CRITICAL SUCCESS FACTORS AFFECTING QUALITY, COST AND TIME CONTROL IN CONSTRUCTION PROJECTS

By

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CERTIFICATION OF APPROVAL

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Approved by,

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Ir. Dr. Idris Bin Othman

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project. The original work of this project is my own except as specified in the acknowledgements and references, and that the original work contained herein have not been undertaken or done by unspecified persons.

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AIN SYAFINAZ BINTI SAMSURI

ABSTRACT

To date, the clients of the construction industry are primarily concerned with quality, time and cost. The majority of construction projects are obtained on the basis of just two of these parameters, in particular time and cost. In order to plan and manage a successful project, the three parameters of time, cost and quality ought to be considered. For time, timely completion of a construction project is often seen as a major criterion of project success by clients, contractors and consultants alike. They announced that the industry will transform by 2020 by improving its quality, safety, environmental sustainability and productivity. This action highlights the importance of quality, cost and time control in construction and acknowledging it as one of the critical factors in successful construction project completion. Construction projects are constantly anticipated to create a balance between cost, time and quality. It is possible to have high quality and low cost, however at the expense of time, and conversely to have high quality and a fast project, but at a cost. High quality is not generally the essential target for the client; however, it is critical to gain a successful project. The cost due to failure, appraisal and prevention are three major cost categories that could be directed by low quality. Therefore, a good project management in managing quality, cost and time control is required to ensure the project to be successful. By identifying factors affecting cost, quality and time control, it will help in increasing the level of effectiveness of those factors in construction projects. Thus, the objectives of this research are to identify the factors that affect the effectiveness of quality, cost and time control in real construction projects. This research is emphasizing on the case study of the on-going high rise building construction project in a construction company in Malaysia. To ensure the objectivity of the data, data collection was captured by comprehensive data gathering from the contractors, consultants and client type of companies. For this research, a case study utilizing questionnaire and data analysis method are used in order to analyse the factors affecting the effectiveness of quality, cost and time control in the construction companies. The identification of the related factors and analysis will help in minimizing the future occurrences of risks in a building construction projects.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Effectiveness, on the other hand refers to doing the right things, i.e. selecting and focusing on producing an output that there is a demand for. The clients of the construction industry are primarily concerned with quality, time and cost. The majority of construction projects are obtained on the basis of just two of these parameters, in particular time and cost (Bennett and Grice, 1990). This is understandable since the majority of project management control systems highlight time and cost, and overlook the relative importance of quality (Hughes and Williams, 1991). It is claimed by Herbsman and Ellis (1991) that the real failings in traditional approaches to project delivery have been in extensive delays in the planned schedules, cost overruns, significant issues in quality, and an expansion in the number of claims and litigation related with construction projects.

In order to plan and manage a successful project, the three parameters of time, cost and quality ought to be considered. For time, timely completion of a construction project is often seen as a major criterion of project success by clients, contractors and consultants alike. Newcombe et al. (1990) note that there has been universal criticism of the failure of the construction industry to deliver projects in a timely way. NEDO (1983) states that a disciplined management effort is needed to complete a construction project on time, and that this concerted management effort will help to control both costs and quality. For cost overruns, in association with project delays are frequently identified as one of the principal factors leading to the high cost of construction (Charles and Andrew, 1990). For quality, to the client, quality may be defined as one of the components that contributes to “value for money” (Flanagan and Tate, 1997).

Construction projects are always expected to create a balance between cost, time and quality. It is possible to have high quality and low cost, however at the expense of time, and conversely to have high quality and a fast project, but at a cost. High quality is not always the primary objective for the client; however, it is extremely important to a successful project. Despite the fact that, enhancing quality is not always the main objective of the project; the low quality could create cost to organisation. The cost of poor quality refers to the costs associated with providing poor quality product or service. The cost due to failure, appraisal and prevention are three major cost categories that could be directed by low quality.

Pursuant to the growth and stability of the construction industry, the Malaysian government announced that the industry will be transformed by 2020 through improvements in the various areas of the sector including quality, safety and professionalism, environmental sustainability, productivity and internationalization. (ITE Build & Interiors, 2015; Business Year, 2016). This action highlights the importance of quality in the sector and acknowledged quality as one of the critical factors of a successful completion of construction project.

Quality in construction project can be regarded as the expectations fulfilment for the project participants (Ashokkumar.D, 2014). Quality too can be defined as meeting the functional requirements, aesthetic and legal of a project based on Mallawaarachchi H. et al.(2015). Regardless the subjective definition and meaning of quality, it is vital in construction project because it involves directly with cost. As example, contractors are often needed to do re-work portions of the project during construction because of inadequate quality (Kakitahi et al. 2011; Hwang et al. 2009). This will induce overhead cost on the extra work and also increase the time to complete the projects.

Moreover, according to Ashokkumar D. (2014), if the quality outcomes of the projects are not according to the required standards, faulty construction will take place. Consequently, additional investments required for removal of defects and maintenance work. In his study also stated that, combination of "poor workmanship" and "design" in the construction process form more than 90% of the total failure events based on survey by NEDO (National Economic Development Office), London aimed at improving methods of quality control for building works. This study also in line with Feigenbaum (1993) when he claimed that quality has remained as the first amongst factors used to determine the degree of failure or success of a project.

Therefore, quality management system has to be adopted in the construction company. The quality management concept is to assure that efforts are done to achieve certain quality level for a product in an organized manner. Based on the perspective of the construction company, quality management in construction projects means maintaining the construction works quality at a certain level of requirement to attain satisfaction of customers which would cause long term competitiveness and business survival for the companies (Tan & Abdul-Rahman, 2005).

Kanji & Wong, (1998) as cited in Hoonakker (2006, p.1) agreed to the view that quality management has been adopted increasingly as a way to solve quality problems by construction companies and to meet the final customer's need. In other words, based on the review by researchers quality management system adoption in the management level of construction industry could reduce the quality failure and save cost – time factors indirectly.

Research studies investigating the reasons why projects fail, for instance Morris and Hough and Gallagher provide lists of factors believed to contribute to the project management success or failure as stated by Atkinson R. (1999). In the meantime, a few criteria against which projects can be measured are available, for instance cost, time and quality often referred to as The Iron Triangle, Figure 1.1.

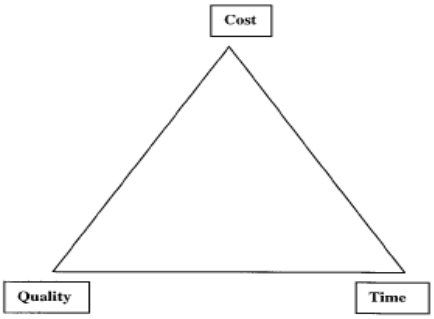


FIGURE 1.1: The Iron Triangle (Atkinson R., 1999)

Could it be the reason some project management is named as having failed results from the criteria used as a measure of success? The questions then become: what criteria are utilized and what other criteria could be utilized to measure achievement? This investigates the existing criteria against which project management is measured and proposes another approach to consider success criteria, called the Square Route. First, who should decide the criteria? Struckenbruck considered the four most important stakeholders to choose the criteria, were the project manager, top management, customer-client, and the team members.

1.2 Problem Statement

Many have underestimated the quality to finish the project by the dateline which will influence the cost of the project later on. They thought quality is insignificant in construction when in fact it is considered as one of the greatest risk in construction project which influence the cost, schedule and safety. In construction industry, if the buildings constructed in low quality, deconstruction and reconstruction will involve.

For instance, the quality of the building turns into an issue when many accidents occurred related to the building failure such as building collapse. So, many criticisms received from public about this quality of the building. When inspections of buildings were done, those things that did not pass the inspection will need to be reconstructed back. So, this will increase the cost utilized for the projects and also extend the time to complete the project.

Proper project management are needed to make the projects to be successful which involving the management of cost, quality and also time. With excellent construction project quality planning, all possible risk of low quality buildings, high cost and also extension of time could be prevented. So, the factors that caused those risks have to be recognized.

Therefore, by recognizing the factors that influence the quality, cost and time control of construction projects, it will acquire more successful construction projects management in the future later.

1.3 Research Questions

Research questions as below:-

i) What are the factors influencing the quality, cost and time control at construction projects?

ii) How are the connection between clients, consultants and contractors with respect to quality, cost and time control management for successful completion and sustainable construction projects?

1.4 Objectives

. The aim of this study is to discover the factors that affects quality, cost and time control at construction projects for successful completion and sustainable construction projects with the utilization of optimization of activities and sustainability performance investigation during construction stages through analyzing case study project and personal interview with project team from government and private sectors. The objectives are outlined as below:

1. To distinguish and rank its factors affecting the quality, cost and time-control during the construction phases which affect successful completion and sustainable construction project based on relative importance index (RII) with correlation between construction practitioners.

2. To validate the factors and construction practitioners' practices that affecting the quality, cost and time control during the construction phases through the application of case study project.

3. To propose an effective project management framework suitable for industrial practitioners to enhance the management of quality, cost and time control in construction project.

1.5 Scope of Study

This research is to determine, rank and investigate the factors affecting the quality, cost and time control at construction projects based on the actual case studies of a high-rise building construction project. The application of gap system in this research has a tendency to improve the validity of it through identifying the relative factors that may have not been investigated yet by past researches. The study focuses on these contractors' practitioners including; (i) engineer and (ii) site supervisor. The ranked factors are then further discussed and examined through personal interview and survey form for 31 respondents in order to acquire more information regarding their quality, cost and time control management on real site condition.

1.6 Case Study Details

The case study was on a high rise building project. The project's objective is to build 198 units of 8 storey low cost apartment on Lot PT 4112, PT 4138, PT 4167 and PT 4165 at Bandar Darulaman, Jitra, Kedah Darul Aman. The details of the project are as shown in table 1.1 below:

TABLE 1.1: Project Details

Project Name	CADANGAN PEMBANGUNAN APARTMENT KOS RENDAH TAMAN TUNKU INTAN SAFINAZ (FASA-1) DI ATAS LOT PT 4112, PT 4138, PT 4167 DAN PT 4165, BANDAR DARULAMAN, DAERAH KUBANG PASU, KEDAH DARUL AMAN.
Location	Bandar Darulaman, Daerah Kubang Pasu, Kedah Darul Aman
Client	BDB Land Sdn Bhd
Consultants	Surveyor :JUB Ikatan Sepakat Sdn Bhd Project Management: APUDG Architect :Rushdan Md Salleh Sdn Bhd C&S Consultant :Perunding Timur (K) Sdn Bhd M&E Engineer : Sarjana Jurutera Perunding Sdn Bhd
Contractor	Main Contractor : BDB Synergy Sdn Bhd Sub Contractor : Fauzi Haji Idris Sdn Bhd

FIGURE 1.2: Low Cost Apartment Taman Tunku Intan Safinaz Construction Site

1.7 The relevancy of project

Construction projects are always anticipated to create an equivalent between cost, time and quality. It is possible to have high quality and low cost, however at the expense of time, and conversely to have high quality and a fast project, but at a cost. However, many have underestimated the quality to finish the project by the dateline which will influence the cost of the project later on which will resulted in the low quality of buildings that may lead to building collapse.

To conclude, it is necessary for the industry to enhance the management of quality, cost and time control in construction projects. This is important to cause less harm to the environment, society and economy. The identification of the factors and construction practitioners' practices that influence quality, cost and time control in construction projects and its analysis outcome could be relevant and useful towards the successful completion of the construction projects.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview of Quality, Cost and Time Control in Construction Project

According to Mallawaarachchi H.et.al. (2015), construction projects are always expected to create a balance between cost, time and quality. It is possible to have high quality and low cost, but at the expense of time, and conversely to have high quality and a fast project, but at a cost. High quality is not always the essential target for the client; however, it is critical to a successful project. Arditi D.et.al. (1997) stated that great expenditures of time, money and resources, both human and material, are wasted each year because of inefficient or non-existent quality management procedures. In the 1950s and 1960s, owners became increasingly concerned with cost and schedule, areas where design professionals were not providing good control. At about the same time, the widespread use in the public sector and, to a large degree, in the private sector, of the sealed competitive bid gave the owner the advantage of competitive pricing, but also forced the general contractor to look for every advantage during construction to control cost and maintain a profitable stance.

In line with what has been stated by Bowen P.A. et.al. (2012), in order to plan and manage a successful project, the three parameters of time, cost and quality should be considered. For time, a disciplined management effort is needed to complete a construction project on time, and that this concerted management effort will help to control both costs and quality. While for cost, cost overruns, in relationship with project delays, are frequently distinguished as one of the essential variables leading to the high cost of construction. Babu A.J.G. et.al. (1996) evaluated that successful project management insures the completion of project in time, within budget, and to the project

specifications. The quality of a completed project may be influenced by project crashing. According to Rahman I.A. et.al. (2013), once a construction projects fails in achieving effective cost effective cost performance, it will result to cost overrun. Therefore, cost performance is also the most important indicator of project success.

2.2 Factors Affecting Quality, Cost and Time Control In Construction Projects

Various studies have been conducted with regard to quality, cost and time control at the construction projects. Mallawaarachchi H.et.al (2015) mentioned that quality is one of the critical factors in the success of construction projects. Design and construction are the two vital phases of project life cycle which influence the quality result of construction projects crucially. Management commitment and leadership in construction organizations could affect construction quality. It is because, the poor management practices directly and indirectly lead to decline of construction productivity and ultimately effect on project quality. The poor quality could create cost to organisation such as due to failure; appraisal and prevention which are three major cost categories that could be directed by poor quality.

According to Rahman I.A et.al. (2013), the main 3 most significant factors of cost overrun are fluctuation of prices of material, cash flow and financial difficulties confronted by contractors and poor site management and supervision. The fluctuation of prices of material is due to monopoly of suppliers or unavailability of construction materials locally. Price fluctuation is also contributed from instability and inflationary rate of a country. This may be due to demand exceeding supply or accentuated by the creation of an artificial scarcity of goods. Adequate cash flow and financial stability of contractors is extremely basic in keeping construction progress as planned. Poor site management and supervision factor is focusing more towards contractor group. It reflects the weakness and incompetence of contractors (Le-Hoai et al., 2008) and affects significantly on the cost performance (Ali and Kamaruzzarnan, 2010).

Al-Jibouri S.H (2003) stated that to be effective, a cost control system must draw the project management's attention to problem areas. The detail and reliability in which any particular system can do this may be considered as a measure of its effectiveness. Another area of indication of the efficiency of any cost control system is that of providing information to estimators. This should include cost of jobs with full descriptions of the conditions and work involved. The cost control system should also provide data for the evaluation of variations which may occur during the contract, in order to help the contractor to build up his new rates of the work according to this information. Cheng (2014) also identified that price fluctuation is another main factor for cost overruns. Arditi D. et. al. (1997) investigated that project requirements are the key factors that define quality in the process of construction.

While, the primary causes for the decline of construction productivity directly or indirectly involved poor management practices. Also, competition to meet short-term goals can lead to internal conflict, adversarial relationships, reduced communication, and accusations when goals are not achieved, and even fabricated reports of conformity. The level of management commitment to continuous quality improvement was rated as one of the most important factors that affect the quality of the constructed facility. Findings are parallel to ISO 9001 which emphasizes the significant of training and underlines that activities demanding acquired abilities ought to be recognized and necessary training to be provided. Besides that, "extent of teamwork of parties participating in the design phase" was found to be the most important factor that affects quality in Gunaydin's study of TQM in US construction projects. Statistical methods also are very important for manufacturing industries in order to improve quality. According to Cleveland (1995), an accurate project cost estimate can provide a good basis for project control during construction; while inaccurate cost estimation is detrimental to both contractors and clients. Nawaz et al. (2013) work on cost performance in Pakistan listed factors that are responsible for cost overruns, to include corruption and bribery, political interests, poor site management, delay in site mobilization, rigid attitude by consultants, extra work without approvals, and frequent changes during execution.

TABLE 2.1: Gap Table of Contributing Factors Affecting Quality, Cost and Time Control in Construction Projects.

NO.	FACTORS	RESEARCHERS	KEY STATEMENT	GAP
1.	Poor Site Management And Supervision	Saad H. Al-Jibouri(2003) Ismail Abdul Rahman et. al.(2013) H.Mallawaarachchi et.Al.(2015) P.A. Bowen et. Al.(2012) A.J.G. Babu et. Al.(1996) David Arditi(1997)	Cost control system must draw the project management's attention to problem areas.	1) What can be done to prevent from having incompetence contractors? 2) What are the key elements of disciplined management effort? 3) How can we improve the capability of the contractors to manage the project? 4) What are the criteria of the inefficient quality management procedures? 5) What type of level of management that can improve the quality of the projects? 6) What is the impact of poor project management in the future?
			The weakness and incompetence of contractors affects significantly on the cost.	
			Management commitment and leadership in construction organizations could affect construction quality.	
			The importance of studying the behavioural aspects of management in attempting to address the problems facing the construction industry.	
			A disciplined management effort is needed to complete a construction project on time, and that this concerted management effort will help to control both costs and quality.	
			Successful project management insures the completion of project in time, within budget, and to the project specifications.	
			Great expenditures of time, money and resources are wasted each year because of inefficient or non-existent quality management procedures.	
			The primary causes for the decline of construction productivity directly or indirectly involved poor management practices.	
			The level of management commitment to continuous quality improvement was rated as one of important factors that affect the quality of the constructed facility.	

TABLE 2.1: Gap Table of Contributing Factors Affecting Quality, Cost And Time Control In Construction Projects(cont.)				
NO.	FACTORS	RESEARCHERS	KEY STATEMENT	GAP
2.	Detailed Information	Saad H. Al-Jibouri(2003) Zayyana Shehu et. Al.(2014)	Area of indication of the efficiency of any cost control system is that of providing information to estimators. Detailed construction programmes using advance computer packages are essential to more accurate costing of future construction projects.	1) What type of information that needed to be provided for the costing of the project?
3.	Cash flow and financial difficulties	Ismail Abdul Rahman et. al.(2013) Zayyana Shehu et. Al.(2014) Cheng(2013)	Price fluctuation is also contributed from instability and inflationary rate of a country. Adequate cash flow and financial stability of contractors is very critical in keeping construction progress as planned. Cost overruns, in association with project delays, are frequently identified as one of the principal factors leading to the high cost of construction. An accurate project cost estimate can provide a good basis for project control during construction. Inaccurate cost estimation is detrimental to both contractors and clients. The cost of quality is considered to be the primary tool for measuring quality. Final project costs have been higher than the cost estimates prepared in too many cases. Price fluctuation is another main factor for cost overruns.	1) What are the activities that affect the cost of the projects? 2) How can project delays effect cost of the projects? 3) What can be done to prevent cost overruns?
4.	Project requirement	David Arditi(1997)	Project requirement are the key factors that define quality in the process of construction.	1) How the project requirements effect the quality construction?
5.	Teamwork	David Arditi(1997)	Extent of teamwork of parties participating in the design phase was found to be the most important factor that affects quality in construction projects.	1) How to improve the teamwork skills between employees?

TABLE 2.1: Gap Table of Contributing Factors Affecting Quality, Cost And Time Control In Construction Projects(cont.)				
NO.	FACTORS	RESEARCHERS	KEY STATEMENT	GAP
6.	Training	David Arditi(1997)	The training of employees in the design phase was found to be not very important, in the construction phase moderately important and in the operation phase very important.	1) What is the type of training that should be given to employees? 2) Which employees that should be trained? 3) For how many times should the employees receive training? 4) Who are going to conduct the training to the employees?
			Findings are parallel to ISO 9001 which emphasizes the importance of training and underlines that activities demanding acquired skills should be identified and the necessary training provided.	
7.	Quality of project	H.Mallawaarachchi et.Al.(2015) P.A. Bowen et. Al.(2012) A.J.G. Babu et. Al.(1996) David Arditi(1997)	Poor quality could negatively effect to project failures.	1) What makes the quality of the project become poor? 2) What is the impact of the poor quality project in the future? 3) How can we improve the quality of the project? 4) How can poor quality project effect the cost and time of the construction project?
			Quality is one of critical factors in the success of construction projects.	
			Many construction organisations have realized quality as a key to develop their building products in supporting the continuing success.	
			The cost due to failure, appraisal and prevention are three major cost categories that could be directed by poor quality.	
			Little evidence exists of successful projects where time, cost and quality have been balanced.	
			The quality of a completed project may be affected by project crashing.	
			The quality of the project built by the constructor is directly related to the quality of the plans and the specifications prepared by the designer, the quality of the equipment and materials supplied by the vendors and the quality of work performed by the subcontractors.	
			Successful projects in the future are decided based on quality, life-cycle costs and supplier responsiveness.	

TABLE 2.1: Gap Table of Contributing Factors Affecting Quality, Cost And Time Control In Construction Projects(cont.)				
NO.	FACTORS	RESEARCHERS	KEY STATEMENT	GAP
8.	Design and construction	H.Mallawaarachchi et.Al.(2015) David Arditi(1997)	Design and construction phases of project affect the quality outcome of construction projects significantly. Owners became increasingly concerned with cost and schedule, areas where design professionals were not providing good control. Drawings and specifications received from the designer affect the quality of the construction.	1) How the design and construction phases effect the quality of projects? 2) How the drawing and specifications effect the quality of projects? 3) Why design professionals did not provide good control of the cost and schedule?
9.	Proper schedule	David Arditi(1997) Reza Aliverdi et. Al.(2012) Hameri et. Al.(2000)	A careful balance between the owner's requirements of the project costs and schedule, desired operating characteristics, materials of construction and the design professional's need for adequate time and budget to meet those requirements during the design process is essential. Earned Value (EV) measures project performance and progress by an integrated management of three most important elements in a project, namely cost, schedule and scope. The essence of using time effectively does not seem to get appropriate attention in project management practice.	1) How the balances between owner's requirements effect the construction project? 2) Does Earned Value technique improve the performance of projects? 3) What makes the time being used ineffectively?
10.	Statistical method	David Arditi(1997)	Statistical methods are very important for manufacturing industries in order to improve quality. The use of statistical method has relatively very little effect on the quality of the construction project.	1) How the statistical methods effect the quality of project?

CHAPTER 3

METHODOLOGY

3.1 Research Methodology

Methodology means the methods to be used to collect data in order to achieve the target of the research project. The main objectives of this methodology section are to show how the data was collected or generated and also how the data was analysed. This chapter 3 will discuss about how the survey questionnaire and interview for this research project were being conducted.

3.1.1 Research Purpose

The purpose of this study is to identify factors affecting the effectiveness of the quality, cost and time in construction projects and rank them. To find out about those factors, the researcher needs to study first about the current performance of project management of the Malaysian construction sector. Those will help in identifying the areas of problems so that the listing of the most common factors can be easily done.

3.1.2 Research Approach

Qualitative research is essentially exploratory research. It is utilized to gain an understanding of underlying reasons, opinions, and inspirations. It gives bits of knowledge into the issue or creates thoughts or speculations for potential quantitative research. Qualitative research is additionally used to uncover trends in thought and opinions, and dive deeper into the issue. Qualitative data collection methods vary using unstructured or semi-structured techniques. Some basic methods include focus groups (group discussions), individual interviews, and participation/observations. The sample size is normally little, and respondents are chosen to satisfy a given quota. The research approach was picked because of the purpose of study. Therefore, qualitative research has been chosen as the research approach in order to get better understanding on the purpose.

3.1.3 Research Strategy

For this research, survey and case study will be utilized as the research strategy of this study. This study purpose is to get clearer comprehension of the factors which lead to the effective quality, cost and time control management in the Malaysia construction sector. The application of research question of 'how' and 'what' will be utilized in this research for better understanding of the purpose of the study. Thus, survey and case study research strategy will help us to cater the "how" and "what" research questions by concentrating on the brief occasions without requires control over the behavioural occasion.

