediction model for each measure. The best subset (the minimum number of predicting variables with the highest percent of predictability) is multiplied by the prioritized measure coefficient value to determine critical success factors (CSFs).

The t-test test has been used to evaluate the result significance statistically. The applicability and validly of the developed model is checked through calculating the average percent of validity (APV) and average percent of invalidity (API) equations using 10% of the test data shown in equation 10 and 11. The result of the data analyzing for this research is presented in section 4.3 and 4.4.

## 4.3 Analytical Hierarchy Process (AHP)

The AHP method is applied to weigh and prioritize key performance indicator (KPI). The indicators prioritizing process comprised of the below steps:

First, from the rated values of observations, the pairwise matrix can be formulated as follow.

Table 4.4 Comparison Matrix and Columns Weight

| Performance | Cost prediction | Time prediction | Bid growth | Work growth | Contractor satisfaction |
|---|---|---|---|---|---|
| Cost prediction | 1.000 | 1.800 | 4.500 | 1.500 | 4.500 |
| Time prediction | 0.556 | 1.000 | 2.500 | 0.667 | 2.500 |
| Bid growth | 0.222 | 0.400 | 1.000 | 0.333 | 1.000 |
| Work growth | 0.667 | 1.500 | 3.000 | 1.000 | 3.000 |
| Con. satisfaction | 0.222 | 0.400 | 1.000 | 0.333 | 1.000 |
| Sum of Columns | 2.667 | 5.100 | 12.000 | 3.833 | 12.000 |

From the comparison matrix, the average weight of each row is calculated to weigh performance measures shown in table 4.4 and table 4.5.

Table 4.5 Calculation of Row Weight Average

| Calculation of row weight average | | | | | | Priority |
|---|---|---|---|---|---|---|
| Cost prediction | 0.375 | 0.353 | 0.375 | 0.391 | 0.375 | 0.374 |
| Time prediction | 0.208 | 0.196 | 0.208 | 0.174 | 0.208 | 0.199 |
| Bid growth | 0.083 | 0.078 | 0.083 | 0.087 | 0.083 | 0.083 |
| Work growth | 0.250 | 0.294 | 0.250 | 0.261 | 0.250 | 0.261 |
| Con. satisfactions | 0.083 | 0.078 | 0.083 | 0.087 | 0.083 | 0.083 |

Table 4.6 Calculation of Weighted Sum of Criterion

| Performance | Cost prediction | Time_ prediction | Bid growth | Work growth | Contractor satisfaction | Weighted Sum |
|---|---|---|---|---|---|---|
| Cost prediction | 0.374 | 0.358 | 0.374 | 0.392 | 0.374 | 1.871 |
| Time prediction | 0.208 | 0.199 | 0.208 | 0.174 | 0.208 | 0.996 |
| Bid growth | 0.083 | 0.080 | 0.083 | 0.087 | 0.083 | 0.416 |
| Work growth | 0.249 | 0.299 | 0.249 | 0.261 | 0.249 | 1.307 |
| Con. satisfaction | 0.083 | 0.080 | 0.083 | 0.087 | 0.083 | 0.416 |

The squared matrix values are used to calculate the Eigen Victor to priorities the performance measures. The prioritized weights of the measures are multiplied by the percent of each predicting factors from the best subset to identify critical success factors. Table 4.6 presents the weighted prioritized KPIs.

Table 4.7 Eigen Victor Calculation

| Performance | Cost | Time | Bid | Work | Contractor | Sum of Rows | Normalized Row Value |
|---|---|---|---|---|---|---|---|
| Cost prediction | 0.998 | 1.914 | 4.493 | 1.439 | 4.494 | 13.340 | 0.335 |
| Time prediction | 0.525 | 1.436 | 6.136 | 0.756 | 2.366 | 11.220 | 0.282 |
| Bid growth | 0.221 | 0.425 | 0.998 | 0.319 | 0.999 | 2.964 | 0.075 |
| Work growth | 0.698 | 1.335 | 3.142 | 0.998 | 3.143 | 9.318 | 0.234 |
| Con. satisfaction | 0.221 | 0.425 | 0.999 | 0.320 | 0.999 | 2.964 | 0.075 |
| | | | | | | 39.808 | 1 |

To verify the validity of the result statistically, the consistency index (CI) and the consistency ratio (CR) are calculated shown in equation 1.

$$CR = CI/RI < 0.1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ 1.$$

Where n is the number of measures and from the random consistency index table 4.8, RI= 1.12. Thus, the consistency index is calculated from equation 2 and 3.

$$C.I. = (\lambda max - n) / (n-1) \quad \ldots\ldots\ldots\ldots 2$$

$$\lambda max = \frac{\sum Weighted\ Measures}{\sum Priortized\ Measures} \ldots\ldots\ldots 3$$

Table 4.8 Random Consistency Index

| n | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| RI | 0 | 0 | 0.58 | 0.9 | 1.12 | 1.24 | 1.32 | 1.41 | 1.45 | 1.49 |

The λmax value is calculated from table 4.8.

Table 4.9 λmax Calculation

| Weighted sum | Priority | C1/C2 | λmax |
|---|---|---|---|
| 1.871 | 0.374 | 5.005 | |
| 0.996 | 0.199 | 5.005 | |
| 0.416 | 0.083 | 5.005 | |
| 1.307 | 0.261 | 5.008 | |
| 0.416 | 0.083 | 5.005 | |
| | | | 5.006 |

The consistency ratio value from equation 1and 2 is equal to:

If, RI=1.12 for n=5, then:

C.I. = (λmax -n) / (n-1) = 5.0059-5/ 4 = 0.000147

CR= CI/RI = 0.000147/ 1.12 = 0.000132< 0.1, Since the CR is smaller than 0.1, we can conclude that the judgement matrix is reasonably consistent. The CR value means there are logical consistency and reliability between the compared measures.

## 4.4 Multiple Linear Regression (MLR)

Regression analysis is performed to develop performance improvement prediction model to identify CSFs. Twenty-nine generalized impacting factors are used to predict prioritized performance measures. Multiple linear regression technique is applied to determine the relationship between five key performance indicators and 29 identified impacting factors in building the model. The statistical model for linear regression is:

$$Yi = \beta 0 + \beta 1\ Xi1 + \beta 2\ Xi2 + \ldots\ldots\ldots\ldots + \beta p\text{-}1\ Xip\text{-}1 + \varepsilon i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4$$

Where (Yi) is the response variable in (i) iteration, β0 and β1 are the parameters of the linear regression model, xi is the (ith) predicting variable, and εi is the random error. Before applying the linear regression technique to the obtained data set, it is important to know that the data is

suitable for linear regression and it is normally distributed. Minitab software has been used to build the performance prediction model. To understand the relationship between the response variable and its predictors, and to know what proportion of the variance predicting the response variable, the Rsq and Rsq adjusted need to be calculated. The obtained Rsq and Rsq adjusted from regression analysis for each measure are presented in table 4.10.

Table 4.10 Rsq and Rsq adjusted for Models with Twenty-nine Predictors

| Model Summary _ Bid growth | | | |
|---|---|---|---|
| S | R-sq | R-sq(adj) | R-sq(pred) |
| 7.980 | 95.10% | 82.18% | 4.48% |
| Model Summary_ Time | | | |
| S | R-sq | R-sq(adj) | R-sq(pred) |
| 5.838 | 76.84% | 15.79% | 0.00% |
| Model Summary_ Cost | | | |
| S | R-sq | R-sq(adj) | R-sq(pred) |
| 3.582 | 94.84% | 81.25% | 9.11% |
| Model Summary_ Work growth | | | |
| S | R-sq | R-sq(adj) | R-sq(pred) |
| 4.292 | 96.96% | 88.94% | 60.77% |
| Model Summary_ Constrictor satisfaction | | | |
| S | R-sq | R-sq(adj) | R-sq(pred) |
| 0.651 | 93.74% | 77.24% | 0.00% |

A best-subset of the predicting variables are selected from the regression analysis to improve the developed model's precision of the predictability with a minimum number of variables and with a higher percentage of the R-sq(adj).