3.1.4 Data Collection

In this research, three sources of information have been used which are literature review, survey and interview. To find the factors affecting quality, cost and time control for successful completion of construction project; more than ten research, articles and journals being reviewed to get better understanding on the study. Next, survey questionnaire also is used to get the feedback from people about this issue. Besides that, interview is used in this study to discuss on a limited number of issues related to the study. Therefore, literature review, survey and interview are used as data collection strategy for this research. The sample of questionnaire survey form and interview from are attached in Appendix A and Appendix B.

3.1.5 Sample Selection

A single case study on the factors affecting the quality, cost and time control for successful completion of construction project was decided for sample selection. First, the sample companies were informed by email about the goal of this study. In order to fulfil the research purpose, it was important to contact the person who had the most experience and knowledge of this research such as site engineer and site supervisors. Therefore, the respondents were constrained to just contractors, consultants and clients only. A total of minimum 30 respondents had been collected for this research. Roscoe (1975) stated that in most ex post facto and experimental research, samples of 30 or more are recommended.

3.1.6 Data Analysis

The next step after gathering data was to analyze all the data obtained from the respondents through survey questionnaire and interview. To analyze the data collected, Statistical Package for Social Science (SPSS) software which could generate tabulated reports, charts, descriptive statistics, plots of distributions and complex statistical analysis from any type of data file will be used. Average Index (AI) method, Relative Importance Index (RII) and Spearman's Correlation test also will be utilized as a part of analyzing the data.

3.1.7 Average Index

To identify the most critical factor affecting quality, cost and time at construction project, the Average Index (AI) method was used and calculated using the following equation described by Abd Majid (1997):

$$Average\ Index\ (AI) = \frac{\sum (ß\ x\ n)}{N}$$

Where,

ß - weighing given to each risk factor by respondents

n - the frequency of the respondents

N - the total number of respondents

EQUATION 3.1: Average Index

Based on the Likert scale, one (1) represents very low or strongly disagree and five (5) represents high impact or strongly agree. The range between the maximum and minimum values is 4. The range is divided by 5 to represent the five classes shown in the Likert scale (strongly disagree, disagree, neutral, agree, and disagree). The calculated interval for each class is 0.8 as shown in the table 3.1 below: The categories were classified as follows:

TABLE 3.1: Average index rating scale

Average index (AVI)	Internal consistency
1.00 < x < 1.80	Very low
1.80 < x < 2.60	Low
2.60 < x < 3.40	Medium
3.40 < x < 4.20	High
4.20 < x < 5.00	Very High

The most crucial factors affecting the effectiveness of quality, cost and time at construction project based on respondents' rating is the highest value of AI.

3.1.8 Relative Importance Index (RII)

To determine the relative importance of each factors and the role of clients, consultants and contractors in this research, Relative Importance Index (RII) is used. This method is according to the relative importance indicates within the range from 1 to 4 as mentioned above. Relative Important Index is calculated for each factor using the following formula:

$$Relative\ Importance\ Inde\,x\ (RII) = \frac{\sum W}{A * N}$$

Where,

W - weighting given to each factor by the respondents (ranging from 1 to 4).
A - highest weight (i. e. 4 in this case)
N - the total number of respondents

EQUATION 3.2: Relative Importance Index

The Relative Importance Index value comprises of a range within 0 to 1. The higher the value of relative important index, the greater the impact of the factor to the effectiveness of the quality, cost and time at construction project. Subsequently, the ranking from this calculation is then used to cross compare the relative importance of the factors as perceived by the 3 selected group of respondent (clients, consultant and contractors). From this ranking, we will the most important quality factors which contribute to the effectiveness of quality; cost and time can be identified.

3.1.9 Spearman's Correlation Test

Spearman's correlation coefficient is a statistical measure of the strength of a monotonic relationship between combined data. It is a strategy to measure how closely the number/potential outcomes related. In a simple meaning, Spearman's rank correlation coefficient is a nonparametric measurement between 2 variables and subsequently is good for ranked items. The coefficient of Spearman's is suitable for discrete and continuous variables. The equation of Spearman correlation is shown as below:

$$\rho = 1 - \frac{6\Sigma d_i^2}{n\,(n^2 - 1)}$$

Interpretation;

Close to -1 : Negative correlation.

Close to 0 : No linear correlation.

Close to +1 : Positive correlation.

EQUATION 3.2: Spearman's Coefficient

3.1.10 Quality Standards

Statistical Package for the Social Sciences is defined as a windows based program that can be used to perform data entry and analysis, additionally to create tables and graphs. It is known as one of the top statistical software due to its ability to handle large amounts of data and can perform various form of analysis. It is also able to produce different sort of statistical analysis including descriptive statistics, prediction of numerical outcomes and also prediction of identifying groups. To guarantee the quality of the survey and interview conducted, the data obtained will be checked using SPSS to check its reliability and validity by Reliability Test and Validity Test.

3.1.11 Reliability Test

The Cronbach's Coefficient Alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability. A "high" value for alpha does not imply that the measure is unidimensional. In fact, Cronbach's alpha is not a statistical test – it is a coefficient of reliability (or consistency). The range of Cronbach's alpha is between 0 to +1. Where the higher the value shows the higher reliability. The Cronbach alpha coefficient value over 0.6 means that the measurement procedure is dependable (Toke et al., 2012).

$$\alpha = \frac{N * \hat{C}}{\hat{C} + (N - 1) * \hat{C}}$$

EQUATION 3.3: Cronbach's Alpha Equation (Cronbach's, 1951)

TABLE 3.2: Cronbach's Alpha Consistency

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.7 \leq \alpha \leq 0.9$	Good
$0.6 \leq \alpha \leq 0.7$	Acceptable
$0.5 \leq \alpha \leq 0.6$	Poor
$\alpha \leq 0.5$	Unacceptable

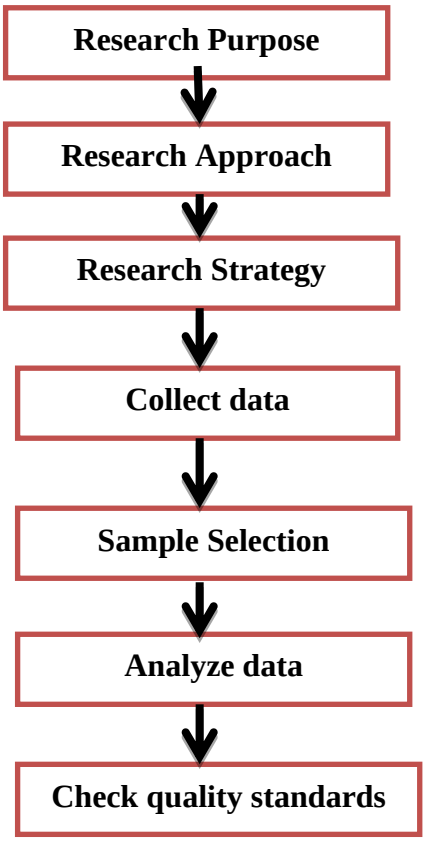
3.1.12 Validity Test

Validity is an assessment of the degree to which it measures what it is supposed to measure. The measurement does not always have to be similar in validity, as it does in reliability. The research questions were designed based on literature review that was drawn from the discussed theories. When a measure is both valid and reliable, the results will appear as in the image to the right. However, in the fact of a measure is reliable, it is not really valid (and vice-versa). The square root of the reliability of a measure provides an upper bound for its correlation with any other example, a measure with a reliability estimate of only 0.65 can never correlate greater with another test or 0.81 (Lester et. al, 2014).

$$S = \sqrt{Reliability}$$

EQUATION 3.4: Validity Coefficient

3.2 Flowchart of Methodology



3.3 Key Project Milestone

NO.	ACTIVITIES	FYP	WEEK NO.
1	Topic selection	FYP 1	1
2	Data research		1-5
3	Submission of extended proposal		6
4	Proposal defence		7-8
5	Submission of interim report		13
6	Distribution of questionnaire & interview	FYP 2	1-4
7	Data analysis		2-9
8	Submission of progress report		10
9	Pre- SEDEX		11
10	Submission of final report		12
11	Submission of project dissertation(soft bound)		13
12	Submission of technical paper		13
13	VIVA		13
14	Submission of project dissertation (hard bound)		14

3.3 Gantt Chart

TABLE 3.3: Gantt Chart for Final Year Project I

ITEMS	MAY		JUNE				JULY				AUGUST			
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
Selection of Project Title & SV														
Data Research and Gathering														
Preparation of Extended Proposal														
Submission of Extended Proposal														
Proposal Defence														
Preparation of Questionnaire														
Preparation of Interim Report														
Submission Of Interim Report Draft & Questionnaire														
Handling Survey(Questionnaire)														
Submission Of Final Report (Interim Report FYP 1)														

TABLE 3.4: Gantt Chart for Final Year Project II

ITEMS	SEPTEMBER		OCTOBER				NOVEMBER				DECEMBER			
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
Site Visit & Interviews														
Analysis of Data Collected														
Submission of Progress Report														
PRE-SEDEX														
Submission of Final Report Draft														
Submission of Project Dissertation (soft bound)														
Submission of Technical Paper														
VIVA														
Submission Of Project Dissertation (hard bound)														

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter aims to analyze and further discuss on the findings of this study. The information gathered are analysed and certain relation between the outcomes is highlighted to address the objectives of this research. The quantitative study findings are laid out both in table and text form. The questionnaire is divided into three (3) sections focusing on construction practitioners including engineer, safety and supervisor.

4.2 Feedback on the survey

A total of 31 questionnaires were administered for this survey, of which all were returned with valid responses. The questionnaires were distributed by using online form. This showed a response rate of 100%. From the results obtained, it was observed that majority of the respondents were of the opinion that they are aware of the importance the effective quality, cost and time control management in construction project in order to make the projects successful. All of the respondents' personal details such as name, email and company's name are treated confidential as stated in the form's terms and condition and agreed by respondents before answering it. Table 4.1 below shows the general information that represents the first section of questionnaire.

Table 4.1: The demographic characteristics of respondents

Items	Description	Frequency	Percentage(%)
AGE	20-29 years old	14	45.2
	30-39 years old	5	16.1
	40-49 years old	11	35.5
	More than 50 years old	1	3.23
GENDER	Male	20	64.5
	Female	11	35.5
QUALIFICATION	Master Degree	1	3.23
	Bachelor Degree	20	64.5
	Diploma	10	32.3

Table 4.1: The demographic characteristics of respondents (continued)

Items	Description	Frequency	Percentage(%)
DESIGNATION	Engineer team	13	41.9
	Safety team	3	9.7
	Supervisor	6	19.4
	Quantity Surveyor	4	12.9
	Others	5	16.1
WORKING DURATION	Less than 5 years	15	48.4
	Less than 10 years	2	6.5
	More than 10 years	14	45.2

4.2.1 Distribution of Respondents by Gender

A representation of gender of 31 respondents in the population is shown in Figure. The respondents percentage based on gender is 64.5% (Frequency = 20) male and 35.5% (Frequency = 11) female. Table 4.1 and Figure 4.1 reveal these figures in a tabular and graphical form respectively. This indicates majority of respondents who are working in the construction industries are male for this survey.

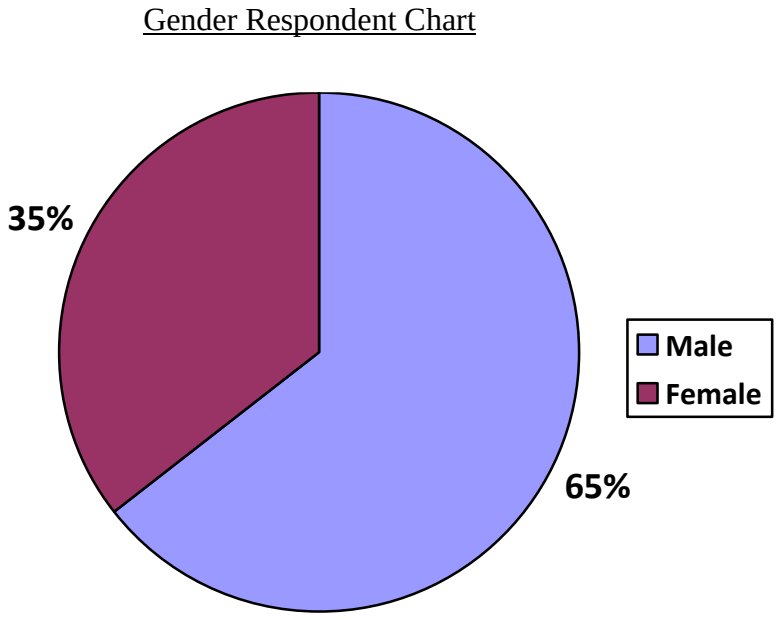


Figure 4.1: Graph of respondents by gender

4.2.2 Distribution of Respondents by Age

A representation of age in the population of 31 respondents is shown in Figure. The percentage of respondents based on age are 45.2% (Frequency = 14) 20 – 29 years old, 16.1% (Frequency = 5) age 30 – 39 years old, 35.5% (Frequency = 11) age 40-49 years old and 3.23% (Frequency=1) age more than 50 years old. Figure 4.2 reveals these figures in a pie chart form while Table 4.1 shows the data in tabular form.

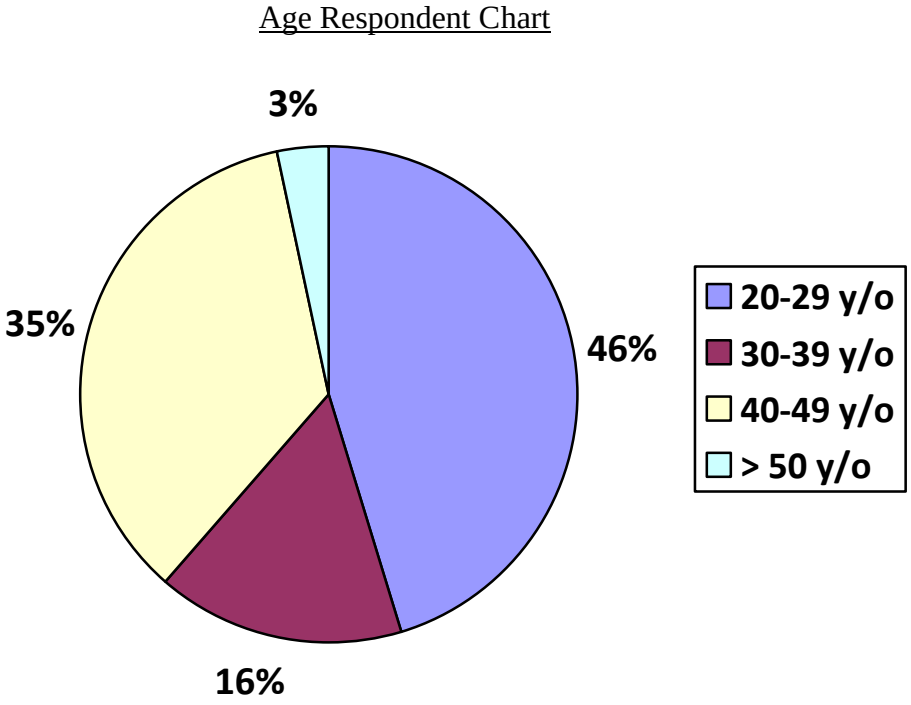


Figure 4.2: Graphical representation of respondents by age.

This shows that majority of the respondents are at their more than 5 years working experience judging by the majority age of the respondents are 30 to 39 years old and above . 45.2% of the respondents represented the employees that have less than 5 years working experience.

4.2.3 Distribution of Respondents by Academic Qualification

Majority of the 31 respondents are graduated with Bachelor Degree represented by 64.5% (Frequency = 20) followed by Diploma, 32.3% (Frequency=10) and Master degree, 3.23% (Frequency=1). This demonstrates that the respondents are educated workforce, having sufficient technical knowledge and reliable to answer the questionnaires. The graphical representation of academic qualifications is shown in Table 4.1 above and pie chart form below respectively.

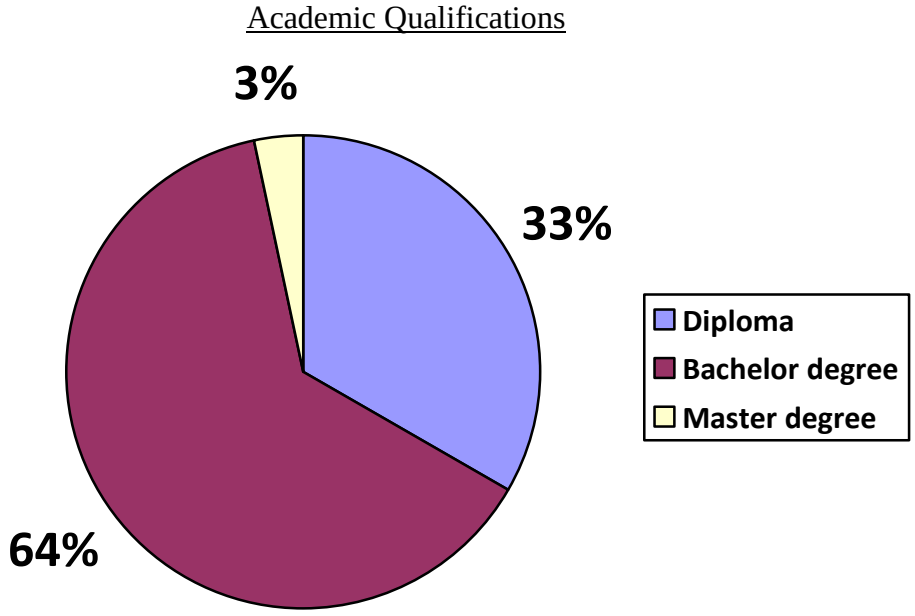


Figure 4.3: Graphical representation of respondents by academic qualifications.

4.2.4 Distribution of Respondents by Position in Company

Questionnaires were distributed among respondents in all level of the company's management. Out of the 31 respondents, the researcher managed to get 12 respondents from engineer team to answer the questionnaire representing the 38.7% of the population following by 9.7% respondents from safety team, 19.4% respondents from supervisor, 12.9% respondents from quantity surveyor and 19.4% respondents from other categories. Table 4.1 and Figure 4.4 reveal these figures in a tabular and graphical form respectively.

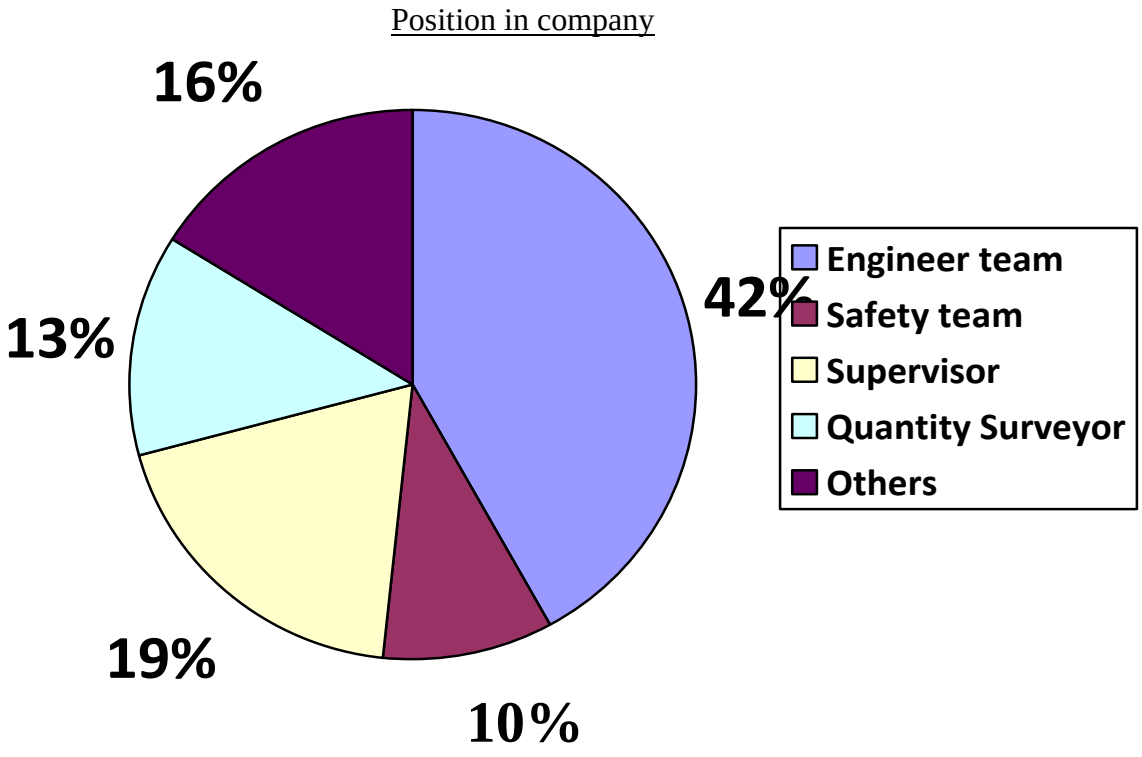


Figure 4.4: Graphical representation of respondents by position in the company

4.2.5 Distribution of Respondents by Years of Experience

Table 4.1 and Figure 4.5 both show the distribution of respondents by experience years in the industry through tabular and graphical form respectively. It was found that the respondents of more than 5 years' experience have more frequency than less than 5 years in this study which is 55%. These results showed that most of the respondents are experienced in the construction activities and operation.

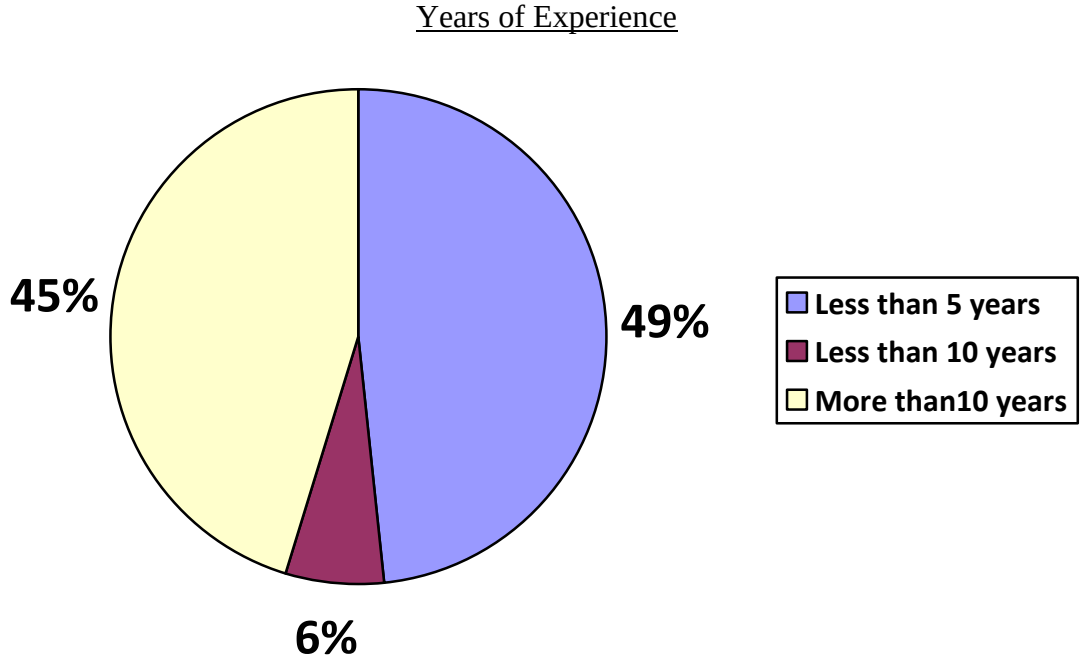


Figure 4.5: Graphical representation of respondents by years of experience

4.2.6 Correlation between contractor practitioners' perspective

The correlation test is done to determine the relationship or connection between two or more things. The test is conducted through Statistical Package for the Social Sciences (SPSS) as mentioned in chapter 3. Based on the data obtained, it is notified that the relationship between Engineer (ET) and Others group are more correlated compared to the other four (4) relationships. The value obtained for the relationship between ET and Others is 0.540 which close to 1. This indicates a positive correlation.

Table 4.2. Correlation test result

			ET	SAFETY	SV	QS	OTHERS
Spearman's rho	ET	Correlation Coefficient	1.000	.481**	.352*	.090	.540**
		Sig. (2-tailed)	.	.003	.033	.597	.001
		N	37	37	37	37	37
	SAFETY	Correlation Coefficient	.481**	1.000	.453**	.340*	.408*
		Sig. (2-tailed)	.003	.	.005	.039	.012
		N	37	37	37	37	37
	SV	Correlation Coefficient	.352*	.453**	1.000	.399*	.257
		Sig. (2-tailed)	.033	.005	.	.015	.124
		N	37	37	37	37	37
	QS	Correlation Coefficient	.090	.340*	.399*	1.000	.149
		Sig. (2-tailed)	.597	.039	.015	.	.380
		N	37	37	37	37	37
	OTHERS	Correlation Coefficient	.540**	.408*	.257	.149	1.000
		Sig. (2-tailed)	.001	.012	.124	.380	.
		N	37	37	37	37	37

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

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.3 Reliability test result

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.930	.932	37

Table 4.4 Validity test result

Validity
0.9644

The value of correlation between engineer and others group (Such as architect) is the highest compared to the other relationship. These shows that Engineer/Others group of respondents both ranked the factors similarly and have same perspectives on effectiveness of quality, cost and time control in construction projects compared to other relationships. The least correlation is identified between engineer and quantity surveyor, due to different parts of their working area, where the engineer and others group are focusing on both

technical and management of the construction site, while the other group of respondents were focusing on costing of the projects.

The result also shows that the Cronbach's alpha is 0.930, which indicates an excellent level of internal consistency (overall reliability) for the set of formulated questions in factors affecting quality, cost and time control in construction projects with the validation value of 0.9644. The results show that the questionnaires prepared are reliable and valid on the subject studies in this research.

4.3 Factors influence quality, cost and time control in construction projects

A list of quality, cost and time control related factors were adapted from the literature review and subjected to the views, knowledge and experience of respondents. They were asked to rate their responses to 12 to 13 questions on the each categories of related factors using a 5-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Moderately, 4=Agree and 4 = Strongly Agree. The outcome of the Average Index (AI) and Relative Importance Index (RII) analysis of the factors are shown in table 4.5, table 4.6 and table 4.7.

4.3.1 Group of factors

4.3.2 Quality related factors

Table 4.5: The rank of quality related factors affects quality, cost and time control in construction projects.

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
Q1.Weakness and incompetence of contractors		1	4	4	22	4.52	0.851	0.903	1
Q5.Poor site management and supervision		1	1	12	17	4.45	0.723	0.890	2
Q2.Lack of management commitment and practices		1	3	10	17	4.39	0.803	0.877	3
Q8.Lack of teamwork skills between workers	1		1	16	13	4.29	0.815	0.858	4
Q3.Lack of leadership skills	1	1	3	13	13	4.16	0.969	0.832	5
Q4.Inefficient quality management procedures and plans	1		7	10	13	4.10	0.978	0.819	6
Q12.Shortage of skilled workers	2		4	12	13	4.10	1.076	0.819	
Q10.Lack of training for employees		1	6	14	10	4.06	0.814	0.813	7
Q11.Lack of awareness on quality of construction materials used	1	1	5	14	10	4.00	0.966	0.800	8
Q9.Poor design quality		3	8	10	10	3.87	0.991	0.774	9
Q6.Lack of detailed design information	2		10	9	10	3.81	1.108	0.761	10
Q7.Lack of revision on project requirement	2	3	9	9	8	3.58	1.177	0.716	11
Q13.Frequent design changes	3	2	12	7	7	3.42	1.205	0.684	12

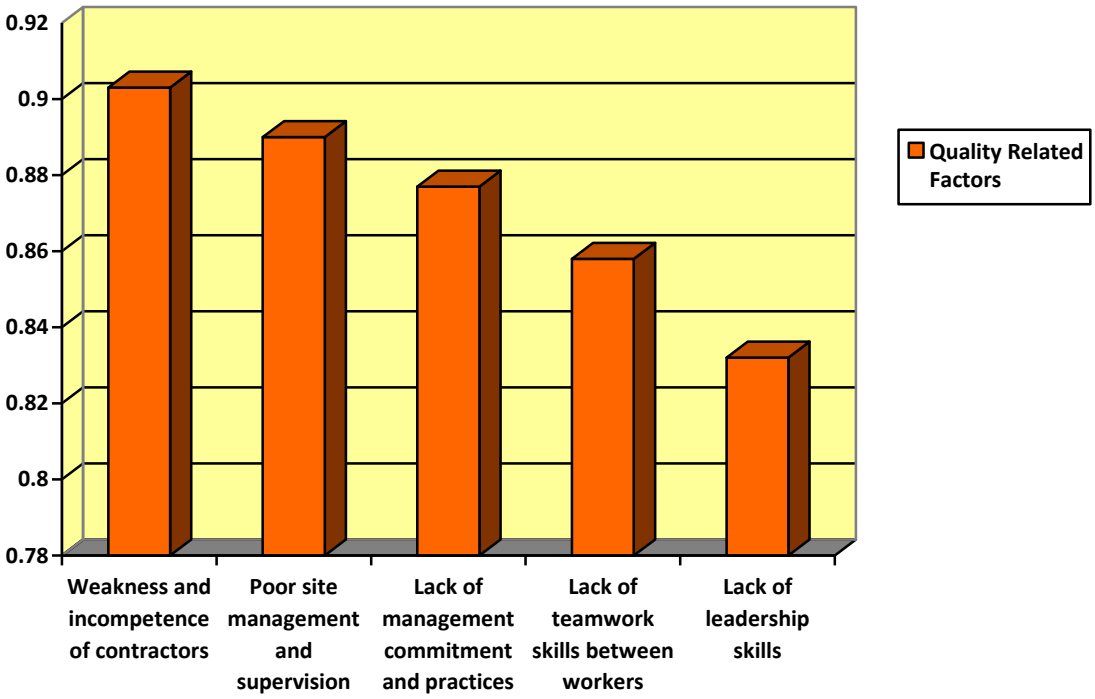


Figure 4.6: Top 5 ranking factors in quality related factors category

By using SPSS, the surveys for quality related factors was analysed as shown in table 4.5. Based on the ranking shown as above, the highest rank factors of quality related factors are weakness and incompetence of contractors with RII (0.903) while poor site management and supervision is ranked as the second most important factors with RII (0.890) following third rank factors which are lack of management commitment and practices with RII (0.877), forth rank factors with RII (0.858), fifth rank factors with RII (0.832), sixth rank factors with RII(0.819), seventh rank factors with RII(0.813) and eight rank factors with RII(0.8). Frequent design changes factor is ranked as the least important factor with RII (0.684) which its average index falls in the range (3.4<x<4.2) categorized as high impact factor. Most of the factors' average index (AVI) falls in the range within (3.4 < x < 4.2) which is classified as high impact factors. About four factors have average index (AVI) in the range within (4.2<x<5) which is classified as very high impact factors that affect the quality control in construction projects.

4.3.3 Cost related factors

Table 4.6: The rank of cost related factors affects quality, cost and time control in construction projects

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
C8.Inadequate cash flow and financial stability			6	11	14	4.26	0.773	0.852	1
C7.Price fluctuation from instability rate of a country			6	11	14	4.26	0.773	0.852	
C5.Poor site management and supervision			6	12	13	4.23	0.762	0.845	2
C1.Weakness and incompetence of contractors		2	5	11	13	4.13	0.922	0.826	3
C2.Lack of management commitment and practices			6	16	9	4.10	0.700	0.819	4
C6.Inaccurate project cost estimation		2	6	11	12	4.06	0.929	0.813	5
C12.Lack of awareness on value of construction materials	1	1	7	11	11	3.97	1.016	0.794	6
C4.Inefficient quality management procedures			9	17	5	3.87	0.651	0.774	7
C3.Lack of leadership skills		3	8	12	8	3.81	0.946	0.761	8
C9.Lack of revision on project requirement		2	11	10	8	3.77	0.921	0.755	9
C11.Poor quality of project		1	13	10	7	3.74	0.855	0.748	10
C10.Lack of training for employees	1	3	17	4	6	3.35	1.018	0.671	11

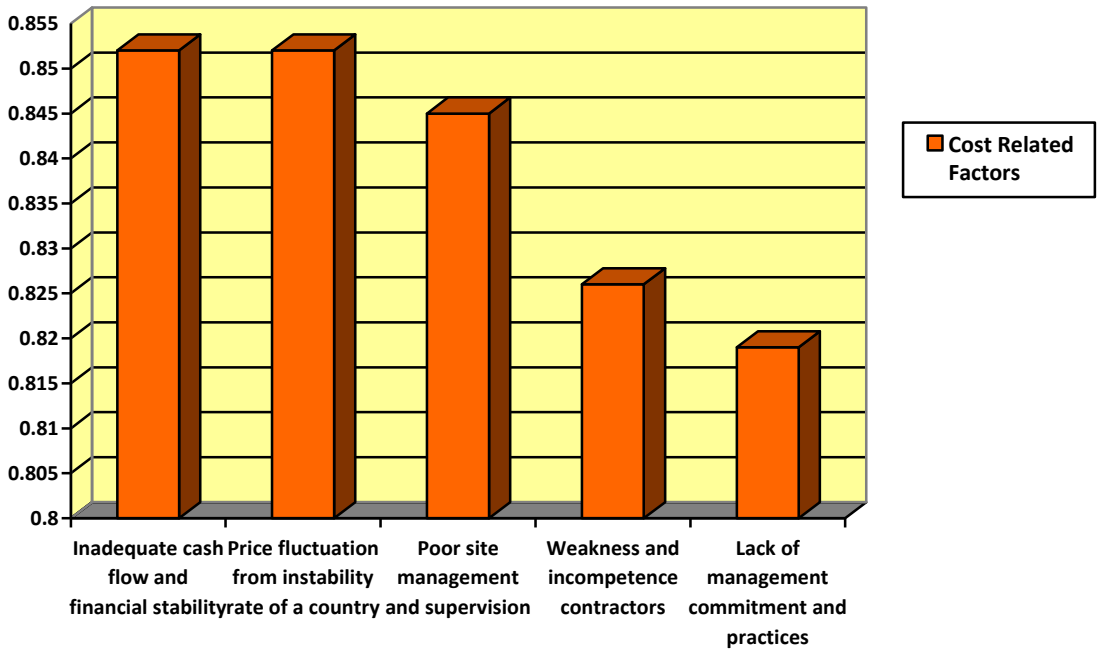


Figure 4.7: Top 5 ranking factors in cost related factors category

By using SPSS, the surveys for cost related factors was analysed as shown in table 4.6. Based on the ranking shown as above, the highest rank factors of cost related factors are inadequate cash flow and financial stability and price fluctuation from instability rate of a country with RII (0.852) while poor site management and supervision is ranked as the second most important factors with RII (0.845) following third ranked factor, weakness and incompetence of contractors with RII (0.826), forth ranked factors with RII (0.819). Lack of training for employees is ranked as the least important factors with RII (0.671) which categorized as medium impact in average index (AI) range (2.6<X<3.4). Most of the factors' Average Index (AI) falls in the range within (3.4 < x < 4.2) which is classified as high impact factors that affect the effectiveness of cost control in construction projects. While the top 3 ranking cost related factors has the average index (AI) in the range within (4.2<x<5) which is classified as very high impact factors.

4.3.4 Time control related factors

Table 4.7: The rank of time control related factors affects quality, cost and time control in construction projects.

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
T1.Weakness and incompetence of contractors			1	9	21	4.65	0.551	0.929	1
T2.Lack of management commitment and practices			6	7	18	4.39	0.803	0.877	2
T4.Poor site management and supervision		1	2	13	15	4.35	0.755	0.871	3
T11.Lack of proper scheduling for sequence of works		2	1	13	15	4.32	0.832	0.865	4
T6.Lack of teamwork skills	1		5	12	13	4.16	0.934	0.832	5
T3.Lack of leadership skills	1	1	4	12	13	4.13	0.991	0.826	6
T9.Slow supplier responsiveness	1	2	8	6	14	3.97	1.140	0.794	7
T7.Lack of training for employees		1	12	10	8	3.81	0.873	0.761	8
T10.Frequent design changes	1	1	10	10	9	3.81	1.014	0.761	
T5.Lack of revision on project requirement		3	9	11	8	3.77	0.956	0.755	9
T8.Poor quality of project	2	1	8	13	7	3.71	1.071	0.742	10
T12.Traditional construction method		4	12	6	9	3.65	1.050	0.729	11

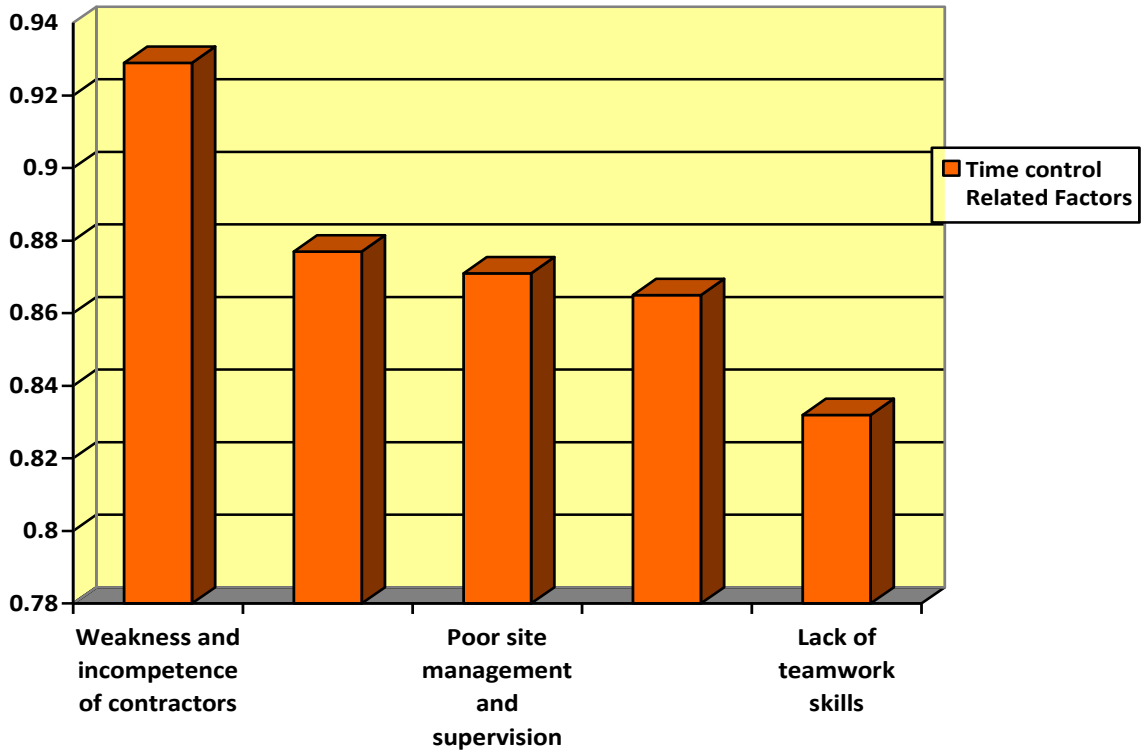


Figure 4.8: Top 5 ranking factors in time control related factors category

By using SPSS, the surveys for time control related factors was analysed as shown in table 4.7. Based on the ranking shown as above, the highest rank factors of time control related factors are weakness and incompetence of contractors with RII (0.929) while lack of management commitment and practices is ranked as the second most important factors with RII (0.877) following third rank factors, poor site management and supervision with RII (0.871), forth rank factors with RII (0.865), fifth rank factors with RII (0.832) and sixth rank factors with RII (0.826). The least ranked important factors are slow supplier responsiveness with RII (0.729). Most of the factors' Average Index (AI) falls in the range within ($3.4 < x < 4.2$) which is classified as high impact factors while top four ranking of time control related factors with average index (AI) falls in the range ($4.2<X<5$) is consider as very high impact towards the factors that affect the time control in construction project.

4.3.5 Contractors practitioners' perspective

4.3.6 Engineers' perspective

Table 4.8 The rank for quality related factors (engineers)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
Q1.Weakness and incompetence of contractors			1	1	11	4.77	0.599	0.954	1
Q2.Lack of management commitment and practices			1	4	8	4.54	0.660	0.908	2
Q5.Poor site management and supervision		1	4		8	4.46	0.877	0.892	3
Q8.Lack of teamwork skills between workers				8	5	4.38	0.506	0.877	4
Q3.Lack of leadership skills		1	1	4	7	4.31	0.947	0.862	5
Q4.Inefficient quality management procedures and plans			3	4	6	4.23	0.832	0.846	6
Q6.Lack of detailed design information			6	2	5	3.92	0.954	0.785	7
Q10.Lack of training for employees		1	2	7	3	3.92	0.862	0.785	
Q11.Lack of awareness on quality of construction materials used		1	2	7	3	3.92	0.862	0.785	
Q12.Shortage of skilled workers	2		2	3	6	3.85	1.463	0.769	8
Q9.Poor design quality		1	4	4	4	3.85	0.987	0.769	
Q7.Lack of revision on project requirement	1	3	3	3	3	3.31	1.316	0.662	9
Q13.Frequent design changes	2		5	4	2	3.31	1.251	0.662	

Table 4.9 The rank for cost related factors (engineers)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
C1.Weakness and incompetence of contractors			1	7	5	4.31	0.630	0.861	1
C5.Poor site management and supervision			2	7	4	4.15	0.689	0.831	2
C2.Lack of management commitment and practices			2	7	4	4.15	0.689	0.831	
C8.Inadequate cash flow and financial stability			3	6	4	4.08	0.760	0.815	3
C7.Price fluctuation from instability rate of a country			4	5	4	4	0.817	0.8	4
C12.Lack of awareness on value of construction materials		1	3	4	5	4	1.000	0.8	
C3.Lack of leadership skills			3	7	3	4	0.707	0.8	
C6.Inaccurate project cost estimation		2	3	3	5	3.85	1.144	0.769	5
C4.Inefficient quality management procedures			4	8	1	3.77	0.599	0.754	6
C11.Poor quality of project		1	5	4	3	3.69	0.947	0.738	7
C9.Lack of revision on project requirement		2	3	6	2	3.62	0.961	0.723	8
C10.Lack of training for employees		3	6	2	2	3.23	1.013	0.646	9

Table 4.10 The rank for time control related factors (engineers)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
T1.Weakness and incompetence of contractors				5	8	4.62	0.506	0.923	1
T2.Lack of management commitment and practices			3	3	7	4.31	0.855	0.862	2
T4.Poor site management and supervision			2	5	6	4.31	0.751	0.862	
T3.Lack of leadership skills		1	1	5	6	4.23	0.927	0.846	3
T8.Poor quality of project			2	8	3	4.08	0.641	0.815	4
T11.Lack of proper scheduling for sequence of works		2	1	6	4	3.92	1.038	0.785	5
T6.Lack of teamwork skills			5	4	4	3.92	0.862	0.785	
T9.Slow supplier responsiveness		2	4	2	5	3.77	1.166	0.754	6
T10.Frequent design changes		1	4	5	3	3.77	0.927	0.754	
T7.Lack of training for employees			7	4	2	3.62	0.768	0.723	7
T5.Lack of revision on project requirement		2	6	2	3	3.46	1.050	0.692	8
T12.Traditional construction method		2	6	3	2	3.38	0.961	0.68	9

The data obtained on engineer's perspective of the selected factors affecting the quality, cost and time control in construction projects are presented in table 4.8, table 4.9 and table 4.10. The data demonstrates, ranked and classified these factors through the application of Relative Importance Index (RII) and Average Index (AVI). It is shown that the relative importance index (RII) of the factors affecting quality, cost and time control in construction projects ranges between 0.646 and 0.954.

Based on the analysis of the results, the engineer's team chose weakness and incompetence of contractors as the highest rank factor for all categories related factor with RII (0.954), AVI (4.77) and SD (0.599) as shown in the table above, while lack of management and practices represents the second most important factor with RII (0.908), AVI (4.54) and SD (0.660). Weakness and incompetence of contractors is classified as high impact factors with average index value within ($4.2 < x < 5$). The respondents indicate that most of quality related factors are within the top highest ranks. It can be observed that six (6) out of thirteen (13) quality related factors are within the highest rank. While for cost related factors, only one (1) factor out of

twelve (12) that are within the highest rank. For time control related factors, only four (4) out of twelve (12) that are within the highest rank.

This implies that the most important factor which poses the highest impact on quality, cost and time control in construction projects according to engineer's perspective is weakness and incompetence of contractors while lack of training employees is the least considered as shown in table above. This shows that most of respondent agree that quality related factor affect the effectiveness of quality, cost and time control in construction projects. It can be seen that the factors including 'weakness and incompetence of contractors', 'lack of management commitment and practices', 'poor site management and supervision', 'lack of leadership skills', and 'lack of teamwork skills', which are relevant to workers and contractors, have the highest impact due to poor working culture.

4.3.7 Safety' perspective

Table 4.11 The rank for quality related factors (safety)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
Q5.Poor site management and supervision					3	5	0.000	1	1
Q2.Lack of management commitment and practices					3	5	0.000	1	
Q1.Weakness and incompetence of contractors				1	2	4.67	0.577	0.93	2
Q10.Lack of training for employees				1	2	4.67	0.577	0.93	
Q11.Lack of awareness on quality of construction materials used				1	2	4.67	0.577	0.93	
Q8.Lack of teamwork skills between workers			1		2	4.33	1.155	0.87	3
Q3.Lack of leadership skills				2	1	4.33	0.577	0.87	
Q9.Poor design quality			1		2	4.33	1.155	0.87	
Q12.Shortage of skilled workers				2	1	4.33	0.577	0.87	
Q4.Inefficient quality management procedures and plans			1	1	1	4	1.000	0.8	4
Q6.Lack of detailed design information			1	1	1	4	1.000	0.8	
Q7.Lack of revision on project requirement			1	1	1	4	1.000	0.8	
Q13.Frequent design changes		1	1		1	3.33	1.528	0.67	5

Table 4.12 The rank for cost related factors (safety)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
C5.Poor site management and supervision					3	5	0.000	1	1
C8.Inadequate cash flow and financial stability				1	2	4.67	0.577	0.93	2
C7.Price fluctuation from instability rate of a country				1	2	4.67	0.577	0.93	
C2.Lack of management commitment and practices				1	2	4.67	0.577	0.93	
C12.Lack of awareness on value of construction materials			1		2	4.33	1.155	0.87	3
C9.Lack of revision on project requirement			1		2	4.33	1.155	0.87	
C3.Lack of leadership skills		1			2	4	1.732	0.8	4
C6.Inaccurate project cost estimation			1	1	1	4	1.000	0.8	
C4.Inefficient quality management procedures			1	1	1	4	1.000	0.8	
C10.Lack of training for employees			1	1	1	4	1.000	0.8	
C11.Poor quality of project			2		1	3.67	1.155	0.73	5
C1.Weakness and incompetence of contractors		1	1		1	3.33	1.528	0.67	6

Table 4.13 The rank for time control related factors (safety)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
T1.Weakness and incompetence of contractors					3	5	0.000	1	1
T2.Lack of management commitment and practices					3	5	0.000	1	
T6.Lack of teamwork skills					3	5	0.000	1	
T11.Lack of proper scheduling for sequence of works				1	2	4.67	0.577	0.93	2
T4.Poor site management and supervision				2	1	4.33	0.577	0.87	3
T9.Slow supplier responsiveness			1		2	4.33	1.155	0.87	
T7.Lack of training for employees			1		2	4.33	1.155	0.87	
T10.Frequent design changes			1		2	4.33	1.155	0.87	
T12.Traditional construction method			1		2	4.33	1.155	0.87	
T3.Lack of leadership skills			1	1	1	4	1.000	0.8	4
T8.Poor quality of project			1	1	1	4	1.000	0.8	
T5.Lack of revision on project requirement		1		1	1	3.67	1.528	0.73	5

The data obtained on engineer's perspective of the selected factors affecting the quality, cost and time control in construction projects are presented in table 4.11, table 4.12 and table 4.13. The data demonstrates, ranked and classified these factors through the application of Relative Importance Index (RII) and Average Index (AVI). It is shown that the relative importance index (RII) of the factors affecting the effectiveness of quality, cost and time control in construction projects ranges between 0.67 and 1.