After many iterations, the best-sub set with a minimum number of predictors and with a higher percent of R-sq(adj) and R-sq(pred) is selected to identify the CSFs. Table 4.11 shows the best-subset predictors for all measure. R-sq(adj) and R-sq(pred) of the best-subsets of the performance measures are presented in table 4.12.

Table 4.11 Best-sub Set Prediction Variables

| Discerption of impacting factors | Factor | Time | Bid | Cost | Work | Cont. |
|---|---|---|---|---|---|---|
| Anticompetitive behavior | X1 | | X | X | X | |
| Monitory uncertainty | X2 | X | X | X | X | X |
| Not being paid | X3 | | | X | | X |
| Lack of regulatory policy | X4 | | | | | X |
| Project & warranty failure (instability) | X5 | X | X | X | | |
| Corruption | X6 | | | X | X | X |
| Theft and crime | X7 | X | | X | X | X |
| Overall security -conflict | X8 | | X | X | | |
| Lack of access to finance (banking) | X9 | | | X | | |
| Tax-admins, the tax rate | X10 | | X | | | X |
| Lack of legal & judicial system | X11 | X | | | X | |
| Lack of skilled & educated workforce | X12 | X | | X | X | |
| Lack of access to land | X13 | | X | | | |
| Poor-infrastructure | X14 | X | | | | X |
| Government financial aid dependency | X15 | | X | X | X | X |
| Lack of internet and technology | X16 | | X | X | X | X |
| Market structure & competition | X17 | X | | | | X |
| International financial support | X18 | | X | | X | X |
| Local expenditure of international agencies | X19 | X | X | X | X | X |
| Government & nongovernment training | X20 | X | | | | X |
| Government invest support | X21 | | X | | | |
| Lack of construction materials availability | X22 | X | X | X | | |
| Lack of admins technical capabilities | X23 | X | X | X | | X |
| Bureaucratic process | X24 | X | X | X | | X |
| International co-investment | X25 | X | | X | | |
| Diaspora investment and tech support | X26 | | X | | X | |
| Uncompetitive quality and price | X27 | X | | | | |
| The rate on return on investment | X28 | | | X | | |
| Lack of government risk reduction policy | X29 | | X | X | X | |

Table 4.12 Best-sub set R-sq (adj) and R-sq (pred)

| Model Summary-Contractor satisfaction | | | |
|---|---|---|---|
| S | R-sq | R-sq(adj) | R-sq(pred) |
| 0.705 | 82.64% | 73.29% | 58.09% |
| Model Summary-Bid growth | | | |
| S | R-sq | R-sq(adj) | R-sq(pred) |
| 7.793 | 89.80% | 83.00% | 66.75% |
| Model Summary- Work growth | | | |
| S | R-sq | R-sq(adj) | R-sq(pred) |
| 5.746 | 85.63% | 80.19% | 68.67% |
| Model Summary-Time | | | |
| S | R-sq | R-sq(adj) | R-sq(pred) |
| 3.836 | 80.59% | 72.59% | 55.94% |
| Model Summary- Cost | | | |
| S | R-sq | R-sq(adj) | R-sq(pred) |
| 2.886 | 93.33% | 87.88% | 75.00% |

The following equations attained from the Minitab show the developed performance prediction models based on the identified KPIs. The developed model's equations are consisting of the best-subset impacting factors shown in table 4.11.

Bid growth =144.0 + 12.37 X1 + 10.04 X2 + 3.90 X5 + 5.40 X8 + 16.27 X10 - 17.21 X13

+ 6.24 X15- 5.61 X16 + 9.09 X18 - 8.25 X19 + 11.95 X21 + 4.53 X29

+ 13.62 X23 - 7.50 X24+ 4.66 X26 + 6.63 X22 …….4

Cont. Satisfaction =14.006 + 1.506 X2 + 0.444 X3 - 0.793 X4 + 0.389 X6 + 0.542 X7

+ 0.964 X10 + 0.960 X14+ 0.589 X15 + 1.182 X16 - 0.396 X17

+ 0.933 X19 + 0.545 X20 + 0.224 X23 + 0.526 X27+ 0.604 X24.....….5

Cost =129.71 + 5.726 X1 + 3.76 X2 + 3.432 X3 + 3.30 X5 + 2.184 X6 - 2.31 X7+ 5.08 X8
+ 1.512 X9 + 3.821 X12 - 1.214 X15 + 2.807 X16 + 3.308 X19 + 1.242 X29+ 1.783 X23
- 3.60 X24 + 3.796 X25 + 3.404 X28 + 1.769 X22 …….……6

Time = 73.27 + 4.011 X2 + 2.933 X5 + 2.429 X7 + 6.64 X11 - 1.659 X12 + 3.59 X14
+ 5.45 X17+ 2.92 X19 + 4.964 X20 + 2.77 X22 - 1.95 X23 - 4.16 X24 + 7.13 X25
+ 2.206 X27 …….……7

Work growth = 149.10 + 4.30 X1 + 6.97 X2 + 5.06 X6 + 5.43 X7 + 2.46 X11 + 4.43 X12
+ 3.39 X15+ 3.75 X16 + 3.75 X18 + 7.91 X29 + 2.08 X26 …….……8

## 4.5 Data Appropriateness for Linear Regression and Normality Check

The quantile-quantile (qq) plot and residual plot of the data set is analyzed to check the obtained data set normality and its appropriateness for linear regression and access the impact of outliers on the collected data. Minitab graph function is utilized to draw the residual and quantile plots of the obtained data.

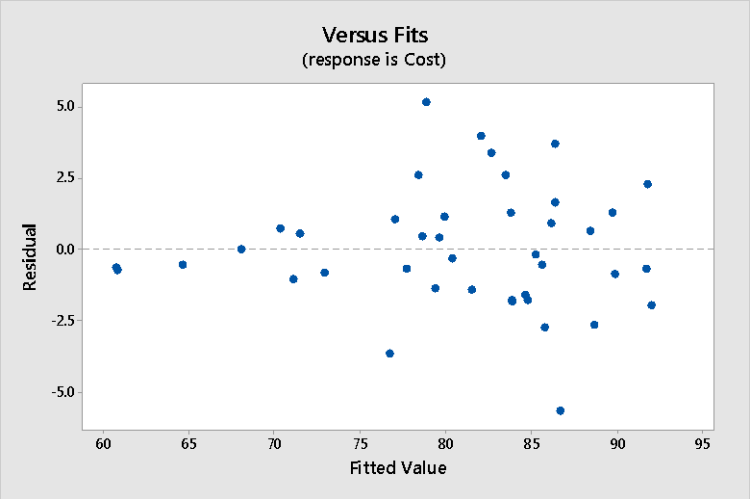



Figure 4.7 Residual Plot of the Cost Measure

The residual plot for cost measure does not show any specific pattern, and it is random which mean that the linear regression can determine the relationship between the response and predicting variables.