Based on the analysis of the results, safety's team chose poor site management and supervision as the highest rank factor for two (2) out of three (3) categories related factor with RII (1), AVI (5) and SD (0) as shown in the table above, while lack of management and practices represents the second most important factor mostly for all categories of related factors with RII (1), AVI (5) and SD (0). Poor site management and supervision is classified as high impact factors with average index value within ($4.2 < x < 5$). The respondents indicate that most of quality related factors and time control related factors are within the top highest ranks. It can be observed that nine (6) out of thirteen/twelve (13/12) quality related factors and time control related factors are within the highest rank. While for cost related factors, only six (6) factor out of twelve (12) that are within the highest rank.

This implies that the most important factor that poses the highest impact on the effectiveness of quality, cost and time control in construction projects according to safety's perspective is poor site management and supervision while frequent design changes and weakness and incompetence of contractors is the least considered for quality and cost related factors as shown in table 4.11 and table 4.12. This shows that most of respondent agree that quality and time control related factor affect effectiveness of quality, cost and time control in construction projects. It can be seen that the factors 'poor site management and supervision', 'lack of management commitment and practices', 'inadequate cash flow and financial stability', 'lack of awareness of value of construction materials' and 'lack of teamwork skills' which are also relevant to workers, have the highest contribution towards successful implementation of waste control due to poor working culture and lack of awareness on the importance of effective project management in construction project.

4.3.8 Supervisor' perspective

Table 4.14 The rank for quality related factors (supervisor)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
Q5.Poor site management and supervision				3	3	4.5	0.548	0.9	1
Q8.Lack of teamwork skills between workers				3	3	4.5	0.548	0.9	
Q6.Lack of detailed design information			1	2	3	4.33	0.817	0.87	2
Q7.Lack of revision on project requirement			1	2	3	4.33	0.817	0.87	
Q10.Lack of training for employees			2	2	2	4	0.894	0.8	3
Q11.Lack of awareness on quality of construction materials used			3		3	4	1.095	0.8	
Q1.Weakness and incompetence of contractors			3		3	4	1.095	0.8	
Q2.Lack of management commitment and practices		1		2	3	4.17	1.169	0.83	4
Q3.Lack of leadership skills			2	1	3	4.17	0.983	0.83	
Q12.Shortage of skilled workers			1	3	2	4.17	0.753	0.83	
Q9.Poor design quality		1		2	3	4.17	1.169	0.83	
Q4.Inefficient quality management procedures and plans			3	1	2	3.83	0.983	0.77	5
Q13.Frequent design changes			4		2	3.67	1.033	0.73	6

Table 4.15 The rank for cost related factors (supervisor)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
C7.Price fluctuation from instability rate of a country			1	2	3	4.33	0.817	0.87	1
C5.Poor site management and supervision			1	2	3	4.33	0.817	0.87	
C8.Inadequate cash flow and financial stability			2	1	3	4.17	0.983	0.83	2
C2.Lack of management commitment and practices			1	3	2	4.17	0.753	0.83	
C6.Inaccurate project cost estimation			1	3	2	4.17	0.753	0.83	
C12.Lack of awareness on value of construction materials			1	3	2	4.17	0.753	0.83	
C1.Weakness and incompetence of contractors			3		3	4	1.095	0.8	3
C4.Inefficient quality management procedures			1	4	1	4	0.632	0.8	
C11.Poor quality of project			1	4	1	4	0.632	0.8	
C9.Lack of revision on project requirement			2	3	1	3.83	0.753	0.77	4
C3.Lack of leadership skills		1	1	3	1	3.67	1.033	0.73	5
C10.Lack of training for employees			5		1	3.33	0.817	0.67	6

Table 4.16 The rank for time control related factors (supervisor)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
T11.Lack of proper scheduling for sequence of works				2	4	4.67	0.516	0.93	1
T1.Weakness and incompetence of contractors			1		5	4.67	0.817	0.93	
T4.Poor site management and supervision				3	3	4.5	0.547	0.9	2
T6.Lack of teamwork skills				3	3	4.5	0.548	0.9	
T2.Lack of management commitment and practices			2	1	3	4.17	0.983	0.83	3
T3.Lack of leadership skills				5	1	4.17	0.408	0.83	
T9.Slow supplier responsiveness			2	1	3	4.17	0.983	0.83	
T5.Lack of revision on project requirement			1	4	1	4	0.632	0.8	4
T12.Traditional construction method			2	2	2	4	0.894	0.8	
T7.Lack of training for employees			2	3	1	3.83	0.753	0.77	5
T10.Frequent design changes			3	1	2	3.83	0.983	0.77	
T8.Poor quality of project			3	1	2	3.83	0.983	0.77	

The data obtained on supervisor's perspective of the selected factors affecting the quality, cost and time control in construction projects are presented in table 4.14, table 4.15 and table 4.16. The data demonstrates, ranked and classified these factors through the application of Relative Importance Index (RII) and Average Index (AVI). It is shown that the relative importance index (RII) of the factors affecting the effectiveness of quality, cost and time control in construction projects ranges between 0.67 and 0.93.

Based on the analysis of the results, the supervisor's team chose poor site management and supervision, price fluctuation from instability rate from a country and lack of proper scheduling for the sequence of work as the highest rank factor for quality, cost and time control related factor with RII (0.9), AVI (4.5) and SD (0.548), RII (0.87), AVI (4.33) and SD (0.817) and RII (0.93), AVI (4.67) and SD (0.516) as shown in the table above, while lack of teamwork skill represents the second most important factor for quality related factors and time control related factors with RII (0.9), AVI (4.5) and SD (0.548). Poor site management and supervision, price fluctuation from instability rate from a country and lack of proper scheduling for the sequence of work are classified as high impact factors with average index value

within (4.2 < x < 5). The respondents indicate that most of quality related factors and time control related factors are within the top highest ranks. It can be observed that four (4) out of thirteen/twelve (13/12) factors are within the highest rank. While for cost related factors, only two (2) factor out of twelve (12) that are within the highest rank.

This implies that the most important factor which poses the highest impact on the effectiveness of quality, cost and time control in construction projects according to supervisor's perspective is poor site management and supervision, price fluctuation from instability rate from a country and lack of proper scheduling for the sequence of work while lack of training employees is the least considered as shown in table above. This shows that most of respondent agree that quality and time control related factor affect the effectiveness of quality, cost and time control in construction projects. It can be seen that the factors including 'poor site management and supervision', 'price fluctuation from instability rate from a country', 'lack of proper scheduling for the sequence of work ', 'lack of management commitment and practices', and 'lack of teamwork skills' which are also relevant to workers, have the highest contribution towards the effectiveness of quality, cost and time control in construction projects due to poor working culture and lack of awareness on the importance of effective project management in construction site.

4.3.9 Quantity Surveyor' perspective

Table 4.17 The rank for quality related factors (quantity surveyor)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
Q13.Frequent design changes				2	2	4.5	0.577	0.9	1
Q4.Inefficient quality management procedures and plans				3	1	4..25	0.500	0.85	2
Q12.Shortage of skilled workers				3	1	4.25	0.500	0.85	
Q11.Lack of awareness on quality of construction materials used				3	1	4.25	0.500	0.85	
Q1.Weakness and incompetence of contractors		1		1	2	4	1.414	0.8	3
Q5.Poor site management and supervision				4		4	0.000	0.8	
Q8.Lack of teamwork skills between workers				4		4	0.000	0.8	
Q3.Lack of leadership skills				4		4	0.000	0.8	
Q10.Lack of training for employees			1	2	1	4	0.817	0.8	
Q9.Poor design quality			1	2	1	4	0.817	0.8	
Q6.Lack of detailed design information			1	2	1	4	0.817	0.8	
Q2.Lack of management commitment and practices			1	3		3.75	0.500	0.75	4
Q7.Lack of revision on project requirement			2	2		3.5	0.577	0.7	5

Table 4.18 The rank for cost related factors (quantity surveyor)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
C8.Inadequate cash flow and financial stability				1	3	4.75	0.500	0.95	1
C7.Price fluctuation from instability rate of a country				2	2	4.5	0.577	0.9	2
C6.Inaccurate project cost estimation				2	2	4.5	0.577	0.9	
C12.Lack of awareness on value of construction materials				3	1	4.25	0.500	0.85	3
C4.Inefficient quality management procedures			1	2	1	4	0.817	0.8	4
C5.Poor site management and supervision			1	2	1	4	0.817	0.8	
C1.Weakness and incompetence of contractors		1		2	1	3.75	1.258	0.75	5
C2.Lack of management commitment and practices			2	1	1	3.75	0.957	0.75	
C11.Poor quality of project			2	1	1	3.75	0.957	0.75	
C10.Lack of training for employees			2	1	1	3.75	0.957	0.75	
C3.Lack of leadership skills		1	1	1	1	3.5	1.291	0.7	6
C9.Lack of revision on project requirement			3		1	3.5	1.000	0.7	

Table 4.19 The rank for time control related factors (quantity surveyor)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
T1.Weakness and incompetence of contractors				2	2	4.5	0.577	0.9	1
T2.Lack of management commitment and practices				2	2	4.5	0.577	0.9	
T4.Poor site management and supervision				2	2	4.5	0.577	0.9	
T11.Lack of proper scheduling for sequence of works				2	2	4.5	0.577	0.9	
T6.Lack of teamwork skills				2	2	4.5	0.577	0.9	
T9.Slow supplier responsiveness				2	2	4.5	0.577	0.9	
T10.Frequent design changes				2	2	4.5	0.577	0.9	
T3.Lack of leadership skills			1	1	2	4.25	0.957	0.85	2
T7.Lack of training for employees			1	2	1	4	0.817	0.8	3
T5.Lack of revision on project requirement			2	1	1	3.75	0.957	0.75	4
T8.Poor quality of project	1		1	2		3	1.414	0.6	5

The data obtained on quantity surveyor's perspective of the selected factors affecting the effectiveness of quality, cost and time control in construction projects are presented in table 4.17, table 4.18 and table 4.19. The data demonstrates, ranked and classified these factors through the application of Relative Importance Index (RII) and Average Index (AVI). It is shown that the relative importance index (RII) of the factors affecting the quality, cost and time control in construction projects ranges between 0.6 and 0.95.

Based on the analysis of the results, the quantity surveyor's team chose frequent design change, inadequate cash flow and financial stability and weakness and incompetence of contractors as the highest rank factor for quality, cost and time control related factor with RII (0.9), AVI (4.5) and SD (0.577), RII (0.95), AVI (4.75) and SD (0.5) and RII (0.9), AVI (4.5) and SD (0.577) as shown in the table above, while inefficient quality management procedure and plans, price fluctuation from instability rate of a country and lack of management commitment and practices represents the second most important factor with RII (0.9), AVI (4.5) and SD (0.577). Frequent design change, inadequate cash flow and financial stability and weakness and incompetence of contractors is classified as high impact factors with average index value within ($4.2 < x < 5$). The respondents indicate that most of time control related factors are within the top highest ranks. It can be observed that eight (8) out of twelve (12) factors are within the highest rank. While for quality and cost related factors, only four (4) factor out of thirteen/twelve (13/12) that are within the highest rank. For time control related factors, only four (4) out of twelve (12) that are within the highest rank.

This implies that the most important factor which poses the highest impact on the effectiveness of quality, cost and time control in construction projects according to quantity surveyor's perspective is frequent design change, inadequate cash flow and financial stability and weakness and incompetence of contractors while poor quality of project is the least considered as shown in table above. This shows that most of respondent agree that time control related factor affect the effectiveness of quality, cost and time control in construction projects. It can be seen that the factors including 'weakness and incompetence of contractors', 'lack of management commitment and practices', 'poor site management and supervision', 'lack of proper

scheduling for sequence of works', and 'lack of teamwork skills', which are relevant to workers and contractors, have the highest impact due to poor working culture.

4.3.10 Others' perspective

Table 4.20 The rank for quality related factors (others)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
Q1.Weakness and incompetence of contractors				1	4	4.8	0.447	0.96	1
Q5.Poor site management and supervision			1	1	3	4.4	0.894	0.88	2
Q2.Lack of management commitment and practices			1	1	3	4.4	0.894	0.88	
Q12.Shortage of skilled workers			1	1	3	4.4	0.894	0.88	
Q10.Lack of training for employees			1	2	2	4.2	0.837	0.84	3
Q4.Inefficient quality management procedures and plans	1			1	3	4	1.732	0.8	4
Q8.Lack of teamwork skills between workers	1			2	2	3.8	1.643	0.76	5
Q3.Lack of leadership skills	1			2	2	3.8	1.643	0.76	
Q11.Lack of awareness on quality of construction materials used	1			3	1	3.6	1.517	0.72	6
Q9.Poor design quality		1	2	2		3.2	0.837	0.64	7
Q7.Lack of revision on project requirement	1		2	1	1	3.2	1.483	0.64	
Q6.Lack of detailed design information	2		1	2		2.6	1.517	0.52	8
Q13.Frequent design changes	1	1	2	1		2.6	1.140	0.52	

Table 4.21 The rank for cost related factors (others)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
C1.Weakness and incompetence of contractors				2	3	4.6	0.548	0.92	1
C7.Price fluctuation from instability rate of a country			1	1	3	4.4	0.894	0.88	2
C6.Inaccurate project cost estimation			1	2	2	4.2	0.837	0.84	3
C8.Inadequate cash flow and financial stability			1	2	2	4.2	0.837	0.84	
C4.Inefficient quality management procedures			1	3	1	4	0.707	0.8	4
C5.Poor site management and supervision			2	1	2	4	1.000	0.8	
C9.Lack of revision on project requirement			2	1	2	4	1.000	0.8	
C2.Lack of management commitment and practices			1	4		3.8	0.447	0.76	5
C3.Lack of leadership skills			3	1	1	3.6	0.894	0.72	6
C11.Poor quality of project			3	1	1	3.6	0.894	0.72	
C12.Lack of awareness on value of construction materials	1		2	1	1	3.2	1.483	0.64	7
C10.Lack of training for employees	1		3		1	3	1.414	0.6	8

Table 4.22 The rank for time control related factors (others)

FACTORS	1: Strongly Disagree	2:Disagree	3:Moderately	4: Agree	5: Strongly Agree	AI	SD	RII	RANK
T1.Weakness and incompetence of contractors				2	3	4.6	0.547	0.92	1
T11.Lack of proper scheduling for sequence of works				2	3	4.6	0.548	0.92	
T5.Lack of revision on project requirement				3	2	4.4	0.548	0.88	2
T2.Lack of management commitment and practices			1	1	3	4.4	0.894	0.88	
T4.Poor site management and supervision		1		1	3	4.2	1.304	0.84	3
T7.Lack of training for employees		1	1	1	2	3.8	1.304	0.76	4
T3.Lack of leadership skills	1		1		3	3.8	1.789	0.76	
T9.Slow supplier responsiveness	1		1	1	2	3.6	1.673	0.72	5
T6.Lack of teamwork skills	1			3	1	3.6	1.517	0.72	
T10.Frequent design changes	1		2	2		3	1.225	0.6	6
T8.Poor quality of project	1	1	1	1	1	3	1.581	0.6	
T12.Traditional construction method		2	2		1	3	1.225	0.6	

The data obtained on others's perspective such as architects of the selected factors affecting the quality, cost and time control in construction projects are presented in table 4.20, table 4.21 and table 4.22. The data demonstrates, ranked and classified these factors through the application of Relative Importance Index (RII) and Average Index (AVI). It is shown that the relative importance index (RII) of the factors affecting the quality, cost and time control in construction projects ranges between 0.52 and 0.96.

Based on the analysis of the results, the engineer's team chose weakness and incompetence of contractors as the highest rank factor for all categories related factor with RII (0.96), AVI (4.8) and SD (0.477) as shown in the table above, while poor site management, price fluctuation from instability rate of a country and lack of proper scheduling for sequence of works represents the second most important factor with RII (0.88), AVI (4.4) and SD (0.894), RII (0.88), AVI (4.4) and SD (0.894) and RII (0.92), AVI (4.6) and SD (0.548). Weakness and incompetence of contractors is classified as high impact factors with average index value within ($4.2 < x < 5$). The respondents indicate that most of quality and time control related factors are within the top highest ranks. It can be observed that five (5) out of thirteen/twelve (13/12)

factors are within the highest rank. While for cost related factors, only four (4) factor out of twelve (12) that are within the highest rank.

This implies that the most important factor which poses the highest impact on quality, cost and time control in construction projects according to others's perspective is weakness and incompetence of contractors while frequent design changes is the least considered as shown in table above. This shows that most of respondent agree that quality and time control related factor affect the quality, cost and time control in construction projects. It can be seen that the factors including 'weakness and incompetence of contractors', 'lack of management commitment and practices', 'poor site management and supervision', 'lack of proper scheduling for sequence of works, and 'lack of revision on project requirement', which are relevant to workers and contractors, have the highest impact due to poor working culture.

4.4 Discussion

This section discusses the results which acquired from previous section, analysis of the data. There are three related factors that have been discussed which are (i) quality related factors; (ii) cost related factors and (iii) time control related factors. The information obtained through pilot survey were analysed and further elaborated.

4.4.1 Critical success factors affecting quality, cost and time control in construction projects

All of the research question deals with identifying factors that affecting the quality, cost and time control in construction projects and ranks them using Relative Importance Index. The factors and ranking will be discussed below with appropriate headings.

Table 4.23 illustrates the most important causes of that affect the quality, cost, and time control in a high rise construction project among respondents according to each categories which are quality related factors, cost related factors and time control related factors.

Table 4.23: Summary of ranked factors according to categories of related factors

Rank/Related factors	Quality	Cost	Time control
1	Weakness and incompetence of contractors	- Inadequate cash flow and financial stability - Price fluctuation from instability rate of a country	Weakness and incompetence of contractors
2	Poor site management and supervision	Poor site management and supervision	Lack of management commitment and practices
3	Lack of management commitment and practices	Weakness and incompetence of contractors	Poor site management and supervision
4	Lack of teamwork skills between workers	Lack of management commitment and practices	Lack of proper scheduling for sequence of works
5	Lack of leadership skills	Inaccurate project cost estimation	Lack of teamwork skills

4.4.2 Weakness and incompetence of contractors

The construction industries always facing with the problem such as delay project that make the project need to apply for extension of time. For example, several projects under the Creating Iconic Places and Attractions by the Kuala Lumpur City Hall (DBKL), worth an estimated RM46.5mil, have been delayed after given four Extension Of Time (EOT) due to the appointment of incompetent contractors, according the 2015 Auditor-General's Report (Series 2) (The Star,2016). This is due to incompetent contractor that have been hire for this project.

Also, from the surveys that have been done, weakness and incompetence of contractors was the highest key influence the quality, cost and time control in construction projects. It is ranked first placed among all categories of the related factors. This factor is voted as highest impact factor among other factors in quality related factors and time control related factors. This indicates that the contractors have lack of skills to manage the projects which can be observed through how clumsiness and reckless of contractors in handling construction tasks. This factor tend to occur during construction due to lack of experience to meet the scope of the project, has poor connection network with subcontractors, do not have adequate staff to handle the project, ineffective communication with customers and subcontractors, poor financial record and so on.

4.4.3 Poor site management and supervision

Most general contractors want milestones to be finished on time and they want their employees and subcontractors to recognize what to do at all time. However, some construction projects can get out of hand - for a variety of different reasons. Sometimes it is the fault of a contractor who is inexperience, sometimes it is because of outside matters, but mostly it is due to poor construction management. Site staff must be qualified so that they aware all requirements for control and monitoring the project.

From the survey, poor site management and supervision is one of the key influences the effectiveness of quality, cost and time control in construction projects. It is ranked second placed for quality and cost related factor while for time control related factor, this factor is ranked third. This rank show that this factor affects critically for quality and cost for construction projects. This indicates that the contractors have poor site supervision which can be observed through the work crews are poorly supervised or not supervised at all, milestones are never completed on time, poor productivity, workers are standing around and waiting, change orders are not properly dealt with, poor coordination of workers and subcontractors, lots of job site accidents and lack of proper permits and insurance. These factors tend to encourage mistakes to occur during construction due to inexperienced contractors or poor subcontractor selection.

For example, during construction, problems arise due to poor day to day supervision of the job site. If workers and subcontractors are left to their own devices without the direction of a project manager, they might become confused and unproductive, further extending the project timeline.

4.4.4 Lack of management commitment and practices

Lack of management commitment and practices factor is also related to contractors and workers of the project. Management or stakeholders are the key players whose drive the projects. From the surveys analysis, lack of management and practices was also one of the key influences the quality, cost and time control in construction projects. It is ranked second placed for time control related factor, third for quality related factor and fourth for cost related factor. This rank show that this factor affects critically for time control in construction projects which usually lead to the delay of the project.

This indicates that the contractors and workers have lack of commitment and practices in managing projects which can be observed through how they arranging the sequence of works so that it will finish before the target date. This factor tends to occur during construction due to lack of training in managing the project and workers, poor communication with the subcontractor and workers and so on. For example, communication between contractors and workers usually become problem due to language barrier which lead in misunderstanding the instruction given to do the works. Top management must always look into the progress, held meeting within subcontractors and main contractor to have discussion to improve in term of quality, cost and time.

4.4.5 Lack of teamwork skills between workers

Some groups such as the architect and engineering team, the owners and investors, and the contractors generally make up a construction team. All team members share the same goal of wanting to finish the project, but they may also have clashing priorities. Owners may want value for money, while for architect and engineers; they are concerned with aesthetics and safety. Aligning these interests and completing a project on time and on budget require teamwork from all participants.

From the surveys, lack of teamwork skills between workers was also one of the key influences the quality, cost and time control in construction projects. It is ranked fourth placed for quality related factor and fifth for time control related factor. This rank show that this factor affects critically for quality and time control in construction projects which usually lead to poor quality of project and delay of the project. This indicates that the contractors and workers have lack of teamwork between each other which can be observed through failure to share appropriate information in a timely manner and the inability to coordinate each other's needs and visions. This factor tends to occur due to poor leadership skills by the contractors.

4.4.6 Lack of leadership skills

Poor leaders can have a negative impact on employees and might even damage the successfulness of the project. Bad leadership affects the company's ability to retain employees and lowers employee morale, motivation and productivity. From the surveys, lack of leadership skills between workers was also one of the key influences the effectiveness of quality, cost and time control in construction projects. It is ranked fifth placed for quality related factor.

This rank show that this factor affects critically for quality in construction projects. This indicates that the contractors have lack of leadership skills which can be observed through lack of communication with the subcontractors and workers, failing to make expectations of the projects clear to the workers, intimidate the workers and so on. This factor tends to occur due to incompetent contractor hired for the projects.

4.4.7 Lack of proper scheduling for sequence of works

Every project has a construction schedule. Not only does the schedule outline how quickly the work will get done, it also outlines how the work will get done. The schedule defines the sequence and method in which the materials will be put in place. Failure in undertaking the planning in actual construction will results into tasks getting neglected or unsatisfactorily done because one is rushing to do the next tasks; and this will make the structure may not achieve the desired structural strength properties. From the poor planning results in delayed project completion, it will also cause cost overruns and poor quality among other things.

From the surveys, lack of proper scheduling for sequence of works was also one of the key influences the effectiveness of quality, cost and time control in construction projects. It is ranked fourth placed for time control related factor. This rank shows that this factor affects critically for the duration to complete construction projects. This indicates that the contractors have lack of experience in

managing schedule for the sequence of works which can be observed through lack of manpower and machinery resources, late delivery of the required materials, financial issues, unrealistic activity duration or interrelationships, wrong assumptions, poor planning and so on (K.A. Alnaas et al, 2014) . This factor will lead to the delay of construction project, increase the cost of the projects and also reduce the quality of the project. This factor tends to occur due to incompetent contractor hired for the projects.

4.4.8 Inadequate cash flow and financial stability

Project cost is one of the most critical factor of the success of project and those who are involved in the project is highly concern about this matter in the construction industry. From the surveys, inadequate cash flow and financial stability was also one of the key influences the effectiveness of quality, cost and time control in construction projects. It is ranked first placed for cost control related factor. This rank shows that this factor affects critically for the cost of the construction projects. This indicates that the contractors have lack of experience in managing financial of the projects which can be observed through failure for contractor to pay to sub-contractors on time and poor cash flow management. This factor also will lead to the delay of construction project due to not enough materials and shortage of site worker (Memon A.H., 2010).

4.4.9 Price fluctuation from instability rate of country

Price fluctuation usually occurs due to the increase of the demand in the financial market. From the surveys, price fluctuation from instability rate of country was also one of the key influences the effectiveness of quality, cost and time control in construction projects. It is ranked first placed for cost control related factor. This rank shows that this factor affects critically for the cost of the construction projects. This indicates that the financial market causes the increment of interest rate in repayment of loan, inflation of material prices, labour wages and transportation costs, increment of foreign exchange

rate for imported materials and plants (Abdul-Rahman H.et al, 2009) which can also cause changes of the cost estimation of the projects. This factor also will lead to the increases the cost utilized for the projects which will be disadvantages for the company.

4.4.10 Inaccurate project estimation

Estimation is the process by which we determine how long a project will take and how much it will cost. This is because the price in tender is not up to market price and improper costing during tender stage. From the surveys, inaccurate project estimation was also one of the key influences the effectiveness of quality, cost and time control in construction projects. It is ranked fifth placed for cost control related factor. This rank shows that this factor affects the cost of the construction projects. This indicates that inaccurate cost estimation by quantity surveyor causes the increases of project costs due to budget overruns and this will be disadvantages for the company. This factors usually occur due to false analogies from referring previous without knowing which data is relevant or not and false precision from quoting the value as single number instead of making it in range .

4.4.11 Relation between quality, cost and time control related factors that affect quality, cost and time control in construction projects

Weakness and incompetence of contractors was the highest key influence the quality, cost and time control in construction projects. It is ranked first placed among all categories of the related factors. This factor is voted as highest impact factor among other factors in quality related factors and time control related factors. This indicates that the contractors have lack of management commitment and practices to manage the construction site and lack of proper scheduling for sequence of works which lead to the second factor in time control related factors, poor site management and supervision. These factors tend to encourage mistakes to occur during construction due to untrained labours, lack of teamwork skills between workers, shortage of

skilled workers and poor working attitude and may also cause by lack of supervision on construction workers.

For example, the ignorance of workers to use wire mesh when doing brickworks and also using materials that are different from the standard specifications will lead to poor quality of projects and problems when handling the projects. The problems will occur due to it does not meet the project requirements. Then, it will lead to delay of the construction projects because they need to redo the things that do not meet the projects requirement. These show that the contractors have lack of revision on project requirement.

It is the same for the poor quality of project. When the construction has low quality projects, problems related to the building structure such as cracks, damage and roughness will occur. These problems also may due to inefficient quality management procedures and plans. These will cause the delay of the projects because they need times to repair the defects. So, these problems will lead to first rank factor in cost related factors which is inadequate cash flow and financial stability due to they need to buy new materials and also pay for the extension of time cost.

The next rank factor which is price fluctuation from instability rate of a country also affects the cost of the construction projects. This factor can be attributed from various reasons such as monopoly of suppliers or unavailability of construction materials locally. This may also due to demand exceeding supply or accentuated by the creation of an artificial scarcity of goods. These fluctuations are reflected in increase cost of raw materials, labour, machinery, other ancillary materials and services. Lack of awareness on value of construction materials will also lead to increase the cost of construction projects due to inaccurate cost estimation for the projects.

4.4.12 Suggestion to improve current practices on management of quality, cost and time control in construction projects.

Based on the open ended of the questionnaire and interview sessions, majority of the respondents claimed that they are aware regarding the importance of effective quality, cost and time control in construction project. An effective project management practice is all about achieving objectives successfully by planning and organising resources. Through analysis of the results, it is observed that most of the respondents agreed that effective quality, cost and time control plan is necessary to reduce any possibilities for future problems such as damage of certain parts of the building due to low quality, cost overruns to do the reworks and also to prevent delay of the projects.

So, the respondents suggested providing training practically and educating the workers and staff regarding site management in order to enhance quality of the buildings, reduce the cost overruns and also prevent delay of the projects. The training should include the definition of effective project management, the factors that could impact the projects from all categories such as quality, cost and time control and also the way to improve its effectiveness. Lastly, the need to have a clear communication between client and contractors are most suggested among the respondents such as having frequent meetings between the main contractor and subcontractor.

4.4.13 Proposed Framework to Enhance the Management of Quality, Cost and Time Control in Construction Project

The framework proposed has been adopted from Jergeas (2015) which emphasizes on project alignment, coaching, training, monitoring project performance (health), and timely issue resolution could tend to increase the effectiveness of project management such as increase the quality, reduce costs of the project and prevent the delay of the project. The framework is developed to guide contractors' practitioners;

i. Identify critical factors that could inhibit the effectiveness of quality, cost and time control in construction project,
ii. Identify ways to overcome these factors (What to do),
iii. Identify what methods can be used to overcome these factors (How to do it),
iv. Analyze whether goal of the framework, to enhance the effectiveness of quality, cost and time control in construction project can be achieved or not.

Based on the thirty seven (37) factors obtained through intensive literature review and discussion with several contractors' practitioners, top five high impact factors affecting the quality, cost and time control in construction project in all related categories (weakness and incompetence of contractors, poor site management and supervision, lack of management commitment and practices, lack of teamwork skills between workers, lack of leadership skills, price fluctuation from instability rate of a country, inadequate cash flow and financial stability, inaccurate project cost estimation, lack of proper scheduling for sequence of works) were analysed and several ways of addressing these problems were proposed accordingly. There are three main strategies proposed based on the identified factors, namely; Proper construction sequence, Training for workers and Proper selection for contractors. These strategies correspond to the factors extracted through analysis and several suggestions on how to overcome these barriers are discussed.

4.4.14 Proper construction sequence

Construction planning is a fundamental and challenging activity in the management and execution of construction projects. It involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any interactions among the different work tasks. A good construction plan is the basis for developing the budget and the schedule for work. Proper project sequence is very important to prevent those mistakes in the projects and also to prevent the delay of the project. Clear instruction should be given to the workers so that they can conduct the tasks in the right way. Besides that, frequent inspection also should be done to avoid future problems caused by the workers.

4.4.15 Training for workers

Training is a program that helps employees learn specific knowledge or skills to improve performance in their current roles. Good training and development programs help workers to manage the works effectively and grow profits. The training modules should be design and develop to meet the company's overall goals such as analysing the skill gaps for each workers, make layer training method and then the effectiveness of the training should be measure to see whether it is good or not so that some improvement of the training can be done to achieve maximum impacts.

4.4.16 Proper selection for contractors

Selection of the best sub-contractor is a vital process in construction projects (Marzouk M.M. et al., 2013). There are many factors that must be taken into consideration when selecting sub-contractors. Improper selection of sub-contractors might lead to many problems during work progress. These include bad quality of work, and delay in project duration. For example, it is good if the chosen company is the one that is appropriate or suitable for the building needs. This can be done by having open discussion with the candidates companies to know their reliable first. Besides that, referral from previous client for the candidates company also important to know the contractor's expertise. Next, the contractor must be

chose not based solely on the price that have been quote by them but based on their experience, comfort level and confidence in that company. Lastly, interview session with the candidates companies also can be done by asking few important questions that relate to the project such as asking about their experience in handling the similar projects.

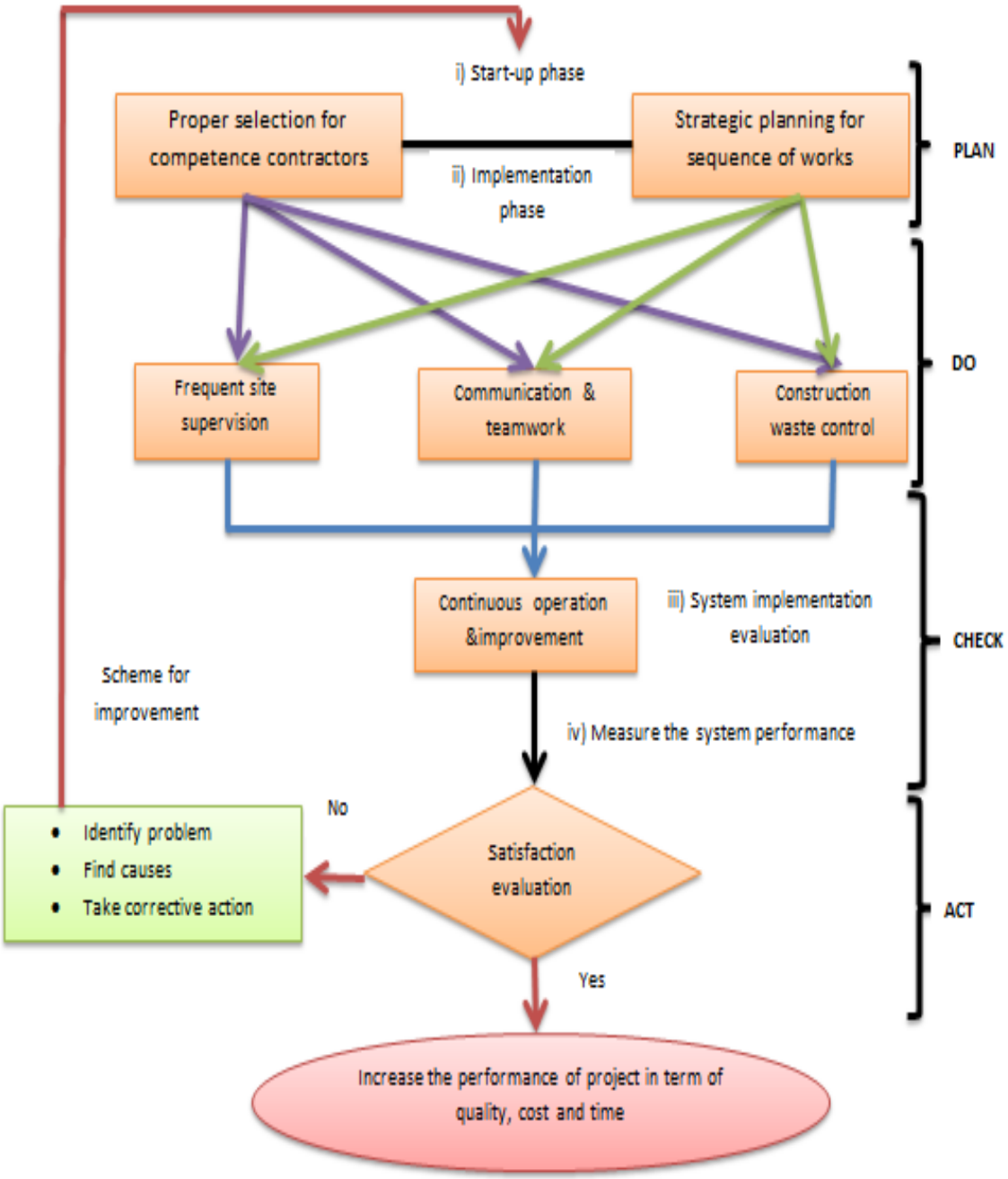


Figure 4.24: Proposed framework for effective quality, cost and time control management in construction projects

There are about four stages in implementing framework for effective project management in construction projects which are (i) Start up phase (ii) Implementation phase (iii) System implementation evaluation (iv) Measurement of the system's performance. Plan is done when analysis of the critical factors that impact the quality, cost and time control in construction project have been done which are related to the problems of the construction projects. Do is done to give solutions to the problems that have been appointed from the plan part. During this phase, measurement to increase the performance of the projects was decided. Check is done by comparing the data between before and after the framework was applied. Act is done when the results were documented during satisfaction evaluation. Some recommendations for the problem to be used in next cycle will be suggested in this phase if the results were not satisfied.

The framework will provide the flow for its implementation to the company depend on their current practices. In start-up phase, proper selection of contractors and strategic planning process projects will be done first as they impact the construction projects the most from the analysis of critical factors. Top management needed to set up an effective project management system at this stage and make sure that every employees involved in the projects got clear vision, mission and strategic direction for the project. This is to prevent miscommunications between the workers. For the implementation phase, it is where all management practices will be applied to the whole organization. To ensure its successfulness, good teamwork and communication between the employees are very important. Next, the system implementation evaluation on the system implemented should be done to measure the effectiveness of the framework to the projects. The company should analyse if there are any problems occur during this phases and plan for the further actions to be taken during the check part which is measuring for the system performance.

Act is done to evaluate satisfaction level from the clients. If they satisfied with results, this mean that the construction that have been produce is high quality, in time and also having less cost overruns for the project. So, this will give good reputation to the company because the customer satisfied with their works and then it will generate business repetition with the clients and also could attract new customers to give new projects to the company.

CHAPTER 5

CONCLUSION & RECOMMENDATIONS

From the survey and interview that have been done in final year project 2, it can be concluded that the author able to meet the objectives from 31 respondents which are to identify and rank its factors influencing the quality, cost and time-control during the construction phases which affect successful completion and sustainable construction project based on relative importance index (RII) with correlation between construction practitioners and to validate the factors and construction practitioners' practices influencing the quality, cost and time control during the construction phases through the application of case study project above by doing some research on the current performance of quality, cost and time at construction site in Malaysia. From the result that have been analyzed, weakness and incompetence contractors is the most critical factor that affect the quality, cost and time control in construction projects. The correlation between five group of practitioners were identified; Engineer/Others showed highest Spearman correlation coefficient ($\beta = 0.540$) which classified as very strong correlation. These indicated that Engineer/Others (such as architects) have more similar views on project management than others four group.

For recommendation, this research should be conduct further in future for more than 31 respondents to achieve more accurate results and make some suggestions for the framework that can be used to improve the management of quality, cost and time control in construction projects. Besides that, this research also can have additional number of case studies so that comparison of the results can be made and to ensure the accuracy of the data obtained. Other than that, the top management can also be educated and awarded the project to ISO certified company. Lastly, by doing this research project, it will help in improving the management of quality, cost and time at construction project in Malaysia which are the time and cost well managed, no delay and cost saving.

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APPENDICES

APPENDIX A: QUESTIONNAIRE SURVEY FORM

QUESTIONNAIRE SURVEY

EFFECTIVENESS OF QUALITY, COST AND TIME CONTROL IN CONSTRUCTION PROJECTS

Disclaimer:

I am a final year final semester Bachelor of Engineering (Hons) Civil Engineering, student of Universiti Teknologi PETRONAS (UTP). In partial fulfilment of the requirements of this degree, I am required to complete final year project (FYP). The questionnaire is intended to gather information to further study the factors affecting the effectiveness of quality, cost and time control in construction projects.

Objectives:

To distinguish and rank its factors affecting the quality, cost and time-control during the construction phases which affect successful completion and sustainable construction project based on relative importance index (RII) with correlation between construction practitioners..

Instructions:

1. Please answer ALL the following questions.
2. Please fill in the blank and tick ✓ in the respective box.
3. All information treated as CONFIDENTIAL and shall be used for academic purpose only.
4. All the data will be on aggregated basis and no individual data will be published.

SECTION A
PERSONAL DETAIL

Q1 Name :

.....

Q2 Gender :

☐ Male
☐ Female

Q3 Age :

☐ 20 – 29 years old
☐ 30 – 39 years old
☐ 40 – 49 years old
☐ > 50 years old

Q4 Qualification :

Q5 Designation :

☐ Project director
☐ Project manager
☐ Project engineer
☐ Site engineer
☐ Planning engineer
☐ Scheduler
☐ Quantity surveyor
☐ Others:

.....

Q6 Working duration :

☐ Less than 5 years
☐ Less than 10 years
☐ More than 10 years

SECTION B
EFFECTIVENESS OF QUALITY, COST AND TIME CONTROL IN CONSTRUCTION PROJECTS

Factors affect the effectiveness of quality, cost and time control in construction projects

Please answer the questions below based on undergoing project.

1 : Strongly disagree 2 : Disagree 3 : Moderately 4 : Agree 5 : Strongly agree

QUALITY RELATED FACTORS						
Factor code	**Factors description**	**1**	**2**	**3**	**4**	**5**
A.1	Weakness and incompetence of contractors					
A.2	Lack of management commitment and practices					
A.3	Lack of leadership skills					
A.4	Inefficient quality management procedures and plans					
A.5	Poor site management and supervision					
A.6	Lack of detailed design information					
A.7	Lack of revision on project requirement					
A.8	Lack of teamwork skills between workers					
A.9	Poor design quality					
A.10	Lack of training for employees					
A.11	Lack of awareness on quality of construction materials used					
A.12	Shortage of skilled workers					
A.13	Frequent design changes					

COST RELATED FACTORS						
Factor code	**Factors description**	**1**	**2**	**3**	**4**	**5**
A.1	Weakness and incompetence of contractors					
A.2	Lack of management commitment and practices					
A.3	Lack of leadership skills					
A.4	Inefficient quality management procedures					
A.5	Poor site management and supervision					
A.6	Inaccurate project cost estimation					
A.7	Price fluctuation from instability rate of a country					
A.8	Inadequate cash flow and financial stability					
A.9	Lack of revision on project requirement					
A.10	Lack of training for employees					
A.11	Poor quality of project					
A.12	Lack of awareness on value of construction materials					

TIME CONTROL RELATED FACTORS						
Factor code	**Factors description**	**1**	**2**	**3**	**4**	**5**
A.1	Weakness and incompetence of contractors					
A.2	Lack of management commitment and practices					
A.3	Lack of leadership skills					
A.4	Poor site management and supervision					
A.5	Lack of revision on project requirement					
A.6	Lack of teamwork skills					
A.7	Lack of training for employees					
A.8	Poor quality of project					
A.9	Slow supplier responsiveness					
A.10	Frequent design changes					
A.11	Lack of proper scheduling for sequence of works					
A.12	Traditional construction method					

SECTION C
CURRENT PRACTICES ON QUALITY, COST AND TIME CONTROL

1. Do you aware the importance of project management in construction project? Reason.

2. Do your current company apply any quality, cost and time control practices on site? If yes, state the practices.

3. Today, the construction project delays, low quality of project and cost overruns still being the crucial problem faced in construction industry. From your point of view, what are the factors contributing to this problem?

4. What are your suggestions towards enhancing the effectiveness of quality, cost and time control in construction site?

SECTION D
PILOT SURVEY FEEDBACK

1. Suggestion on the improvement of the survey. Give opinion.

2. May I contact you again for future involvement in another questionnaire form regarding the effectiveness of quality, cost and time control of construction projects in your company?

APPENDIX B: INTERVIEW FORM

INTERVIEW

EFFECTIVENESS OF QUALITY, COST AND TIME CONTROL IN CONSTRUCTION PROJECTS

Disclaimer:

I am a final year final semester Bachelor of Engineering (Hons) Civil Engineering, student of Universiti Teknologi PETRONAS (UTP). In partial fulfilment of the requirements of this degree, I am required to complete final year project (FYP). The questionnaire is intended to gather information to for my research concerning the risk factors for successful completion and sustainable of construction projects. Information collected and shared from this questionnaire will strictly be confidential and will not be used for any intentions other than this research study. Individual details will not be revealed in publication.

Objectives:

To validate the factors and construction practitioners' practices that affecting the quality, cost and time control during the construction phases through the application of case study project.

Instructions:

1. Please answer ALL the following questions.
2. Please fill in the blank and tick ✓ in the respective box.
3. All information treated as CONFIDENTIAL and shall be used for academic purpose only.
4. All the data will be on aggregated basis and no individual data will be published.

SECTION A
PERSONAL DETAIL

Q1 Gender :

☐ Male

☐ Female

Q2 Age :

☐ 20 – 29 years old

☐ 30 – 39 years old

☐ 40 – 49 years old

☐ > 50 years old

Q3 Qualification :

Q4 Designation :

☐ Project director

☐ Project manager

☐ Project engineer

☐ Site engineer

☐ Planning engineer

☐ Scheduler

☐ Quantity surveyor

☐ Others:

.....

Q5 Working duration :

☐ Less than 5 years

☐ Less than 10 years

☐ More than 10 years

SECTION B
QUESTIONS

Q1 What is your view on current situation of the management of quality, cost and time control in construction projects nowadays?

Q2 How does effective management of quality, cost and time control affect the project?

Q3 Which factors do you think has the highest impact towards effectiveness of quality, cost and time control in construction projects?

(a) Weakness and incompetence of contractors
(b) Poor site management and supervision
(c) Lack of management commitment and practices
(d) Inadequate cash flow and financial stability
(e) Lack of proper scheduling for sequence of works. Why?

Q4 Based on your opinions, what are can be done to overcome this barrier?

Q5 Last questions, what factors will you choose as the second highest impact that can be improved to increase the effectiveness of quality, cost and time control in project? Why you chose and what is your suggestion for further improvement?