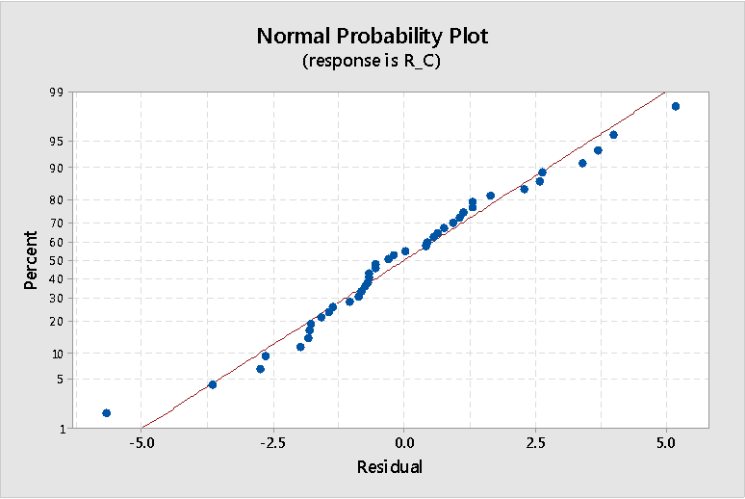



Figure 4.8 qq Plot of the Cost Measure

Based on the qq plot for the cost, residual appears to be approximately normal.

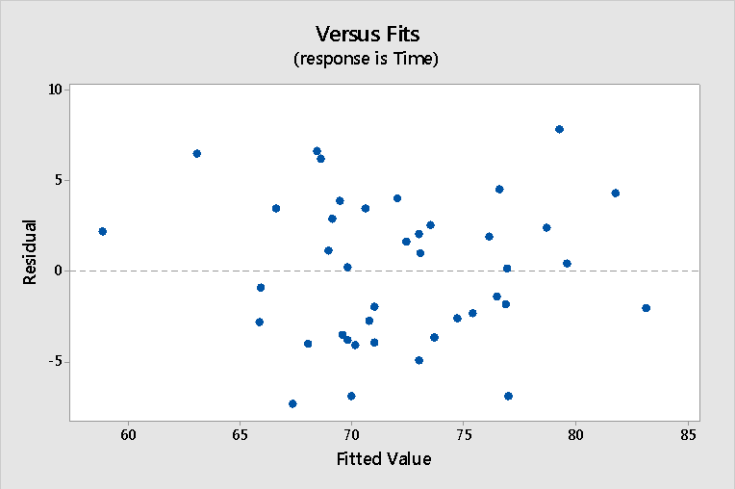



Figure 4.9 Residual Plot of the Time Measure

The residual plot for the time measure does not show any specific pattern, and it is random which mean that the relationship between variables can be determined by linear regression.

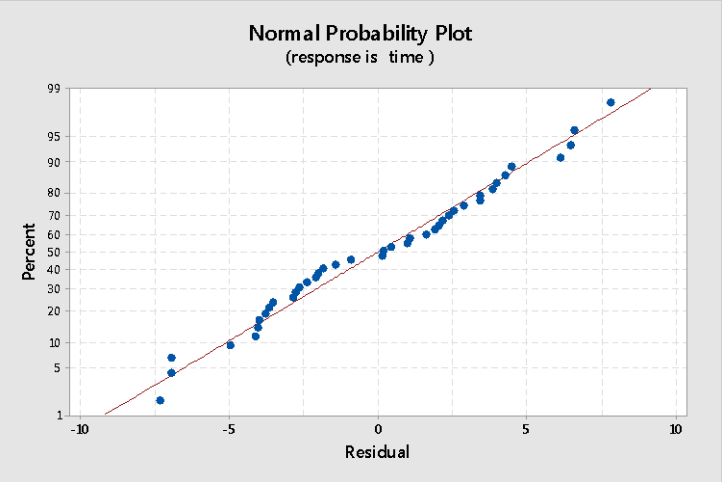



Figure 4.10 Residual Plot of the Time Measure

The qq plot for time does not show any obvious outlier, and the data distribution appears to be normal.

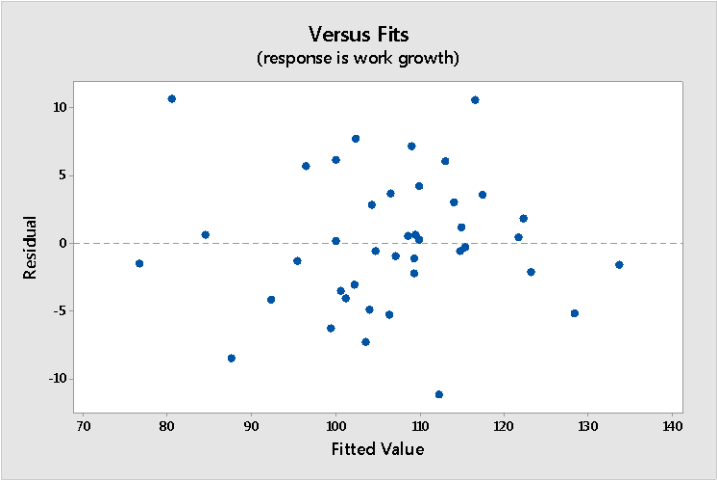



Figure 4.11 Residual Plot of the Work Growth Measure

The residual plot for the work growth measure is random. Thus, the relationship between variables can be determined by linear regression.

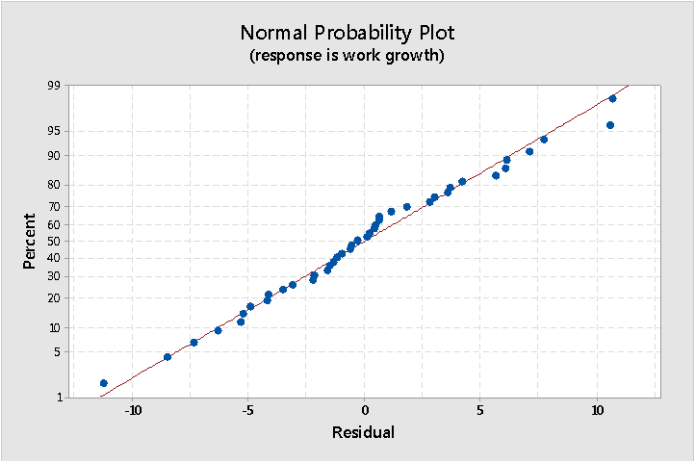



Figure 4.12 qq Plot of the Work Growth Measure

The residual plot appears to be normal based on the qq plot for the work growth measure.

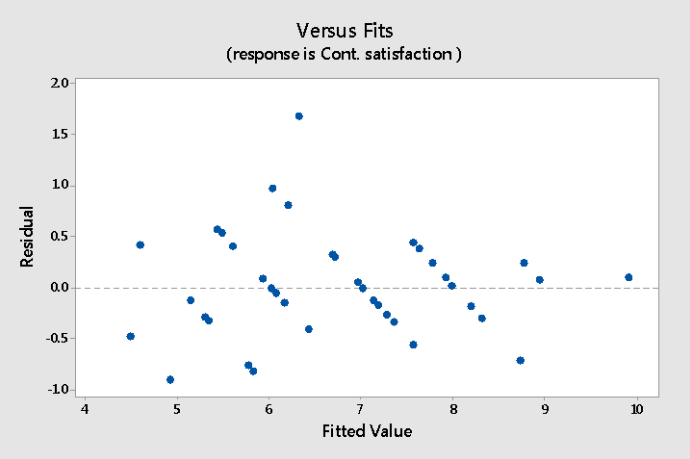



Figure 4.13 Residual Plot of the Contractor Satisfaction Measure

The residual plot for the contractor satisfaction measure is nearly random. However, the data points are somewhat clustered. Despite it, the relationship between variables can be determined by linear Regression technique.

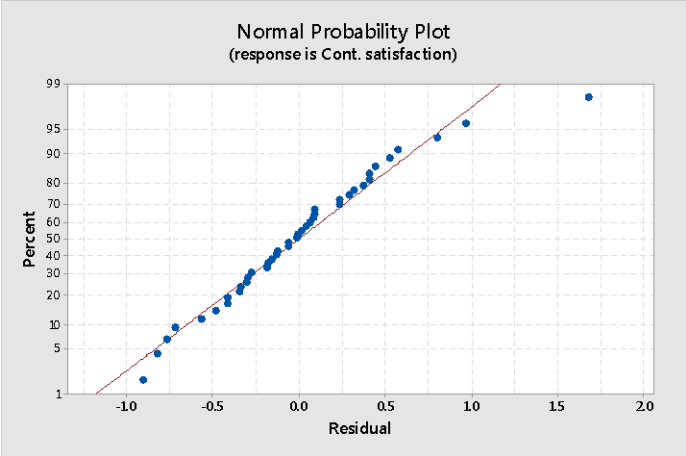



Figure 4.14 qq Plot of the Contractor Satisfaction

The QQ plot for the contractor satisfaction measure shows one outlier in the data set. However, the outlier does not show a significant impact on the result, and the data distribution appears to be approximately normal.

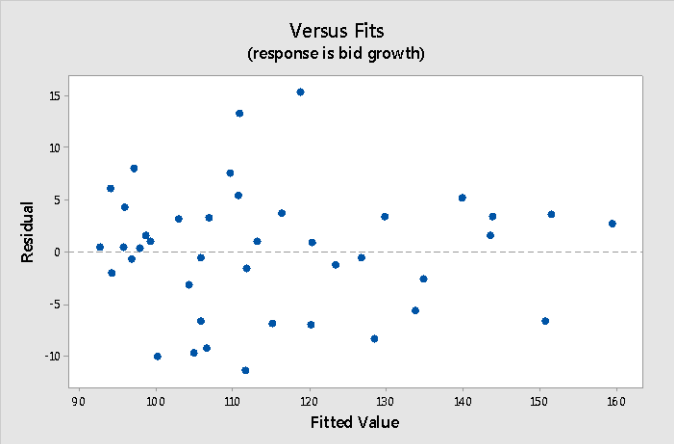



Figure 4.15 Residual Plot of the Bid Growth Measure

The residual plot of the bid growth measure does not show any specific pattern, and it is random which means that the relationship between variables can be determined by linear regression.

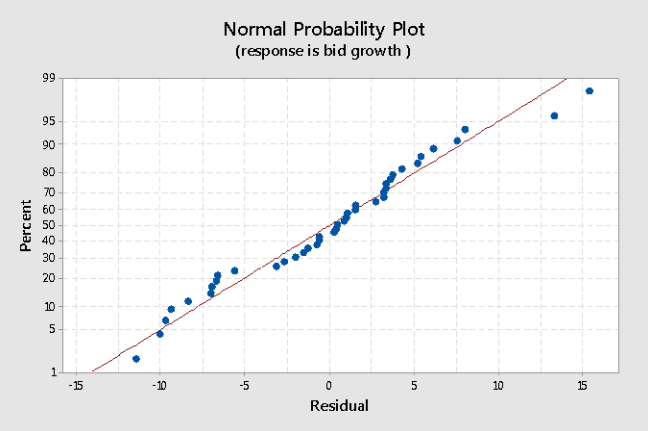



Figure 4.16 qq Plot of the Bid Growth Measure

The qq plot the bid growth measure does not show obvious outliers in the data set, and the data distribution appears to be approximately normal.

## 4.6 Validation of the Result

The t-test is run at 0.15 alpha to check the significance level of the relationship between the response and prediction variables of the developed models and the alpha value was compared to the P-value of the predicting variables to make sure that all predictors are significant. Predicting factors with the P-value≥ 0.15 were stepwise removed from the best-sub set until all predictors become significant at P-Value ≤0.15. The result is presented in table 4.13.

Table 4.13 Significance Level of the Impacting Factors

| Bid | P-Value | Contr. | P-Value | Work | P-Value | Cost | P-Value | Time | P-Value |
|---|---|---|---|---|---|---|---|---|---|
| X1 | 0 | X2 | 0.00 | X1 | 0.004 | X1 | 0 | X12 | 0 |
| X2 | 0 | X3 | 0.05 | X2 | 0 | X2 | 0.002 | X20 | 0.001 |
| X5 | 0.076 | X4 | 0.00 | X6 | 0 | X3 | 0 | X27 | 0.008 |
| X8 | 0.024 | X6 | 0.08 | X7 | 0 | X5 | 0.002 | X11 | 0 |
| X10 | 0 | X7 | 0.02 | X11 | 0.112 | X6 | 0.01 | X17 | 0.072 |
| X13 | 0 | X10 | 0.00 | X12 | 0.006 | X7 | 0.058 | X2 | 0.002 |
| X15 | 0 | X14 | 0.00 | X15 | 0.002 | X8 | 0 | X7 | 0 |
| X16 | 0.116 | X15 | 0.00 | X16 | 0.02 | X9 | 0.062 | X5 | 0.023 |
| X18 | 0.001 | X16 | 0.00 | X18 | 0.005 | X12 | 0 | X24 | 0 |
| X19 | 0.001 | X17 | 0.04 | X29 | 0.001 | X15 | 0.03 | X14 | 0.033 |
| X21 | 0 | X18 | 0.00 | X26 | 0.150 | X16 | 0.002 | X19 | 0.07 |
| X29 | 0.093 | X19 | 0.02 | | | X19 | 0.001 | X22 | 0.002 |
| X23 | 0 | X20 | 0.18 | | | X29 | 0.081 | X23 | 0 |
| X24 | 0.003 | X23 | 0.00 | | | X23 | 0.023 | | |
| X26 | 0.067 | X24 | 0.00 | | | X24 | 0.002 | | |
| X22 | 0.044 | X27 | 0.05 | | | X25 | 0 | | |
| | | | | | | X28 | 0 | | |
| | | | | | | X22 | 0.014 | | |

## 4.7 Critical Success Factors

The backward elimination process is applied to the best-subset variables to determine what percent each factor contributes to predicting construction organization performance to remove minor contributing variables. The significant contributing factors are multiplied by the prioritized measure weight to identify critical success factors.

$$WCSF_i = W_j \; x \; PWij \qquad \text{.....9}$$

Where ($WCSF_i$) is the critical success factor weight, ($W_j$) is the normalized weight of performance measure, and ($PWij$) is the percent of the predictability of the impacting factor (i) in (j) performance measure model. Table 4.14 shows identified critical success factors in a post-conflict condition impacting local construction organization performance.