APPENDIX C: SPSS RESULTS

*DATA VIEW AND OUTPUT FOR QUALITY RELATED FACTORS

	ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
1	001	5.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
2	002	5.00	5.00	4.00	4.00	5.00	5.00	4.00	4.00	5.00	3.00	5.00	4.00	3.00
3	003	5.00	3.00	2.00	4.00	2.00	5.00	3.00	4.00	4.00	4.00	2.00	5.00	4.00
4	004	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00
5	005	5.00	5.00	4.00	5.00	4.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.00
6	006	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
7	007	5.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00	2.00	5.00	5.00	5.00	2.00
8	008	5.00	5.00	5.00	5.00	5.00	1.00	3.00	5.00	3.00	5.00	4.00	5.00	1.00
9	009	5.00	4.00	4.00	4.00	5.00	3.00	2.00	5.00	2.00	2.00	3.00	5.00	3.00
10	010	5.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
11	011	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00	4.00	4.00	3.00
12	012	5.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00
13	013	2.00	3.00	4.00	4.00	4.00	5.00	3.00	4.00	5.00	5.00	5.00	4.00	5.00
14	014	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
15	015	4.00	5.00	4.00	4.00	5.00	4.00	3.00	3.00	5.00	4.00	4.00	4.00	2.00
16	016	5.00	5.00	5.00	5.00	5.00	3.00	2.00	4.00	4.00	4.00	4.00	1.00	1.00
17	017	5.00	5.00	5.00	5.00	5.00	3.00	2.00	4.00	4.00	4.00	4.00	1.00	1.00
18	018	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
19	019	5.00	5.00	3.00	3.00	5.00	3.00	3.00	4.00	3.00	4.00	5.00	5.00	3.00
20	020	4.00	3.00	1.00	1.00	3.00	1.00	1.00	1.00	4.00	4.00	1.00	3.00	3.00
21	021	5.00	5.00	5.00	3.00	5.00	5.00	1.00	5.00	5.00	5.00	5.00	5.00	5.00
22	022	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
23	023	3.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Q1	31	2.00	5.00	4.5161	.85131	.725
Q2	31	2.00	5.00	4.3871	.80322	.645
Q3	31	1.00	5.00	4.1613	.96943	.940
Q4	31	1.00	5.00	4.0968	.97826	.957
Q5	31	2.00	5.00	4.4516	.72290	.523
Q6	31	1.00	5.00	3.8065	1.10813	1.228
Q7	31	1.00	5.00	3.5806	1.17684	1.385
Q8	31	1.00	5.00	4.2581	.81518	.665
Q9	31	2.00	5.00	3.8710	.99136	.983
Q10	31	2.00	5.00	4.0645	.81386	.662
Q11	31	1.00	5.00	4.0000	.96609	.933
Q12	31	1.00	5.00	4.0968	1.07563	1.157
Q13	31	1.00	5.00	3.4194	1.20483	1.452
Valid N (listwise)	31					

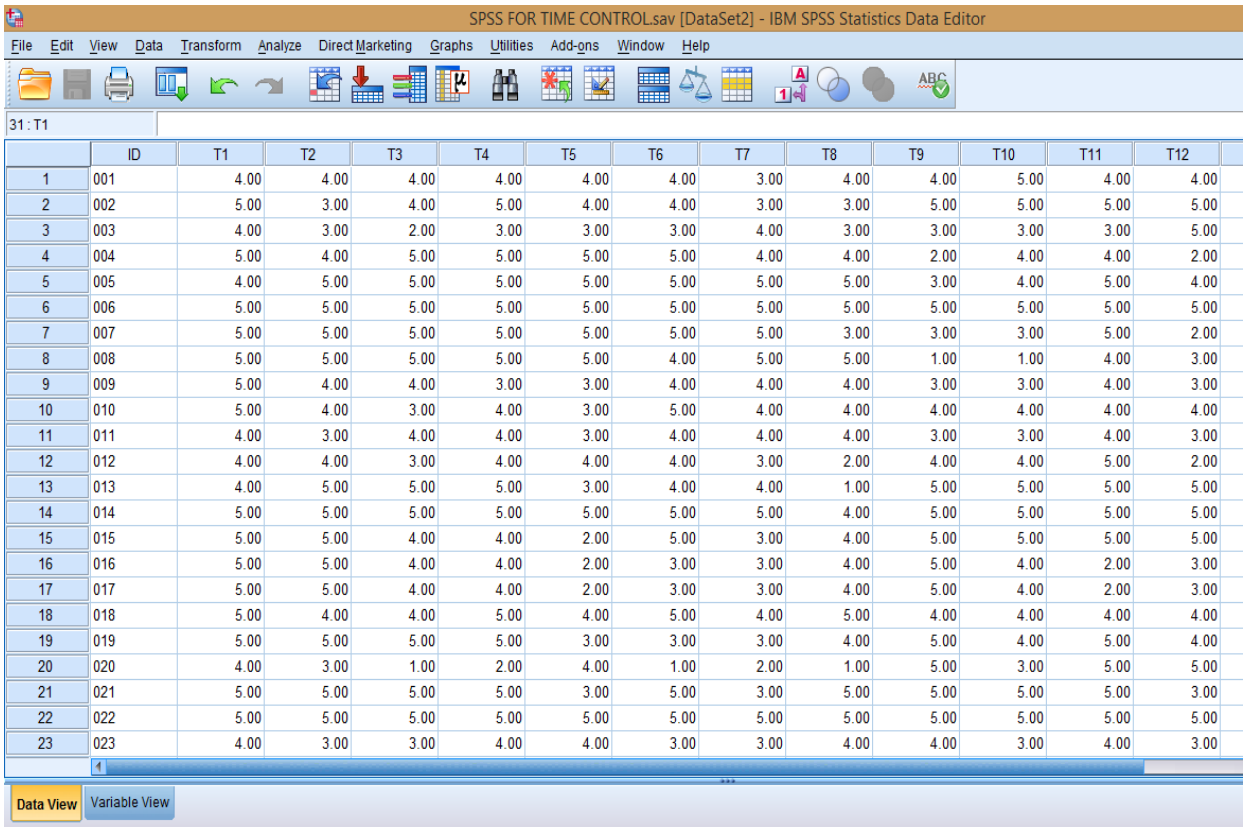
***DATA VIEW AND OUTPUT FOR COST RELATED FACTORS**

	ID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
1	001	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00
2	002	5.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	5.00
3	003	4.00	3.00	4.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	2.00	4.00
4	004	4.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	2.00	4.00	2.00
5	005	5.00	4.00	5.00	4.00	5.00	4.00	5.00	4.00	5.00	5.00	5.00	5.00
6	006	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
7	007	4.00	4.00	3.00	3.00	3.00	3.00	3.00	5.00	4.00	3.00	4.00	3.00
8	008	5.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
9	009	3.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	3.00	3.00	4.00	3.00
10	010	4.00	3.00	3.00	3.00	3.00	4.00	4.00	5.00	3.00	3.00	3.00	4.00
11	011	4.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	4.00	3.00	3.00	5.00
12	012	5.00	3.00	3.00	4.00	3.00	4.00	5.00	4.00	5.00	3.00	3.00	4.00
13	013	2.00	3.00	2.00	4.00	5.00	5.00	5.00	5.00	3.00	3.00	5.00	4.00
14	014	5.00	5.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00	5.00	3.00	5.00
15	015	2.00	5.00	2.00	4.00	5.00	4.00	5.00	4.00	5.00	3.00	3.00	5.00
16	016	4.00	5.00	4.00	4.00	4.00	2.00	3.00	3.00	2.00	2.00	3.00	4.00
17	017	4.00	5.00	4.00	4.00	4.00	2.00	3.00	3.00	2.00	2.00	3.00	4.00
18	018	5.00	5.00	4.00	4.00	5.00	4.00	3.00	3.00	4.00	3.00	4.00	4.00
19	019	5.00	4.00	4.00	3.00	4.00	5.00	4.00	5.00	4.00	3.00	4.00	5.00
20	020	4.00	4.00	3.00	4.00	4.00	4.00	5.00	3.00	3.00	1.00	3.00	1.00
21	021	5.00	5.00	5.00	3.00	5.00	5.00	3.00	5.00	3.00	3.00	5.00	3.00
22	022	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
23	023	4.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00	4.00	3.00	3.00	3.00

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
C1	31	2.00	5.00	4.1290	.92166	.849
C2	31	3.00	5.00	4.0968	.70023	.490
C3	31	2.00	5.00	3.8065	.94585	.895
C4	31	3.00	5.00	3.9032	.65089	.424
C5	31	3.00	5.00	4.2258	.76200	.581
C6	31	2.00	5.00	4.0645	.92864	.862
C7	31	3.00	5.00	4.2581	.77321	.598
C8	31	3.00	5.00	4.2581	.77321	.598
C9	31	2.00	5.00	3.7742	.92050	.847
C10	31	1.00	5.00	3.3548	1.01812	1.037
C11	31	2.00	5.00	3.7419	.85509	.731
C12	31	1.00	5.00	3.9677	1.01600	1.032
Valid N (listwise)	31					

***DATA VIEW AND OUTPUT FOR TIME CONTROL RELATED FACTORS**



	ID	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
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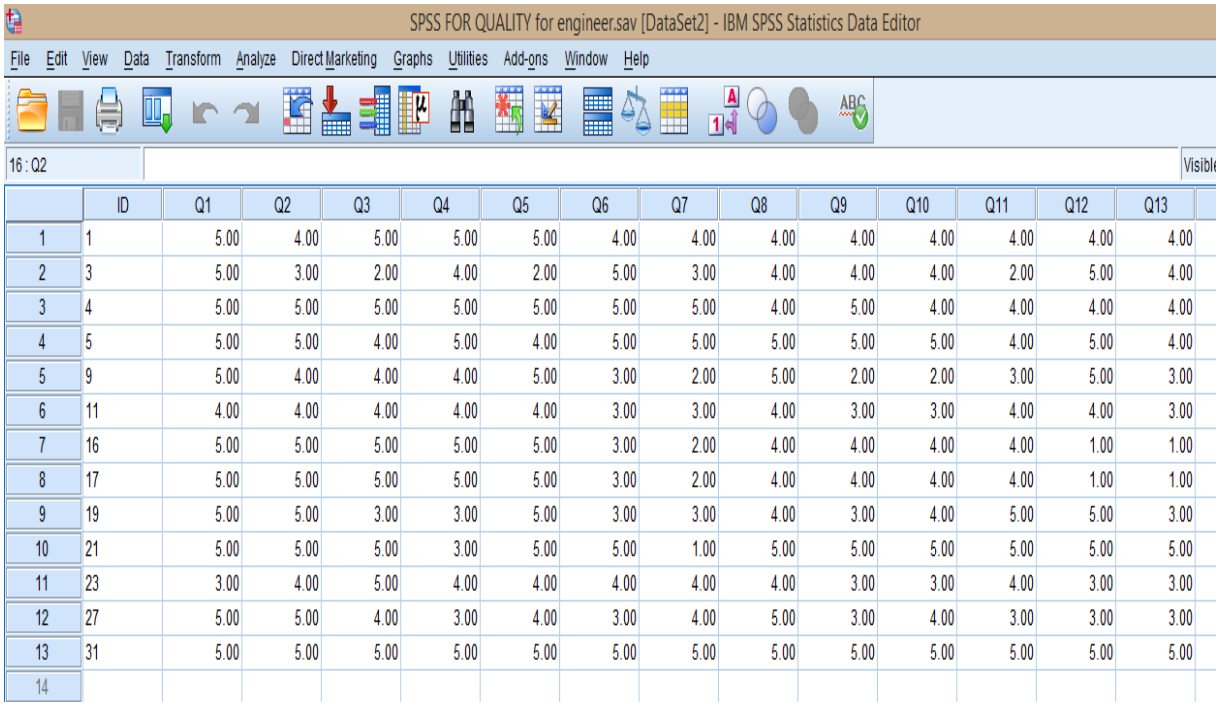
2	002	5.00	3.00	4.00	5.00	4.00	4.00	3.00	3.00	5.00	5.00	5.00	5.00
3	003	4.00	3.00	2.00	3.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00	5.00
4	004	5.00	4.00	5.00	5.00	5.00	5.00	4.00	4.00	2.00	4.00	4.00	2.00
5	005	4.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	3.00	4.00	5.00	4.00
6	006	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
7	007	5.00	5.00	5.00	5.00	5.00	5.00	5.00	3.00	3.00	3.00	5.00	2.00
8	008	5.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00	1.00	1.00	4.00	3.00
9	009	5.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00
10	010	5.00	4.00	3.00	4.00	3.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00
11	011	4.00	3.00	4.00	4.00	3.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00
12	012	4.00	4.00	3.00	4.00	4.00	4.00	3.00	2.00	4.00	4.00	5.00	2.00
13	013	4.00	5.00	5.00	5.00	3.00	4.00	4.00	1.00	5.00	5.00	5.00	5.00
14	014	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00
15	015	5.00	5.00	4.00	4.00	2.00	5.00	3.00	4.00	5.00	5.00	5.00	5.00
16	016	5.00	5.00	4.00	4.00	2.00	3.00	3.00	4.00	5.00	4.00	2.00	3.00
17	017	5.00	5.00	4.00	4.00	2.00	3.00	3.00	4.00	5.00	4.00	2.00	3.00
18	018	5.00	4.00	4.00	5.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00
19	019	5.00	5.00	5.00	5.00	3.00	3.00	3.00	4.00	5.00	4.00	5.00	4.00
20	020	4.00	3.00	1.00	2.00	4.00	1.00	2.00	1.00	5.00	3.00	5.00	5.00
21	021	5.00	5.00	5.00	5.00	3.00	5.00	3.00	5.00	5.00	5.00	5.00	3.00
22	022	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
23	023	4.00	3.00	3.00	4.00	4.00	3.00	3.00	4.00	4.00	3.00	4.00	3.00

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
T1	31	3.00	5.00	4.6452	.55066	.303
T2	31	3.00	5.00	4.3871	.80322	.645
T3	31	1.00	5.00	4.1290	.99136	.983
T4	31	2.00	5.00	4.3548	.75491	.570
T5	31	2.00	5.00	3.7742	.95602	.914
T6	31	1.00	5.00	4.1613	.93441	.873
T7	31	2.00	5.00	3.8065	.87252	.761
T8	31	1.00	5.00	3.7097	1.07062	1.146
T9	31	1.00	5.00	3.9677	1.13970	1.299
T10	31	1.00	5.00	3.8065	1.01388	1.028
T11	31	2.00	5.00	4.3226	.83215	.692
T12	31	2.00	5.00	3.6452	1.05035	1.103
Valid N (listwise)	31					

***DATA VIEW AND OUTPUT FOR QUALITY RELATED FACTORS (ENGINEERS)**

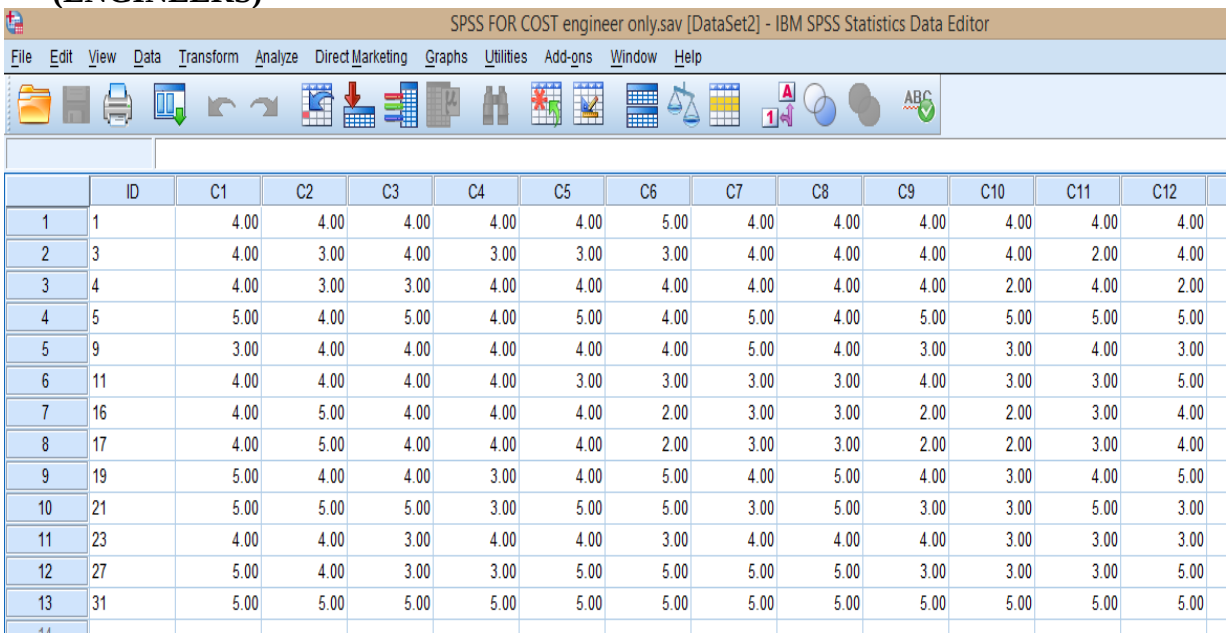


	ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
1	1	5.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
2	3	5.00	3.00	2.00	4.00	2.00	5.00	3.00	4.00	4.00	4.00	2.00	5.00	4.00
3	4	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00
4	5	5.00	5.00	4.00	5.00	4.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.00
5	9	5.00	4.00	4.00	4.00	5.00	3.00	2.00	5.00	2.00	2.00	3.00	5.00	3.00
6	11	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00	4.00	4.00	3.00
7	16	5.00	5.00	5.00	5.00	5.00	3.00	2.00	4.00	4.00	4.00	4.00	1.00	1.00
8	17	5.00	5.00	5.00	5.00	5.00	3.00	2.00	4.00	4.00	4.00	4.00	1.00	1.00
9	19	5.00	5.00	3.00	3.00	5.00	3.00	3.00	4.00	3.00	4.00	5.00	5.00	3.00
10	21	5.00	5.00	5.00	3.00	5.00	5.00	1.00	5.00	5.00	5.00	5.00	5.00	5.00
11	23	3.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00
12	27	5.00	5.00	4.00	3.00	4.00	3.00	4.00	5.00	3.00	4.00	3.00	3.00	3.00
13	31	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
14														

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Q1	13	3.00	5.00	4.7692	.59914	.359
Q2	13	3.00	5.00	4.5385	.66023	.436
Q3	13	2.00	5.00	4.3077	.94733	.897
Q4	13	3.00	5.00	4.2308	.83205	.692
Q5	13	2.00	5.00	4.4615	.87706	.769
Q6	13	3.00	5.00	3.9231	.95407	.910
Q7	13	1.00	5.00	3.3077	1.31559	1.731
Q8	13	4.00	5.00	4.3846	.50637	.256
Q9	13	2.00	5.00	3.8462	.98710	.974
Q10	13	2.00	5.00	3.9231	.86232	.744
Q11	13	2.00	5.00	3.9231	.86232	.744
Q12	13	1.00	5.00	3.8462	1.46322	2.141
Q13	13	1.00	5.00	3.3077	1.25064	1.564
Valid N (listwise)	13					

***DATA VIEW AND OUTPUT FOR COST RELATED FACTORS (ENGINEERS)**

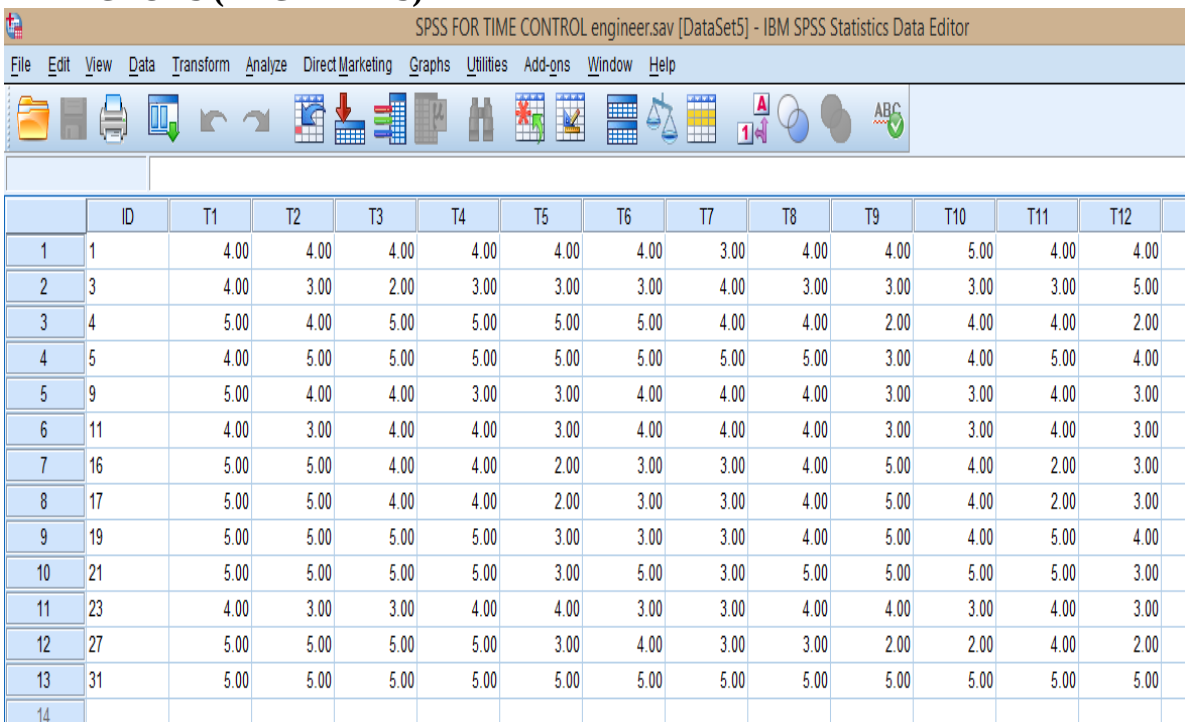


	ID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
1	1	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00
2	3	4.00	3.00	4.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	2.00	4.00
3	4	4.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	2.00	4.00	2.00
4	5	5.00	4.00	5.00	4.00	5.00	4.00	5.00	4.00	5.00	5.00	5.00	5.00
5	9	3.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	3.00	3.00	4.00	3.00
6	11	4.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	4.00	3.00	3.00	5.00
7	16	4.00	5.00	4.00	4.00	4.00	2.00	3.00	3.00	2.00	2.00	3.00	4.00
8	17	4.00	5.00	4.00	4.00	4.00	2.00	3.00	3.00	2.00	2.00	3.00	4.00
9	19	5.00	4.00	4.00	3.00	4.00	5.00	4.00	5.00	4.00	3.00	4.00	5.00
10	21	5.00	5.00	5.00	3.00	5.00	5.00	3.00	5.00	3.00	3.00	5.00	3.00
11	23	4.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00	4.00	3.00	3.00	3.00
12	27	5.00	4.00	3.00	3.00	5.00	5.00	5.00	5.00	3.00	3.00	3.00	5.00
13	31	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
C1	13	3.00	5.00	4.3077	.63043	.397
C2	13	3.00	5.00	4.1538	.68874	.474
C3	13	3.00	5.00	4.0000	.70711	.500
C4	13	3.00	5.00	3.7692	.59914	.359
C5	13	3.00	5.00	4.1538	.68874	.474
C6	13	2.00	5.00	3.8462	1.14354	1.308
C7	13	3.00	5.00	4.0000	.81650	.667
C8	13	3.00	5.00	4.0769	.75955	.577
C9	13	2.00	5.00	3.6154	.96077	.923
C10	13	2.00	5.00	3.2308	1.01274	1.026
C11	13	2.00	5.00	3.6923	.94733	.897
C12	13	2.00	5.00	4.0000	1.00000	1.000
Valid N (listwise)	13					