Table 4.14 Critical Success Factors Impacting Construction Organization Performance

| Rank | Factor | $WCSF_i$ | Description of the impacting factor |
|---|---|---|---|
| 1 | X1 | 10.489 | Anticompetitive behavior |
| 2 | X12 | 8.350 | Lack of skilled & educated workforce |
| 3 | X25 | 6.920 | International co-investment |
| 4 | X20 | 5.928 | Government & nongovernment training |
| 5 | X28 | 5.727 | The rate of return on investment |
| 6 | X27 | 5.638 | Uncompetitive quality and price |
| 7 | X11 | 5.556 | Lack of legal & judicial system |
| 8 | X17 | 4.956 | Market structure & competition |
| 9 | X2 | 4.567 | Monitory uncertainty and access to finance |
| 10 | X7 | 4.485 | Theft and crime |
| 11 | X8 | 3.435 | Overall security -conflict |
| 12 | X5 | 2.455 | Project & warranty failure (instability) |
| 13 | X24 | 2.275 | Bureaucratic process |
| 14 | X14 | 2.264 | Poor-infrastructure |
| 15 | X6 | 2.254 | Corruption |

## 4.8 Validation of the Developed Models

The 10% test data from the survey questionnaire is used to calculate the average validity percent (AVP) and average invalidity percent (AIP) of the developed models. Zayed and Halpin (2005) used AVP and AIP terms to calculate average validity percent and average invalidity percent of the established model to access the piling process time cycle and cost. By using the following equations to calculate the developed model AVP and AIP.

$$AIP = \left(\sum_{i=1}^{n} (|1 - (Ei \div Ci)|)\right) * 100 \quad \text{.....10}$$

$$AV\ P = 100 - AIP \quad \text{.....11}$$

Where:

AVP is average validity percent;

AIP is average invalidity percent;

$E_i$ is estimated value; and

$C_i$ is the actual value.

The AVP and AIP for the developed models are presented as following:

Table 4.15 Validation Result, Cost.

| Observation | $C_i$ | $E_i$ |
|---|---|---|
| 1 | 82 | 73.936 |
| 2 | 90 | 96.554 |
| 3 | 77 | 81.744 |
| 4 | 88 | 104.44 |
| 5 | 83 | 74.838 |
| 6 | 92 | 97.386 |
| 7 | 88 | 105.135 |
| 8 | 79 | 64.198 |
| 9 | 79 | 76.116 |
| 10 | 78 | 94.264 |
| | AIP (%) | 23.2 |
| | AVP (%) | 76.8 |

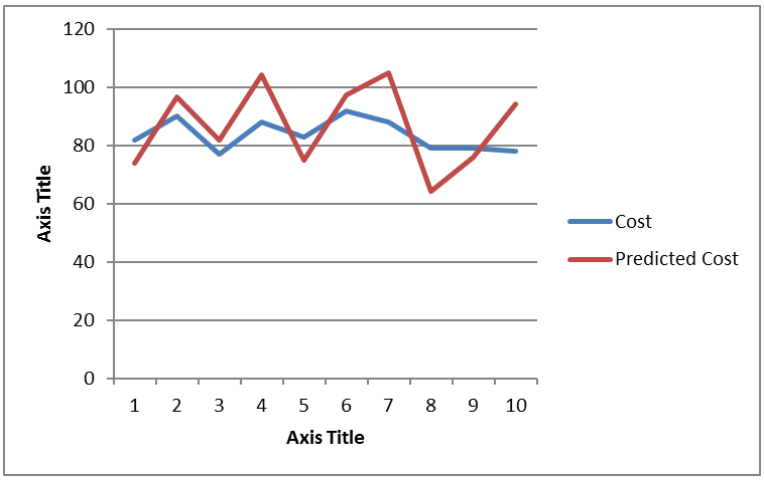



Figure 4.17 Actual values vs. Modeled Values for Cost Model

Table 4.16 Validation Result, Time.

| Observation | $C_i$ | $E_i$ |
|---|---|---|
| 1 | 85 | 63.742 |
| 2 | 62 | 57.265 |
| 3 | 65 | 57.491 |
| 4 | 70 | 71.447 |
| 5 | 59 | 53.597 |
| 6 | 70 | 62.296 |
| 7 | 68 | 61.289 |
| 8 | 69 | 65.135 |
| 9 | 50 | 60.16 |
| 10 | 69 | 68.074 |
| | AIP (%) | 10.4 |
| | AVP (%) | 89.6 |

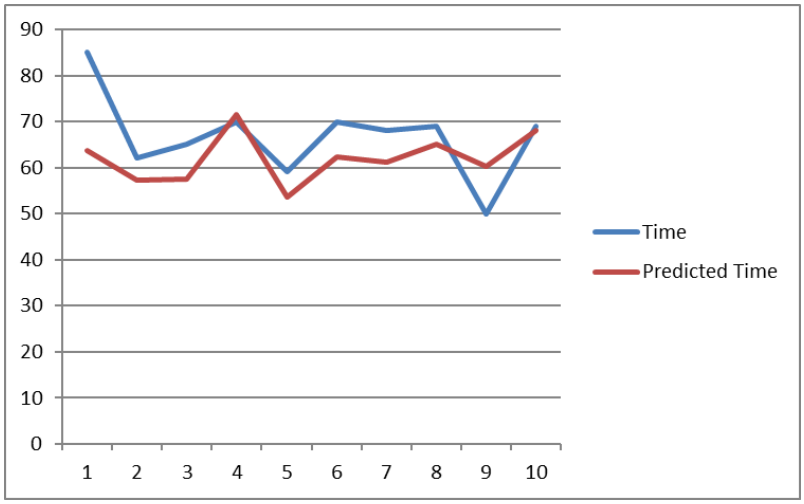



Figure 4.18 Actual Value vs. Modeled Values for Time Model

Table 4.17 Validation Result, Work Growth.

| Observation | Ci | Ei |
|---|---|---|
| 1 | 118 | 111.346 |
| 2 | 114 | 99.746 |
| 3 | 91 | 109.16 |
| 4 | 115 | 112.716 |
| 5 | 70 | 94.426 |
| 6 | 107 | 115.752 |
| 7 | 96 | 81.934 |
| 8 | 118 | 101.096 |
| 9 | 121 | 97.74 |
| 10 | 90 | 149.99 |
| | AIP (%) | 19.8 |
| | AVP (%) | 80.2 |

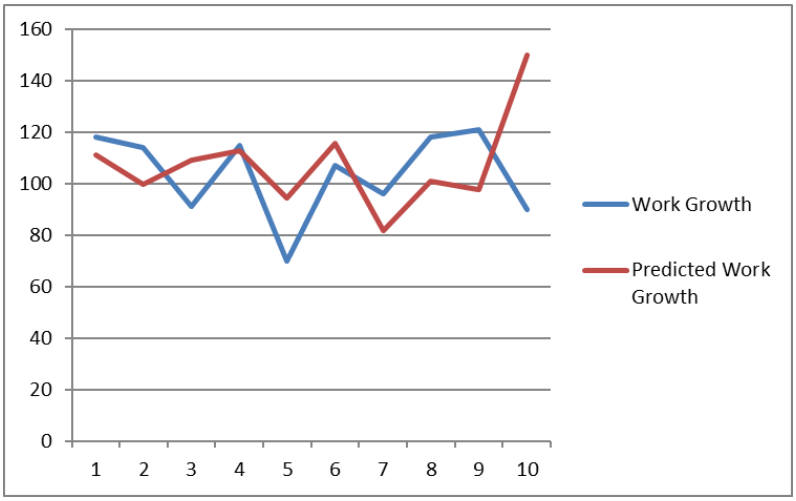



Figure 4.19 Actual Value vs. Modeled Values for Work Growth

Table 4.18 Validation Result, Cont. Satisfaction.

| Observation | Ci | Ei |
|---|---|---|
| 1 | 5 | 5.741 |
| 2 | 6 | 7.142 |
| 3 | 6 | 5.269 |
| 4 | 8 | 10.176 |
| 5 | 7 | 5.067 |
| 6 | 8 | 10.141 |
| 7 | 8 | 9.202 |
| 8 | 9 | 9.149 |
| 9 | 8 | 8.805 |
| 10 | 5 | 7.519 |
| | AIP (%) | 20.5 |
| | AVP (%) | 79.5 |

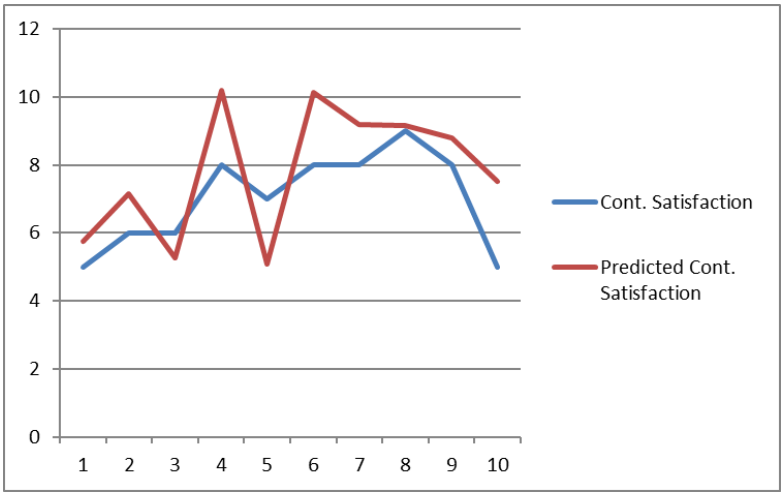



Figure 4.20 Actual Value vs. Modeled Values for Cont. Satisfaction

Table 4.19 Validation Result, Bid Growth.

| Observation | Ci | Ei |
|---|---|---|
| 1 | 135 | 162.63 |
| 2 | 112 | 134.24 |
| 3 | 100 | 72.71 |
| 4 | 88 | 75.89 |
| 5 | 119 | 113.69 |
| 6 | 130 | 140.07 |
| 7 | 127 | 130.58 |
| 8 | 112 | 76.64 |
| 9 | 115 | 132.55 |
| 10 | 88 | 85.35 |
| | AIP (%) | 14.6 |
| | AVP (%) | 85.4 |

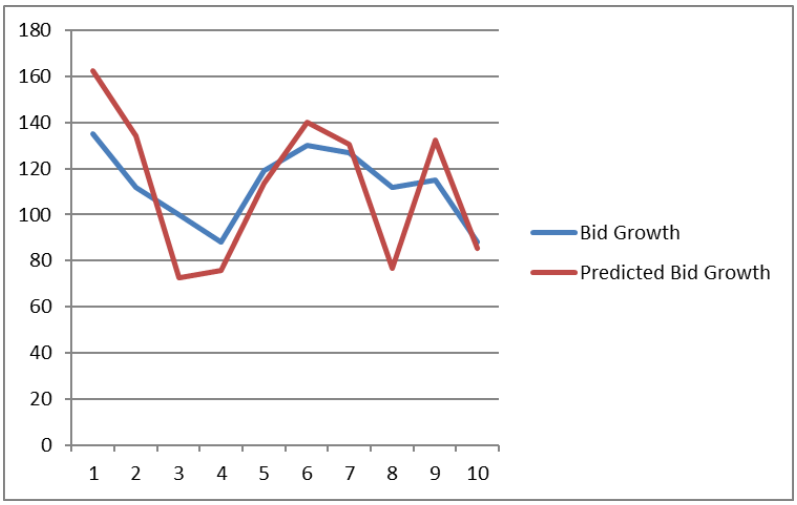



Figure 4.21 Actual Value vs. Modeled Values for Bid Growth

## 4.9 Summary

This chapter described the obtained data analysis utilizing the AHP decision-making method and the linear regression modeling technique. The contents of this chapter encompassed data assessment and checking the data appropriateness for the proposed methodology analytical techniques. In addition, this chapter includes the sensitivity analysis and statistically evaluation of the results to verify and validate the developed models.

# CHAPTER 5. SUMMARY, CONCLUSTION, AND RECOMMENDATION FUTURE STUDIES

## 5.1 Summary

The post-conflict condition results from a civil war or other internal conflicts; the need for reconstruction and economy recovery is crucial in post-conflict condition. The post-conflict state is a complicated situation where in addition to political and security problems, many social and economic challenges threats economic recovery and the country development. Construction companies with other entities for instance telecommunication, banking, and logistics companies are the leading entities, which enter the market in the early stages of the post-conflict condition to gear up the country to reconstruction and development. However, there are many challenges and constraints with some opportunities to the construction organizations in a post-conflict situation, and these challenges are insufficiently addressed in the construction management literature. Therefore, this study focused on the effects of post-conflict environment factors on local construction organization performance. This research presented a framework to develop performance prediction model to examine the impact of post-conflict environment factors on construction organization performance. The objective of this study was to explore the relationship of post-conflict environment and organization performance to formulate success strategy in a post-conflict condition. The framework of this research comprised four essential phases: identify post-conflict environment impacting factors, identify key performance indicators (KPIs), assess critical success factors (CSFs), determine CSFs and formulate the best strategy to improve performance. Analytical hierarchy process (AHP) and multiple linear regression (MLR) modeling technique were applied to analyze quantitative and qualitative variables obtained from the literature and expert experiences through a comprehensive literature search and survey questionnaire.

## 5.2 Conclusion

The study result indicates that the effect of the task and the general environment in a post-conflict condition on organization performance is significant. The research finding shows that performance measures of the project cost had substantial significance in modeling performance compare to other performance measures. The project performance duration predictability had the second and the annual work growth rate had the third prioritized weight from the five identified measures to characterize organization performance success and failure in a post-conflict condition shown in table 4.6. In addition, the consistency analysis demonstrates that there are logical consistency and reliability amongst the compared measures since the consistency index is smaller than (CI< 0.1). Thus, in post-conflict condition, the project cost at completion and quick project completion is always a matter of concern of the organization management team.

Moreover, from the sensitivity analysis and results, it is concluded that fifteen critical factors from the survey questionnaire presented in table4.14 have a significant impact on the organization performance. Based on the CSFs ranking in table 4.14, the competition opportunities for local construction companies are rough in a post-conflict condition, which means there are not equal opportunities for all local construction companies. The unskilled technical workforce is the second biggest problem facing local construction organization in a post-conflict environment. The third challenge for local construction companies is the availability of the work, and it is more dependent on the international company's investment. However, in the early stage of post-conflict condition, international community and other international bilateral organizations provide significant aids and financial support to help the suffered country, which creates essential business opportunities to the international and local companies (Del Castillo, 200; Bray, 2005; World Bank, 2005; Earnest, 2015). Construction opportunities and the substantial amount of available money in the post-conflict situation attract international construction companies with experience to invest,

and their early move in helps foreign companies to have repeated business with good profitability (Bray, 2005). The local companies initiate and enter the market after the foreign companies entering the market with a lack of strategy, small capital, deskilled labors, and no experiences (World Bank report, 2005). Thus, that is another reason that highlights the importance of the international company's investment into the local construction companies, which are associated with the international organizations and donor countries financial aids. However, in post-conflict condition, insufficient attention being paid to help the local construction industry to sustain after the exit of international companies from the construction market. The remaining other CSFs that challenge the local construction organization performance in a post-conflict condition is generalized as Insecurity, financing problems, corrupt and out of date administrative system. The CSFs resulting from the impact of the post-conflict situation needs to be addressed while formulating organizational success strategy.

In addition to the challenges of the post-conflict condition, there are some opportunities for local construction organization such as a high rate of return on investment and easy criteria of interning the market. Moreover, uncompetitive quality and market structure is another reason that some companies see it as an opportunity to stay in the market while well-established companies see it as a challenge to their performance since it affects organizational success negatively.