***DATA VIEW AND OUTPUT FOR TIME CONTROL RELATED FACTORS (ENGINEERS)**

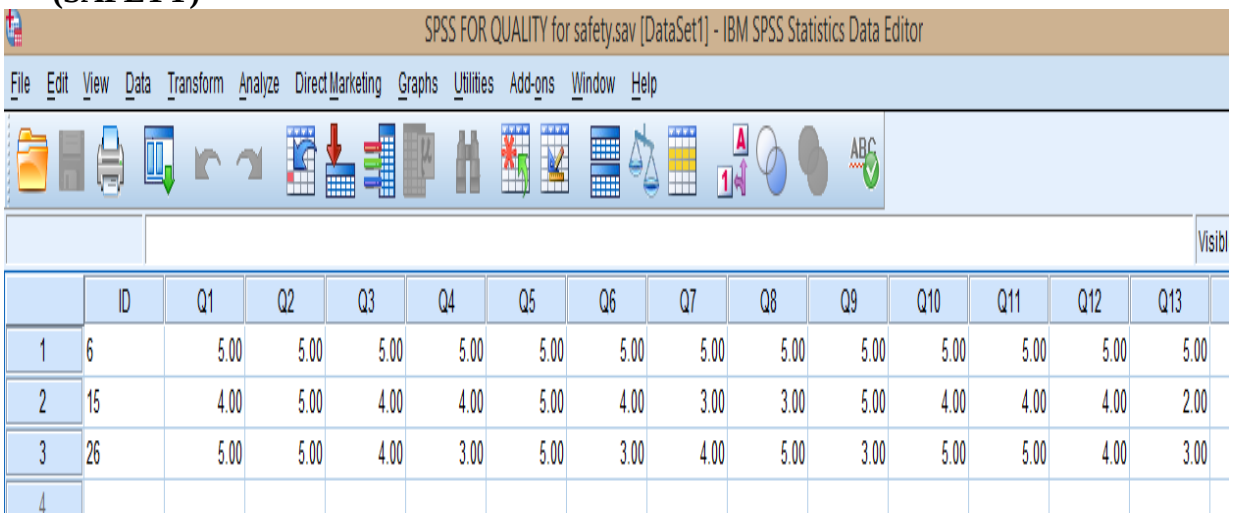


	ID	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
1	1	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	5.00	4.00	4.00
2	3	4.00	3.00	2.00	3.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00	5.00
3	4	5.00	4.00	5.00	5.00	5.00	5.00	4.00	4.00	2.00	4.00	4.00	2.00
4	5	4.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	3.00	4.00	5.00	4.00
5	9	5.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00
6	11	4.00	3.00	4.00	4.00	3.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00
7	16	5.00	5.00	4.00	4.00	2.00	3.00	3.00	4.00	5.00	4.00	2.00	3.00
8	17	5.00	5.00	4.00	4.00	2.00	3.00	3.00	4.00	5.00	4.00	2.00	3.00
9	19	5.00	5.00	5.00	5.00	3.00	3.00	3.00	4.00	5.00	4.00	5.00	4.00
10	21	5.00	5.00	5.00	5.00	3.00	5.00	3.00	5.00	5.00	5.00	5.00	3.00
11	23	4.00	3.00	3.00	4.00	4.00	3.00	3.00	4.00	4.00	3.00	4.00	3.00
12	27	5.00	5.00	5.00	5.00	3.00	4.00	3.00	3.00	2.00	2.00	4.00	2.00
13	31	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
14													

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
T1	13	4.00	5.00	4.6154	.50637	.256
T2	13	3.00	5.00	4.3077	.85485	.731
T3	13	2.00	5.00	4.2308	.92681	.859
T4	13	3.00	5.00	4.3077	.75107	.564
T5	13	2.00	5.00	3.4615	1.05003	1.103
T6	13	3.00	5.00	3.9231	.86232	.744
T7	13	3.00	5.00	3.6154	.76795	.590
T8	13	3.00	5.00	4.0769	.64051	.410
T9	13	2.00	5.00	3.7692	1.16575	1.359
T10	13	2.00	5.00	3.7692	.92681	.859
T11	13	2.00	5.00	3.9231	1.03775	1.077
T12	13	2.00	5.00	3.3846	.96077	.923
Valid N (listwise)	13					

***DATA VIEW AND OUTPUT FOR QUALITY RELATED FACTORS (SAFETY)**

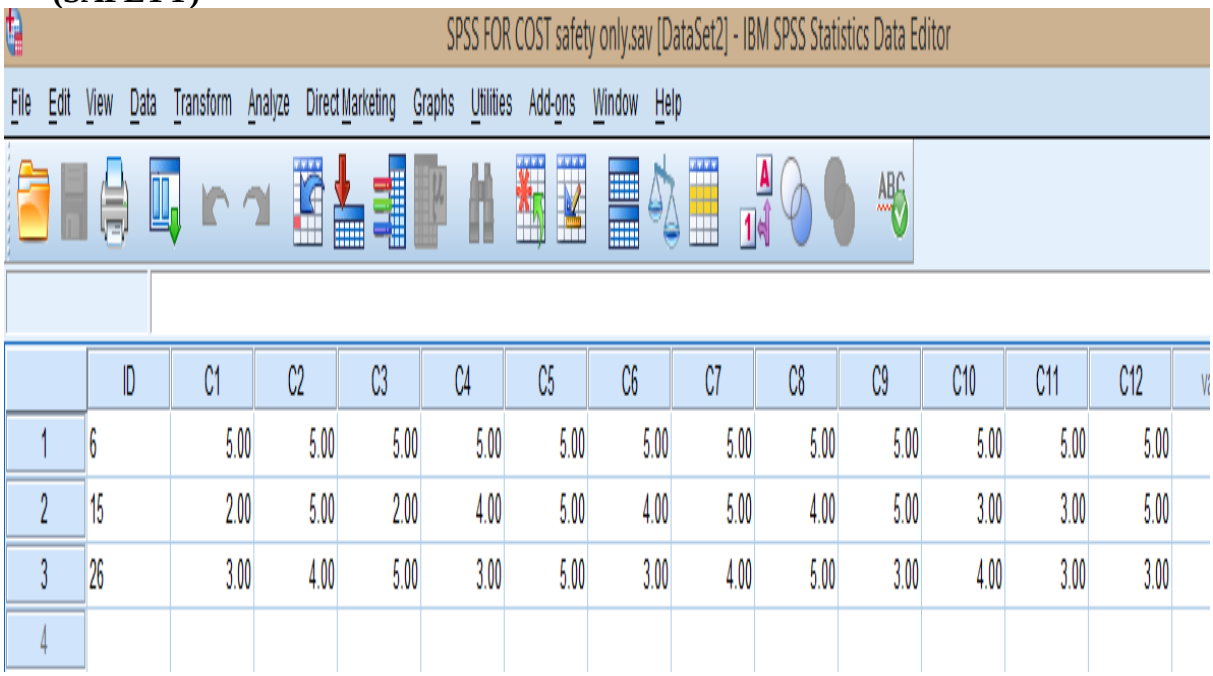


	ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
1	6	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
2	15	4.00	5.00	4.00	4.00	5.00	4.00	3.00	3.00	5.00	4.00	4.00	4.00	2.00
3	26	5.00	5.00	4.00	3.00	5.00	3.00	4.00	5.00	3.00	5.00	5.00	4.00	3.00
4														

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Q1	3	4.00	5.00	4.6667	.57735	.333
Q2	3	5.00	5.00	5.0000	.00000	.000
Q3	3	4.00	5.00	4.3333	.57735	.333
Q4	3	3.00	5.00	4.0000	1.00000	1.000
Q5	3	5.00	5.00	5.0000	.00000	.000
Q6	3	3.00	5.00	4.0000	1.00000	1.000
Q7	3	3.00	5.00	4.0000	1.00000	1.000
Q8	3	3.00	5.00	4.3333	1.15470	1.333
Q9	3	3.00	5.00	4.3333	1.15470	1.333
Q10	3	4.00	5.00	4.6667	.57735	.333
Q11	3	4.00	5.00	4.6667	.57735	.333
Q12	3	4.00	5.00	4.3333	.57735	.333
Q13	3	2.00	5.00	3.3333	1.52753	2.333
Valid N (listwise)	3					

***DATA VIEW AND OUTPUT FOR COST RELATED FACTORS (SAFETY)**

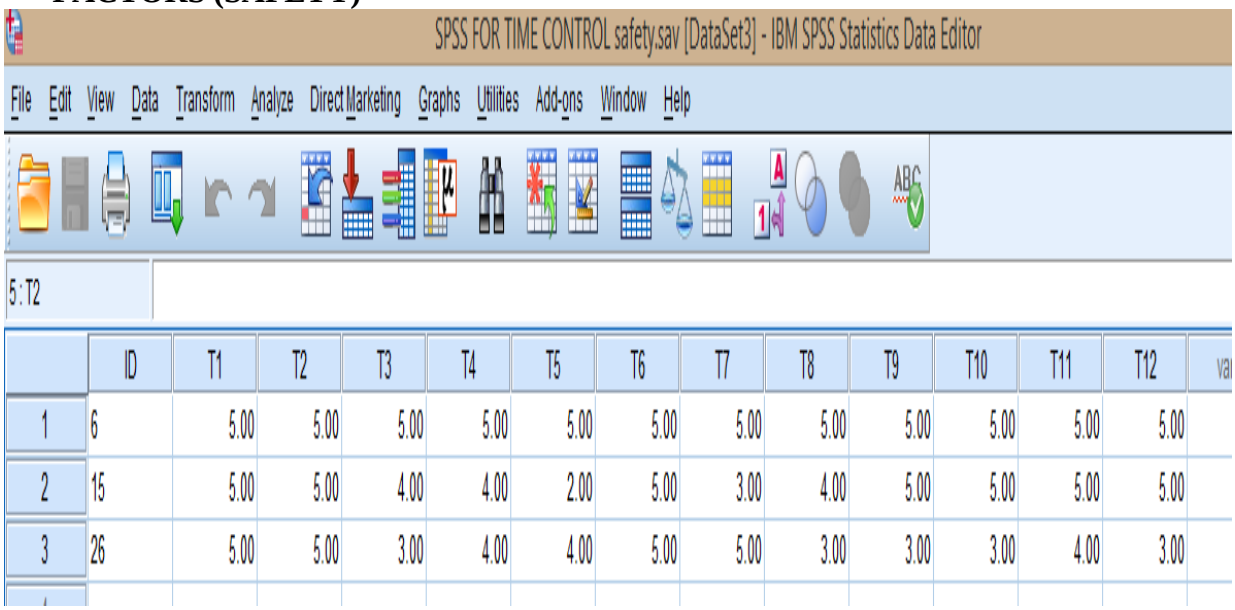


	ID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
1	6	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
2	15	2.00	5.00	2.00	4.00	5.00	4.00	5.00	4.00	5.00	3.00	3.00	5.00
3	26	3.00	4.00	5.00	3.00	5.00	3.00	4.00	5.00	3.00	4.00	3.00	3.00
4													

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
C1	3	2.00	5.00	3.3333	1.52753	2.333
C2	3	4.00	5.00	4.6667	.57735	.333
C3	3	2.00	5.00	4.0000	1.73205	3.000
C4	3	3.00	5.00	4.0000	1.00000	1.000
C5	3	5.00	5.00	5.0000	.00000	.000
C6	3	3.00	5.00	4.0000	1.00000	1.000
C7	3	4.00	5.00	4.6667	.57735	.333
C8	3	4.00	5.00	4.6667	.57735	.333
C9	3	3.00	5.00	4.3333	1.15470	1.333
C10	3	3.00	5.00	4.0000	1.00000	1.000
C11	3	3.00	5.00	3.6667	1.15470	1.333
C12	3	3.00	5.00	4.3333	1.15470	1.333
Valid N (listwise)	3					

***DATA VIEW AND OUTPUT FOR TIME CONTROL RELATED FACTORS (SAFETY)**

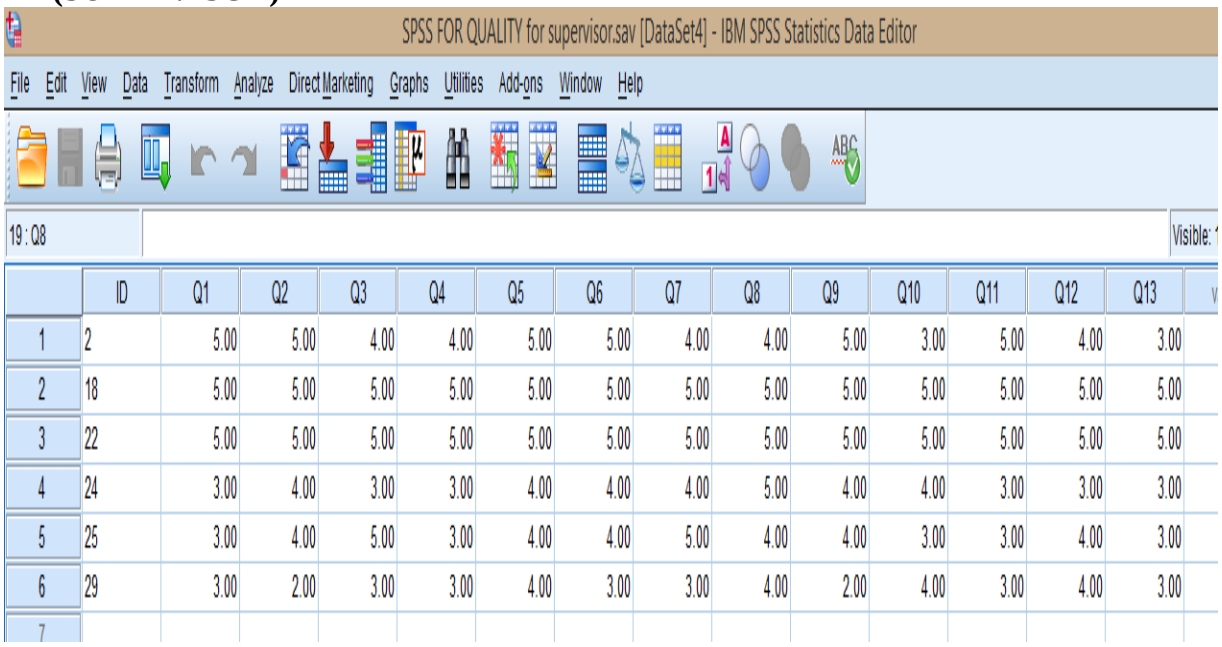


	ID	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
1	6	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
2	15	5.00	5.00	4.00	4.00	2.00	5.00	3.00	4.00	5.00	5.00	5.00	5.00
3	26	5.00	5.00	3.00	4.00	4.00	5.00	5.00	3.00	3.00	3.00	4.00	3.00

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
T1	3	5.00	5.00	5.0000	.00000	.000
T2	3	5.00	5.00	5.0000	.00000	.000
T3	3	3.00	5.00	4.0000	1.00000	1.000
T4	3	4.00	5.00	4.3333	.57735	.333
T5	3	2.00	5.00	3.6667	1.52753	2.333
T6	3	5.00	5.00	5.0000	.00000	.000
T7	3	3.00	5.00	4.3333	1.15470	1.333
T8	3	3.00	5.00	4.0000	1.00000	1.000
T9	3	3.00	5.00	4.3333	1.15470	1.333
T10	3	3.00	5.00	4.3333	1.15470	1.333
T11	3	4.00	5.00	4.6667	.57735	.333
T12	3	3.00	5.00	4.3333	1.15470	1.333
Valid N (listwise)	3					

***DATA VIEW AND OUTPUT FOR QUALITY RELATED FACTORS (SUPERVISOR)**

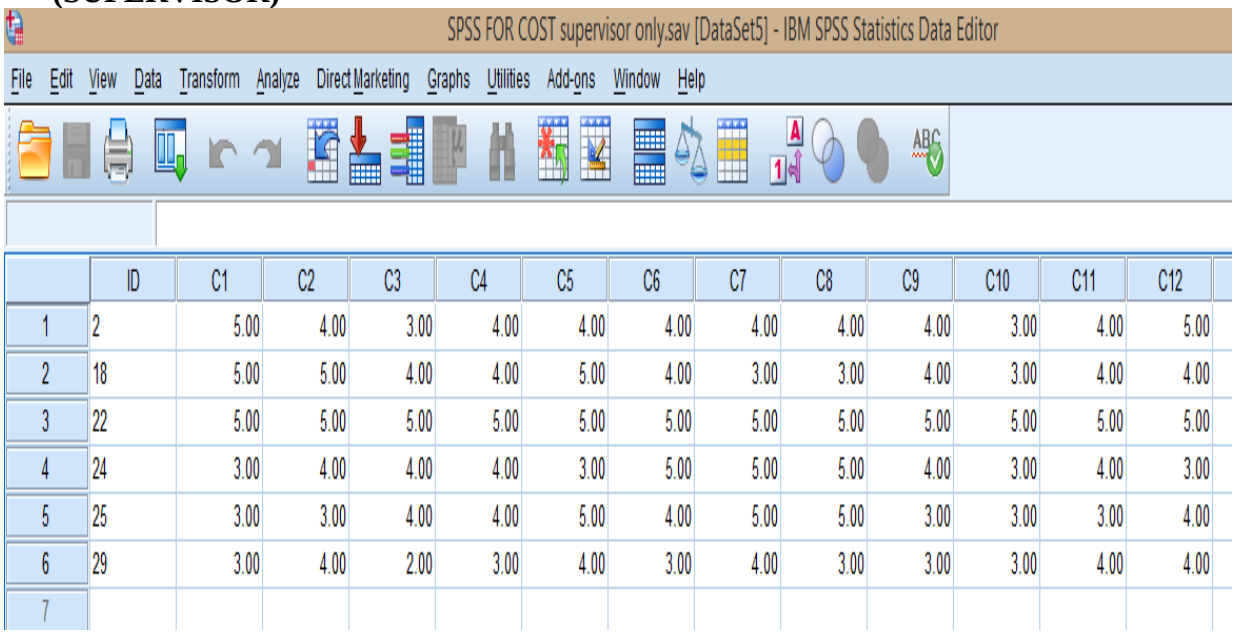


	ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
1	2	5.00	5.00	4.00	4.00	5.00	5.00	4.00	4.00	5.00	3.00	5.00	4.00	3.00
2	18	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
3	22	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
4	24	3.00	4.00	3.00	3.00	4.00	4.00	4.00	5.00	4.00	4.00	3.00	3.00	3.00
5	25	3.00	4.00	5.00	3.00	4.00	4.00	5.00	4.00	4.00	3.00	3.00	4.00	3.00
6	29	3.00	2.00	3.00	3.00	4.00	3.00	3.00	4.00	2.00	4.00	3.00	4.00	3.00
7														

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Q1	6	3.00	5.00	4.0000	1.09545	1.200
Q2	6	2.00	5.00	4.1667	1.16905	1.367
Q3	6	3.00	5.00	4.1667	.98319	.967
Q4	6	3.00	5.00	3.8333	.98319	.967
Q5	6	4.00	5.00	4.5000	.54772	.300
Q6	6	3.00	5.00	4.3333	.81650	.667
Q7	6	3.00	5.00	4.3333	.81650	.667
Q8	6	4.00	5.00	4.5000	.54772	.300
Q9	6	2.00	5.00	4.1667	1.16905	1.367
Q10	6	3.00	5.00	4.0000	.89443	.800
Q11	6	3.00	5.00	4.0000	1.09545	1.200
Q12	6	3.00	5.00	4.1667	.75277	.567
Q13	6	3.00	5.00	3.6667	1.03280	1.067
Valid N (listwise)	6					

***DATA VIEW AND OUTPUT FOR COST RELATED FACTORS (SUPERVISOR)**

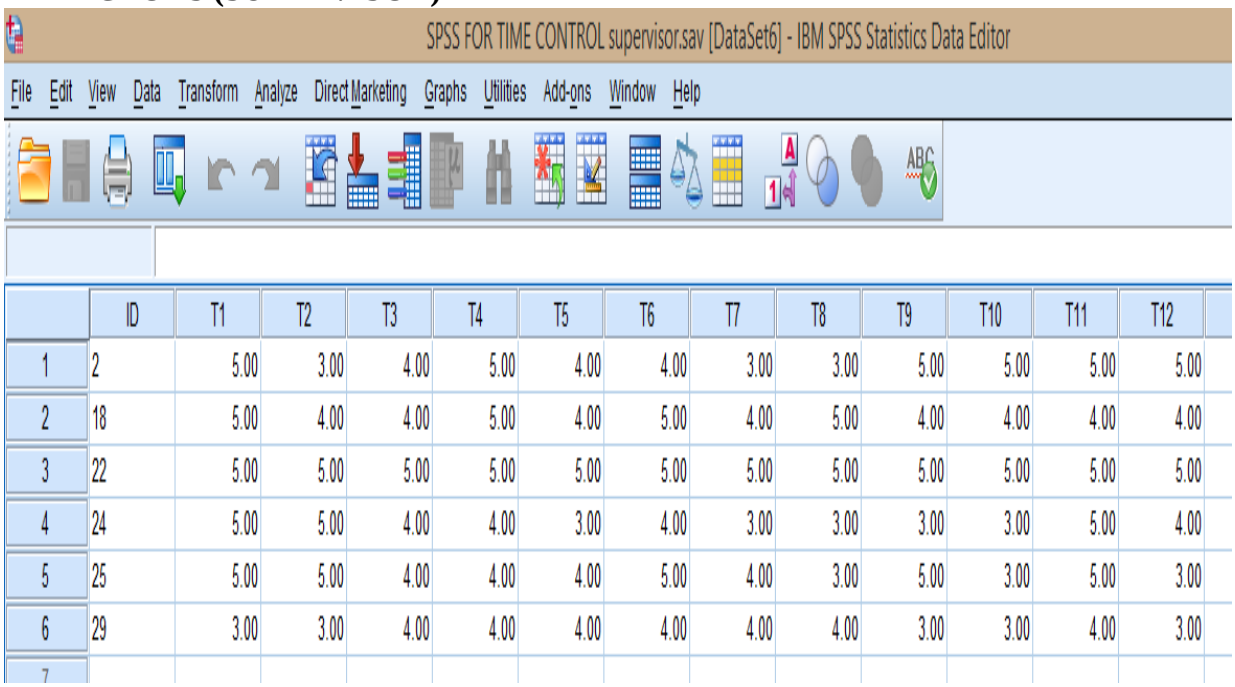


	ID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
1	2	5.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	5.00
2	18	5.00	5.00	4.00	4.00	5.00	4.00	3.00	3.00	4.00	3.00	4.00	4.00
3	22	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
4	24	3.00	4.00	4.00	4.00	3.00	5.00	5.00	5.00	4.00	3.00	4.00	3.00
5	25	3.00	3.00	4.00	4.00	5.00	4.00	5.00	5.00	3.00	3.00	3.00	4.00
6	29	3.00	4.00	2.00	3.00	4.00	3.00	4.00	3.00	3.00	3.00	4.00	4.00
7													

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
C1	6	3.00	5.00	4.0000	1.09545	1.200
C2	6	3.00	5.00	4.1667	.75277	.567
C3	6	2.00	5.00	3.6667	1.03280	1.067
C4	6	3.00	5.00	4.0000	.63246	.400
C5	6	3.00	5.00	4.3333	.81650	.667
C6	6	3.00	5.00	4.1667	.75277	.567
C7	6	3.00	5.00	4.3333	.81650	.667
C8	6	3.00	5.00	4.1667	.98319	.967
C9	6	3.00	5.00	3.8333	.75277	.567
C10	6	3.00	5.00	3.3333	.81650	.667
C11	6	3.00	5.00	4.0000	.63246	.400
C12	6	3.00	5.00	4.1667	.75277	.567
Valid N (listwise)	6					