Analytical hierarchy process (AHP) and multiple linear regression (MLR) modeling technique have been used to analyze quantitative and qualitative variables obtained from the literature and experts' experiences. From the proposed methodology and assessment of the obtained data, it is concluded that in this study the AHP decision-making method and MLR techniques are suitable tools to develop a performance prediction model. The established model is further verified and validated using 10% of the collected data where average validity percent of

the models (AVP) were between 75 to 89 % which means the developed models have rational applicability. Ranked CSFs implies that the general environment in post-conflict condition has a more significant impact on organization performance than non-conflict condition since the economic and political factors are more unstable in a post-conflict situation than non-conflict condition. Also, in post-conflict countries, the task environment of the construction industry is not well established since many construction organizations are newly entering the market and that makes them unable to track and benchmark their competitors' performance based on their task environment.

Finally, the developed models and identified CSFs in a non-conflict environment are substantially different from the CSFs, which are resulting from a post-conflict condition. Therefore, industry practitioner and academic scholars in a post-conflict situation of the external environment need to consider the impact of the post-conflict condition on local construction organization while identifying CSFs and formulating success strategy. Studying the effects of the post-conflict situation CSFs on organization performance will help the policymakers and the industry practitioners to develop a competitive success strategy and to improve organizational performance within that environment.

## 5.3 Potential Limitations

Limitations of this study are:

- From the literature review and expert experiences, a total twenty-nine post-conflict condition impacting factors are identified while some of these factors are generalized from sub-similar factors. In addition, there is still a probability that some factor could be left out.
- The data is obtained from one specific geographical location (Afghanistan) which might not be applicable totally to another post-conflict country because of the differences in geopolitical condition, duration of the conflict, culture, population, availability of the resources, workforce skills and other differences between the post-conflict countries.
- The survey questionnaire was sent to more than 500 companies stationed in big cities in Afghanistan, 84 filled questionnaires were received from which only 51 questionnaires were usable, and these 51 filled questionnaires were used to build the performance prediction model in a post-conflict condition.
- The surveyed companies were not differentiated based on their type, size, and structure, and the survey participants were from the different functional positions and departments of the surveyed firms.
- The best-subset function of Minitab software for the MLR analysis provided multiple sets of variables that predict organization performance with different predictors, and therefore, a predictor in one best subset with significant contribution could be a minor contributor in another best subset. Thus, the aim was to select the best subset with highest R-square adjusted and having the minimum number of predictors with the P-value smaller than 0.15.

## 5.4 Recommendations and Future Work

The developed model predicts construction organization performance in post-conflict condition. And, these recommendations will improve the precision of the developed model prediction in a post-conflict condition:

- Use a simple numerical scale to rate the impact of post-conflict environment on identified qualitative and quantitative performance measures, for instance, use Likert scale or build your own having negative and positive values;

- The post-conflict environment factors negative and positive impact on an organization performance needs to be differentiated by different numerical values while rating the affect of these factors;

- It is important that the survey participant rate the factors according to its effect on the relevant performance measure and the factor perceived impact on the company performance rather than considering it in general;

- For future work and research, differentiating companies based on its size, type, structure, and the survey participant functional role probably will add to the precision of performance predicting model; and

- The shortlisted critical success factors can be further validated by utilizing deferent approaches and by applying this framework and model in a different location.

- In addition, future research needs to focus on Identifying critical success factors of international companies in the post-conflict environment and compare it to the local construction companies CSFs to determine the consistency and variability of the CSFs between the international and local construction organizations.

# APPENDIX A. SURVEYS

Over View

Many post-conflict environment factors may have impact on construction organization performance. These factors could be political, economic, technological, legal, social, and cultural. The identification of effect and weight of these factors on construction organization performance is essential since it can be used to define critical success factors for construction organization to analyze and evaluate the challenges and opportunities caused by different external environmental factors in the construction industry and to formulate competent strategy in organizational level in different environmental situations to increase efficiency.

As subject matter expert, webelieve that your judgment and expertise in filling the following tables will help us to classify and identify critical success factors and determine their weights which can assist academic researcher to develop performance prediction model and industry practitioner to formulate competent strategy in organizational level in different environmental situations toincrease efficiency.

*Q1.2.*
Type of Construction

- ○ Building
- ○ Road
- ○ Other [ ]

*Q1.3.* Position in company

*Q1.4.*
Main Factors Definitions:

| Measure | Defination |
|---|---|
| Cost Predictability | the prediction of construction project cost plus associated cost( administrative cost, indirect cost). |
| Time Predictability | the prediction of project performance period plus associated time required for NTP, invoice payment , project handover. |
| Volume of work growth rate | Company gross annual contract amount growth. |
| Contractor Satisfaction | Contractor Satisfaction in Biding process, contract award, Bid security, change order, payment warranty. |
| Bid growth | firm annual growth in number of Biding projects |

*Q1.5.* Based on scale of 1 to 5, Please rate the importance of bellow metrics compare to each other for your organization.

| | Choose the more important one | | | Choose one | | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | Equal | Extremely important 5 | Very important 4 | Moderately important 3 | Slightly important 2 | Both equal 1 |
| A. Cost Predictability B.Time Predictability | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A. Cost Predictability B.work growth rate | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| A. Cost Predictability B.Contractor Satisfaction | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A. Cost Predictability B.Bid growth | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A. Time Predictability B.work growth rate | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A. Time Predictability B.Contractor Satisfaction | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A. Time Predictability B.Bid growth | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A.work growth rate B.Contractor Satisfaction | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A.work growth rate B.Bid growth | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A.Contractor Satisfaction B.Bid growth | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

*Q1.6.*
Please provide answer to the following performance indicators

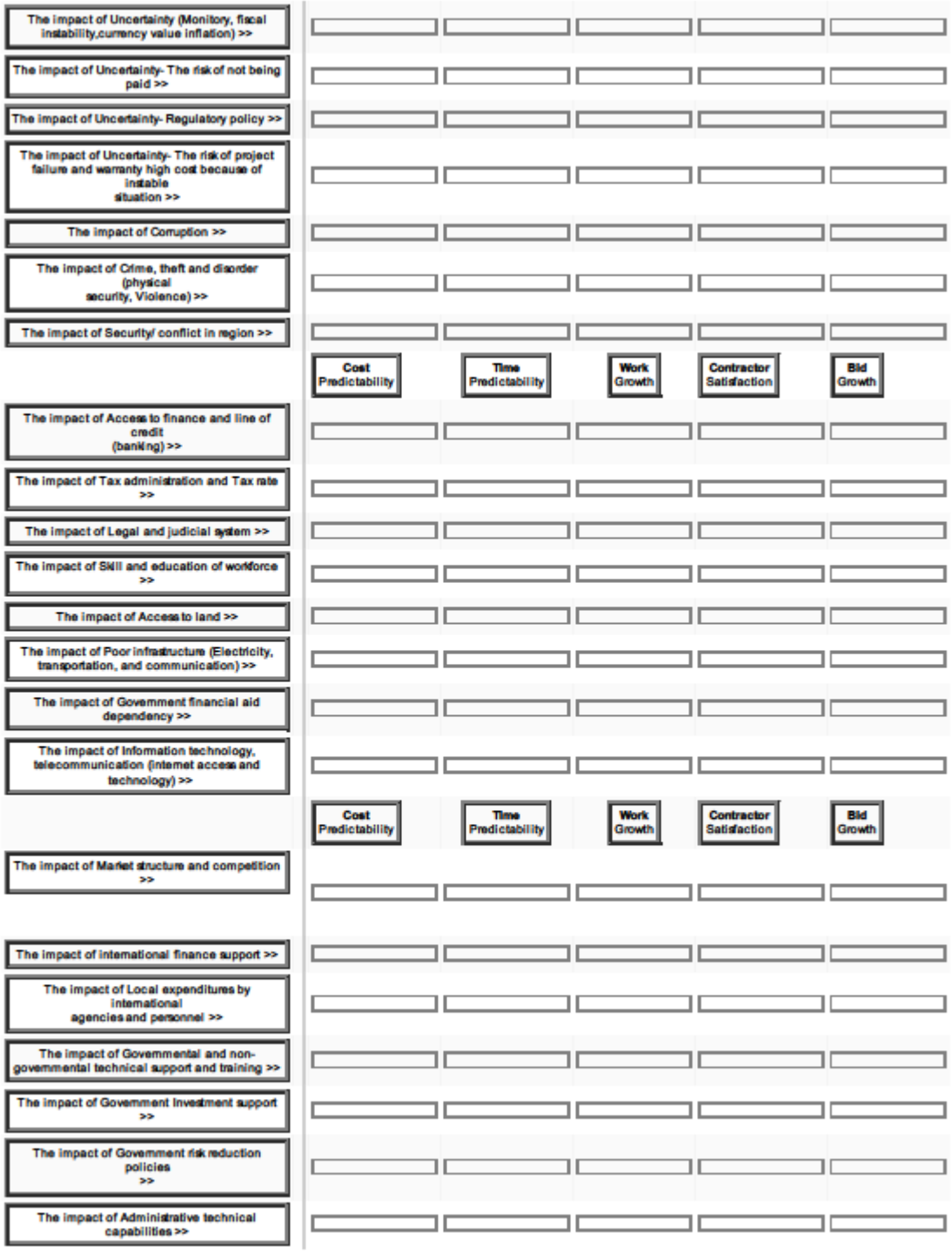
| | |
|---|---|
| Cost Predictability in% | (Number of projects completed under or on budget )/(Total number of projects ) x100% |
| Time Predictability in % | (Number of project completed on or ahead of time )/(Total number of projects ) x100% |
| Work growth in % | (Average number of Construction projects in the past three years- Average number of all construction projects)/(Average number of all construction projects) .100% |
| Contractor Satisfaction: Rate it in scale 1-10 | Biding process and award, Bid security, change order, Payment, warranty: |
| Bid growth in % | Average bid documents received in past 2 years - Average bid documents received annually / Average bid documents received annually *100 |

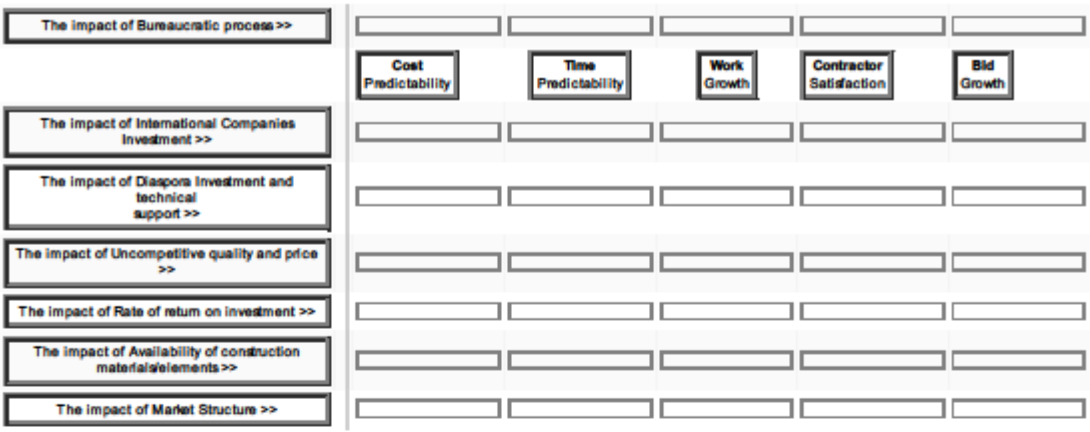
| | |
|---|---|
| Predictability Time in % | |
| work growth in % | |
| Contractor Satisfaction in scale 1-10 | |
| Bid growth in % | |
| Cost Predictability in% | |

*Q1.7.* Please rate the impact of bellow factors in scale -3 to +3 on provided performance indicators:
Extremely good = +3 Neither good nor bad = 0 Slightly bad = -1
Moderately good= +2 Moderately bad = -2
Slightly good = +1 Extremely bad = -3

**Please consider the impact of right side rows on the title of the each cell-column, and fill each cell with a number provided above from -3,-2,-1,0,1,2 to 3.**

| | Cost Predictability | Time Predictability | Work Growth | Contractor Satisfaction | Bid Growth |
|---|---|---|---|---|---|
| The impact of Anticompetitive behavior on >> | | | | | |


The impact of Uncertainty (Monitory, fiscal instability,currency value inflation) >>
The impact of Uncertainty- The risk of not being paid >>
The impact of Uncertainty- Regulatory policy >>
The impact of Uncertainty- The risk of project failure and warranty high cost because of instable situation >>
The impact of Corruption >>
The impact of Crime, theft and disorder (physical security, Violence) >>
The impact of Security/ conflict in region >>
Cost Predictability
Time Predictability
Work Growth
Contractor Satisfaction
Bid Growth
The impact of Access to finance and line of credit (banking) >>
The impact of Tax administration and Tax rate >>
The impact of Legal and judicial system >>
The impact of Skill and education of workforce >>
The impact of Access to land >>
The impact of Poor infrastructure (Electricity, transportation, and communication) >>
The impact of Government financial aid dependency >>
The impact of Information technology, telecommunication (internet access and technology) >>
Cost Predictability
Time Predictability
Work Growth
Contractor Satisfaction
Bid Growth
The impact of Market structure and competition >>
The impact of International finance support >>
The impact of Local expenditures by international agencies and personnel >>
The impact of Governmental and non-governmental technical support and training >>
The impact of Government investment support >>
The impact of Government risk reduction policies >>
The impact of Administrative technical capabilities >>


The impact of Bureaucratic process >>
Cost Predictability
Time Predictability
Work Growth
Contractor Satisfaction
Bid Growth
The impact of International Companies Investment >>
The impact of Diaspora Investment and technical support >>
The impact of Uncompetitive quality and price >>
The impact of Rate of return on investment >>
The impact of Availability of construction materials/elements >>
The impact of Market Structure >>

# APPENDIX B. INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL

APPENDIX B. INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL

PURDUE
UNIVERSITY

HUMAN RESEARCH PROTECTION PROGRAM
INSTITUTIONAL REVIEW BOARDS

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| | |
|---|---|
| **To:** | EMAD ELWAKIL<br>KNOY |
| **From:** | JEANNIE DICLEMENTI, Chair<br>Social Science IRB |
| **Date:** | 05/07/2018 |
| **Committee Action:** | **IRB Review Not Required** |
| **IRB Protocol #:** | 1804020521 |
| **Study Title:** | Modeling Construction Organization Performance in Post-Conflict Environment |

Thank you for your submission. We have reviewed the above-referenced project and determined that it does not meet the definition of human subjects research as defined by 45 CFR 46. Consequently, it does not require IRB review. If the project changes scope such that it may become human subjects research in the future, please contact us.

You are required to retain a copy of this letter for your records. We appreciate your commitment towards ensuring the ethical conduct of human subjects research and wish you luck with your project.

Ernest C. Young Hall, 10th Floor - 155 S. Grant St. - West Lafayette, IN 47907-2114 - (765) 494-5942 - Fax: (765) 494-9911

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