***DATA VIEW AND OUTPUT FOR TIME CONTROL RELATED FACTORS (SUPERVISOR)**

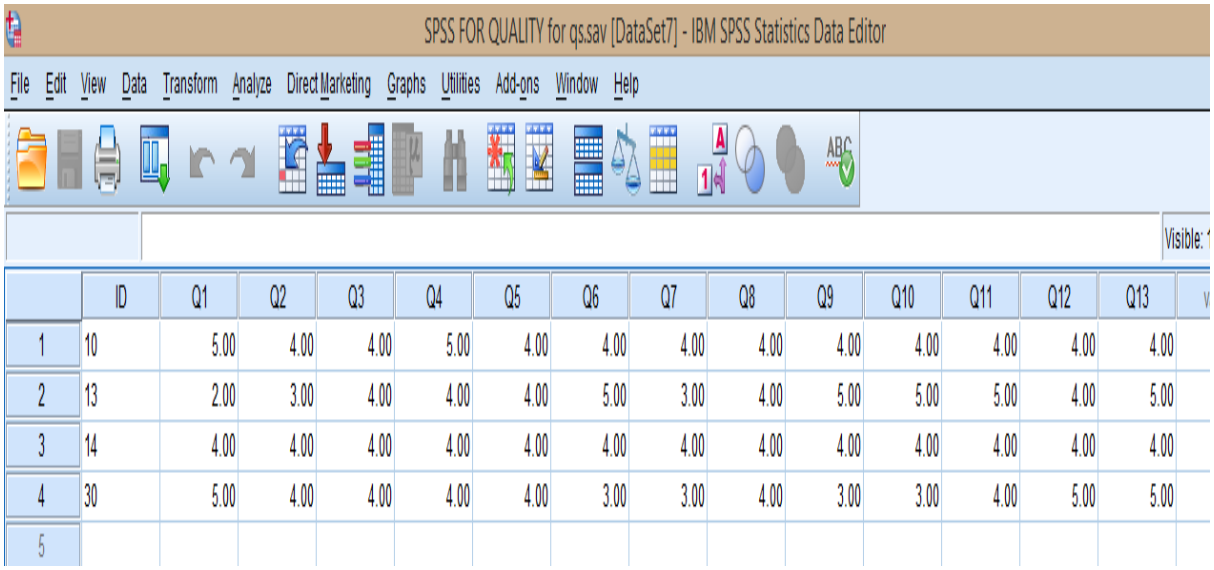


	ID	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
1	2	5.00	3.00	4.00	5.00	4.00	4.00	3.00	3.00	5.00	5.00	5.00	5.00
2	18	5.00	4.00	4.00	5.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00
3	22	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
4	24	5.00	5.00	4.00	4.00	3.00	4.00	3.00	3.00	3.00	3.00	5.00	4.00
5	25	5.00	5.00	4.00	4.00	4.00	5.00	4.00	3.00	5.00	3.00	5.00	3.00
6	29	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00
7													

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
T1	6	3.00	5.00	4.6667	.81650	.667
T2	6	3.00	5.00	4.1667	.98319	.967
T3	6	4.00	5.00	4.1667	.40825	.167
T4	6	4.00	5.00	4.5000	.54772	.300
T5	6	3.00	5.00	4.0000	.63246	.400
T6	6	4.00	5.00	4.5000	.54772	.300
T7	6	3.00	5.00	3.8333	.75277	.567
T8	6	3.00	5.00	3.8333	.98319	.967
T9	6	3.00	5.00	4.1667	.98319	.967
T10	6	3.00	5.00	3.8333	.98319	.967
T11	6	4.00	5.00	4.6667	.51640	.267
T12	6	3.00	5.00	4.0000	.89443	.800
Valid N (listwise)	6					

***DATA VIEW AND OUTPUT FOR QUALITY RELATED FACTORS (QUANTITY SURVEYOR)**



	ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
1	10	5.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
2	13	2.00	3.00	4.00	4.00	4.00	5.00	3.00	4.00	5.00	5.00	5.00	4.00	5.00
3	14	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
4	30	5.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00	4.00	5.00	5.00
5														

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Q1	4	2.00	5.00	4.0000	1.41421	2.000
Q2	4	3.00	4.00	3.7500	.50000	.250
Q3	4	4.00	4.00	4.0000	.00000	.000
Q4	4	4.00	5.00	4.2500	.50000	.250
Q5	4	4.00	4.00	4.0000	.00000	.000
Q6	4	3.00	5.00	4.0000	.81650	.667
Q7	4	3.00	4.00	3.5000	.57735	.333
Q8	4	4.00	4.00	4.0000	.00000	.000
Q9	4	3.00	5.00	4.0000	.81650	.667
Q10	4	3.00	5.00	4.0000	.81650	.667
Q11	4	4.00	5.00	4.2500	.50000	.250
Q12	4	4.00	5.00	4.2500	.50000	.250
Q13	4	4.00	5.00	4.5000	.57735	.333
Valid N (listwise)	4					

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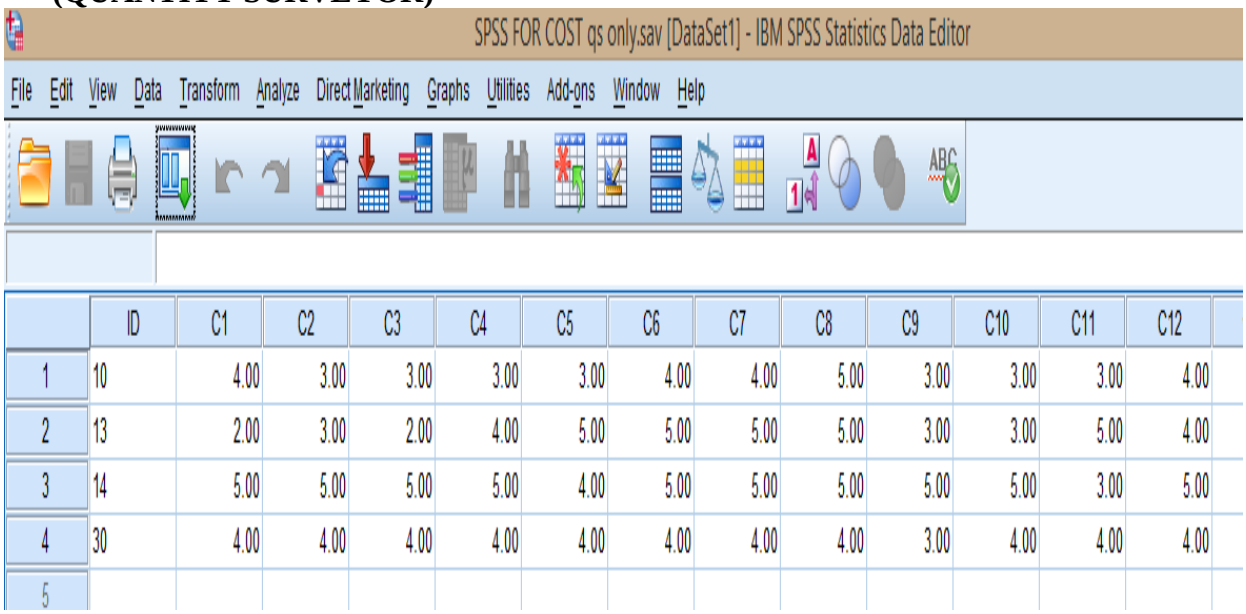
***DATA VIEW AND OUTPUT FOR COST RELATED FACTORS (QUANTITY SURVEYOR)**



	ID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
1	10	4.00	3.00	3.00	3.00	3.00	4.00	4.00	5.00	3.00	3.00	3.00	4.00
2	13	2.00	3.00	2.00	4.00	5.00	5.00	5.00	5.00	3.00	3.00	5.00	4.00
3	14	5.00	5.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00	5.00	3.00	5.00
4	30	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00
5													

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
C1	4	2.00	5.00	3.7500	1.25831	1.583
C2	4	3.00	5.00	3.7500	.95743	.917
C3	4	2.00	5.00	3.5000	1.29099	1.667
C4	4	3.00	5.00	4.0000	.81650	.667
C5	4	3.00	5.00	4.0000	.81650	.667
C6	4	4.00	5.00	4.5000	.57735	.333
C7	4	4.00	5.00	4.5000	.57735	.333
C8	4	4.00	5.00	4.7500	.50000	.250
C9	4	3.00	5.00	3.5000	1.00000	1.000
C10	4	3.00	5.00	3.7500	.95743	.917
C11	4	3.00	5.00	3.7500	.95743	.917
C12	4	4.00	5.00	4.2500	.50000	.250
Valid N (listwise)	4					

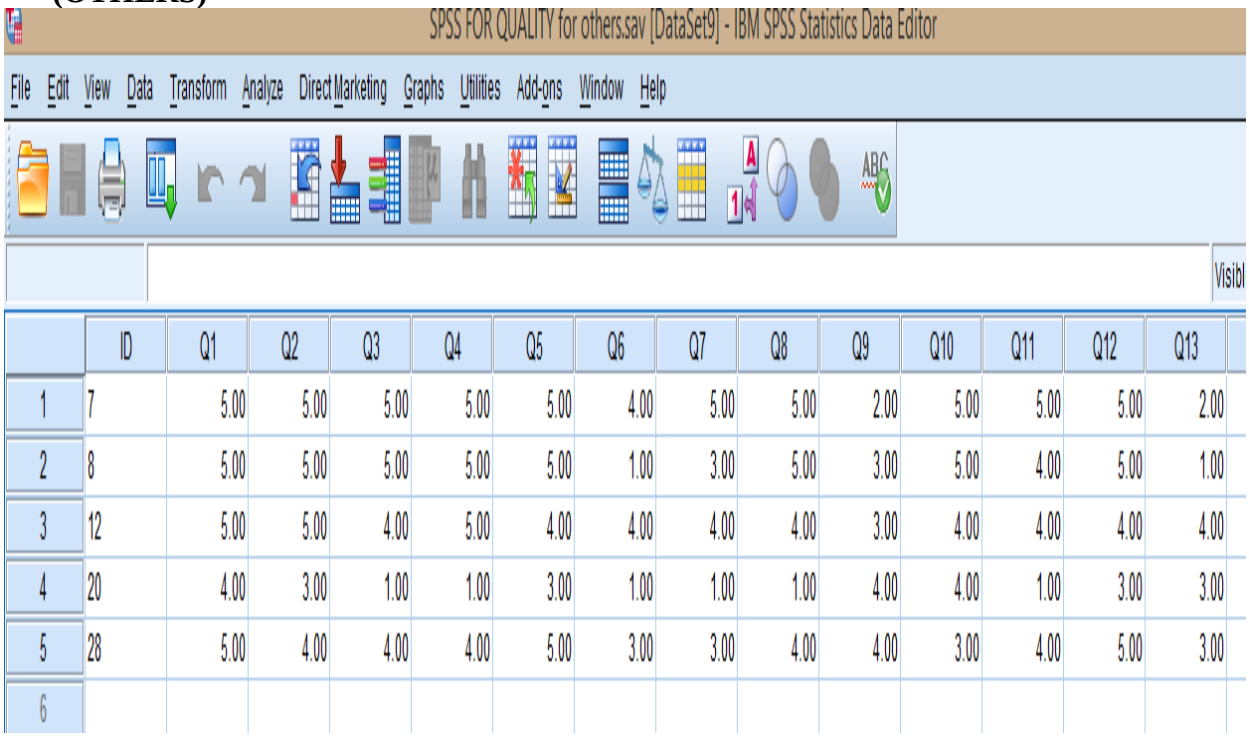
***DATA VIEW AND OUTPUT FOR TIME CONTROL RELATED FACTORS (QUANTITY SURVEYOR)**

	ID	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
1	10	5.00	4.00	3.00	4.00	3.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00
2	13	4.00	5.00	5.00	5.00	3.00	4.00	4.00	1.00	5.00	5.00	5.00	5.00
3	14	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00
4	30	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	3.00
5													

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
T1	4	4.00	5.00	4.5000	.57735	.333
T2	4	4.00	5.00	4.5000	.57735	.333
T3	4	3.00	5.00	4.2500	.95743	.917
T4	4	4.00	5.00	4.5000	.57735	.333
T5	4	3.00	5.00	3.7500	.95743	.917
T6	4	4.00	5.00	4.5000	.57735	.333
T7	4	3.00	5.00	4.0000	.81650	.667
T8	4	1.00	4.00	3.0000	1.41421	2.000
T9	4	4.00	5.00	4.5000	.57735	.333
T10	4	4.00	5.00	4.5000	.57735	.333
T11	4	4.00	5.00	4.5000	.57735	.333
T12	4	3.00	5.00	4.2500	.95743	.917
Valid N (listwise)	4					

***DATA VIEW AND OUTPUT FOR QUALITY RELATED FACTORS (OTHERS)**

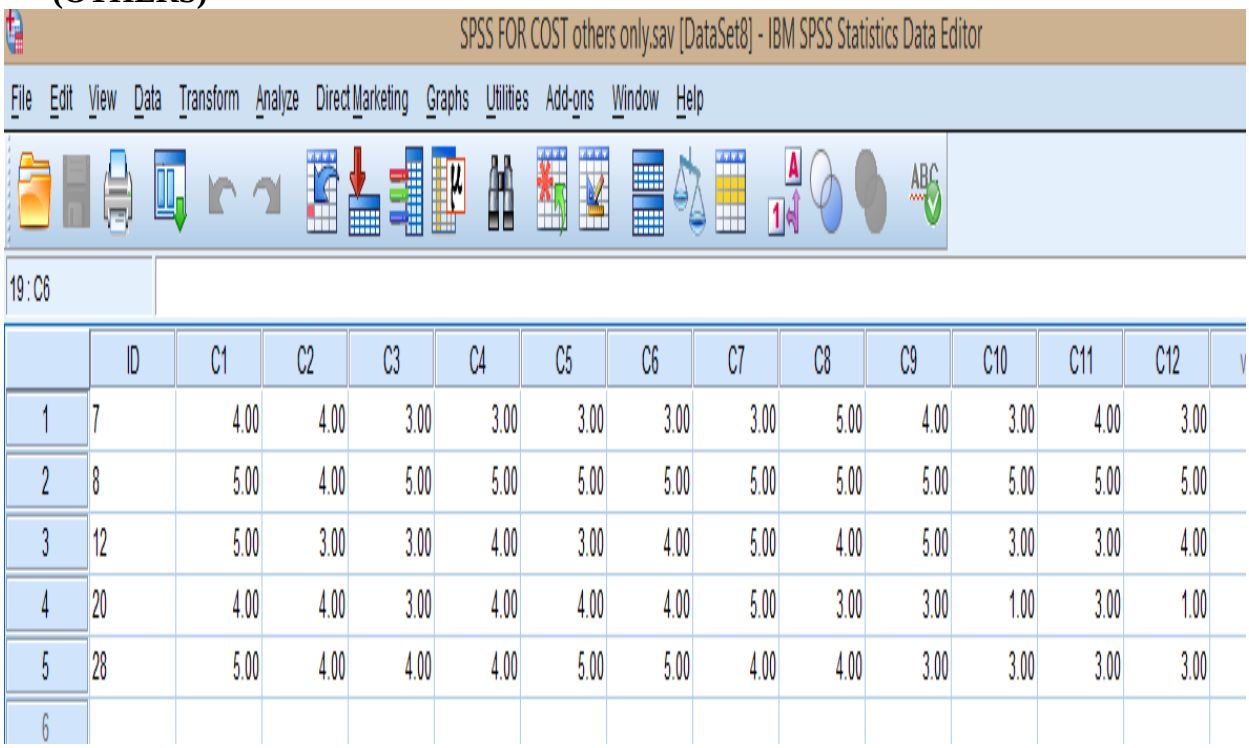


	ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
1	7	5.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00	2.00	5.00	5.00	5.00	2.00
2	8	5.00	5.00	5.00	5.00	5.00	1.00	3.00	5.00	3.00	5.00	4.00	5.00	1.00
3	12	5.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00
4	20	4.00	3.00	1.00	1.00	3.00	1.00	1.00	1.00	4.00	4.00	1.00	3.00	3.00
5	28	5.00	4.00	4.00	4.00	5.00	3.00	3.00	4.00	4.00	3.00	4.00	5.00	3.00
6														

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Q1	5	4.00	5.00	4.8000	.44721	.200
Q2	5	3.00	5.00	4.4000	.89443	.800
Q3	5	1.00	5.00	3.8000	1.64317	2.700
Q4	5	1.00	5.00	4.0000	1.73205	3.000
Q5	5	3.00	5.00	4.4000	.89443	.800
Q6	5	1.00	4.00	2.6000	1.51658	2.300
Q7	5	1.00	5.00	3.2000	1.48324	2.200
Q8	5	1.00	5.00	3.8000	1.64317	2.700
Q9	5	2.00	4.00	3.2000	.83666	.700
Q10	5	3.00	5.00	4.2000	.83666	.700
Q11	5	1.00	5.00	3.6000	1.51658	2.300
Q12	5	3.00	5.00	4.4000	.89443	.800
Q13	5	1.00	4.00	2.6000	1.14018	1.300
Valid N (listwise)	5					

***DATA VIEW AND OUTPUT FOR COST RELATED FACTORS (OTHERS)**

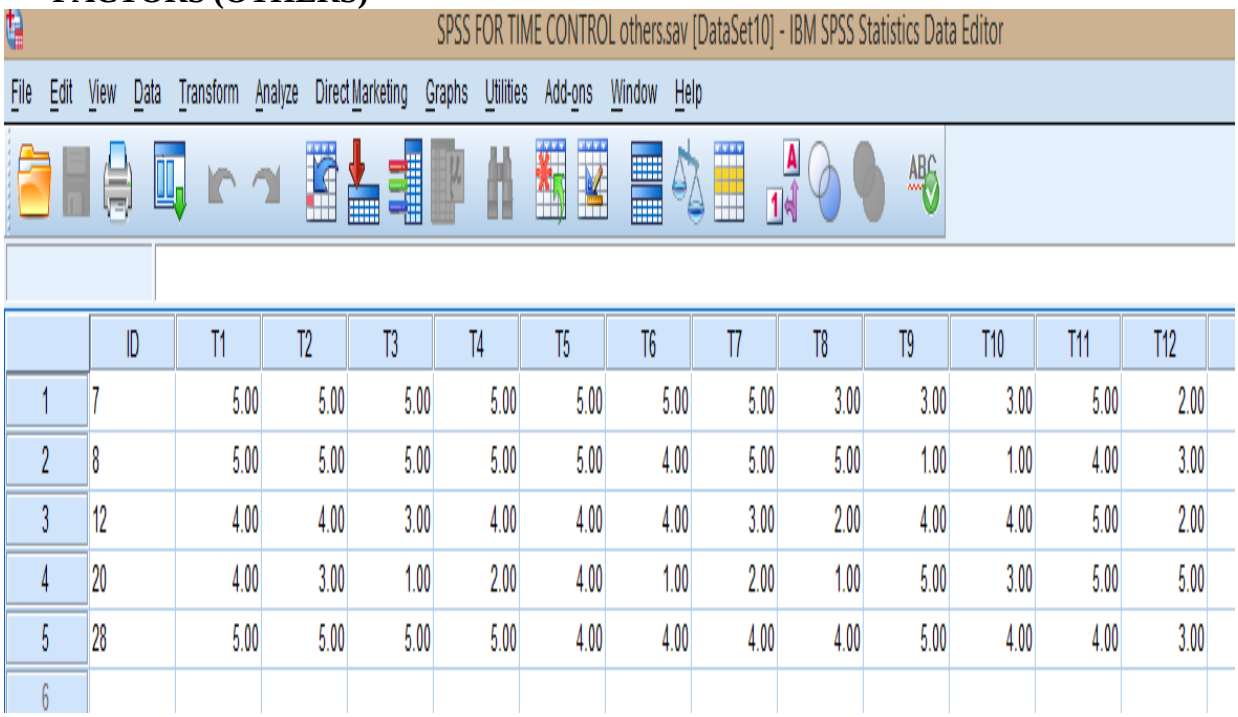


	ID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
1	7	4.00	4.00	3.00	3.00	3.00	3.00	3.00	5.00	4.00	3.00	4.00	3.00
2	8	5.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
3	12	5.00	3.00	3.00	4.00	3.00	4.00	5.00	4.00	5.00	3.00	3.00	4.00
4	20	4.00	4.00	3.00	4.00	4.00	4.00	5.00	3.00	3.00	1.00	3.00	1.00
5	28	5.00	4.00	4.00	4.00	5.00	5.00	4.00	4.00	3.00	3.00	3.00	3.00
6													

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
C1	5	4.00	5.00	4.6000	.54772	.300
C2	5	3.00	4.00	3.8000	.44721	.200
C3	5	3.00	5.00	3.6000	.89443	.800
C4	5	3.00	5.00	4.0000	.70711	.500
C5	5	3.00	5.00	4.0000	1.00000	1.000
C6	5	3.00	5.00	4.2000	.83666	.700
C7	5	3.00	5.00	4.4000	.89443	.800
C8	5	3.00	5.00	4.2000	.83666	.700
C9	5	3.00	5.00	4.0000	1.00000	1.000
C10	5	1.00	5.00	3.0000	1.41421	2.000
C11	5	3.00	5.00	3.6000	.89443	.800
C12	5	1.00	5.00	3.2000	1.48324	2.200
Valid N (listwise)	5					

***DATA VIEW AND OUTPUT FOR TIME CONTROL RELATED FACTORS (OTHERS)**



	ID	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
1	7	5.00	5.00	5.00	5.00	5.00	5.00	5.00	3.00	3.00	3.00	5.00	2.00
2	8	5.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00	1.00	1.00	4.00	3.00
3	12	4.00	4.00	3.00	4.00	4.00	4.00	3.00	2.00	4.00	4.00	5.00	2.00
4	20	4.00	3.00	1.00	2.00	4.00	1.00	2.00	1.00	5.00	3.00	5.00	5.00
5	28	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	3.00
6													

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
T1	5	4.00	5.00	4.6000	.54772	.300
T2	5	3.00	5.00	4.4000	.89443	.800
T3	5	1.00	5.00	3.8000	1.78885	3.200
T4	5	2.00	5.00	4.2000	1.30384	1.700
T5	5	4.00	5.00	4.4000	.54772	.300
T6	5	1.00	5.00	3.6000	1.51658	2.300
T7	5	2.00	5.00	3.8000	1.30384	1.700
T8	5	1.00	5.00	3.0000	1.58114	2.500
T9	5	1.00	5.00	3.6000	1.67332	2.800
T10	5	1.00	4.00	3.0000	1.22474	1.500
T11	5	4.00	5.00	4.6000	.54772	.300
T12	5	2.00	5.00	3.0000	1.22474	1.500
Valid N (listwise)	5					

APPENDIX D: CORRELATION TEST

			ET	SAFETY	SV	QS	OTHERS
Spearman's rho	ET	Correlation Coefficient	1.000	.481**	.352*	.090	.540**
		Sig. (2-tailed)	.	.003	.033	.597	.001
		N	37	37	37	37	37
	SAFETY	Correlation Coefficient	.481**	1.000	.453**	.340*	.408*
		Sig. (2-tailed)	.003	.	.005	.039	.012
		N	37	37	37	37	37
	SV	Correlation Coefficient	.352*	.453**	1.000	.399*	.257
		Sig. (2-tailed)	.033	.005	.	.015	.124
		N	37	37	37	37	37
	QS	Correlation Coefficient	.090	.340*	.399*	1.000	.149
		Sig. (2-tailed)	.597	.039	.015	.	.380
		N	37	37	37	37	37
	OTHERS	Correlation Coefficient	.540**	.408*	.257	.149	1.000
		Sig. (2-tailed)	.001	.012	.124	.380	.
		N	37	37	37	37	37

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

*. Correlation is significant at the 0.05 level (2-tailed).

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.930	.932	37