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Challenges in the Implementation of Quality Management in the Construction Sector in Palestine

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Dedication

To My Mother, Father, Brothers and Sisters

To My Dear Husband

(Samer)

And To My Lovely Son

(Amir)

Allah Bless them

For their support, encouragement and constant assistance to bring this work to light.

With Love and Respect

Maysoon

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الإقرار

أنا الموقعة أدناه مقدمة الرسالة التي تحمل العنوان:

Challenges in the Implementation of Quality Management in the Construction Sector in Palestine

اقر بان ما اشتملت عليه هذه الرسالة إنما هو نتاج جهدي الخاص، باستثناء ما تمت الإشارة إليه حيثما ورد، إن هذه الرسالة ككل، أو أي جزء من هذه لم يقدم من قبل لنيل درجة أو لقب علمي أو بحثي لدى أية مؤسسة تعليمية أو بحثية أخرى.

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's name: اسم الطالبة: ميسون هشام سياج

Signature: التوقيع:

Date: التاريخ: 23/4/2015

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List of Abbreviations

BS	British Standards
COQ	Cost of Quality
CSFs	Critical Success Factors
CSsF	Critical Success Sub Factors
DP	Deming Prize
EFQM	European Foundation for Quality Management
EN	European Norm
FIDIC	Federation International of Consulting Engineers
EQA	European Quality Award
GDP	Gross Domestic Produce
ISO	International Organization for Standardization
MBNQA	Malcolm Baldrige National Quality Award
MCSsF	Modify critical success sub factors
NGT	Nominal Group Technique
PCBS	Palestinian Central Bureau of Statistics
PCU	Palestinian Contractors Union
PECDAR	Palestinian Economic Council for Development and Reconstruction
PMBOK	Project Management Body of Knowledge
QA	Quality Assurance
QC	Quality Control
QM	Quality Management
SPSS	Statistical Package for Social Science
TQM	Total Quality Management
U.K	United Kingdom
USA	United States of America

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Abstract

The construction industry has been one pivotal industry for the development of the Palestinian infrastructure and economy. But it lacks efficiency, quality is poor, budgets are unreliable and prices are excessive. Better management would result in increased efficiency with reduced quality failures yet saving tremendous amount of money. The improvement of quality has become a major challenge faced by the construction industry and can involve, reducing cost of rework, reducing maintenance cost and improving the life cycle value of the projects. Total Quality Management (TQM) is one better solution to overcome these problems, and TQM is considered one of the most important approaches to success of construction industry.

This present study is intended to provide the necessary information needed to better manage the quality of a construction sector in Palestine. The aim of this study is to identify the current status and to highlight main problems and obstacles faced by construction companies in the implementation of TQM and to determine the success factors necessary for the implementation of TQM at construction sector in Palestine.

Both qualitative and quantitative research methodology were utilized in this study. The questionnaire was developed and used as a tool for data

collection. The population of the research consisted of managers and engineers in construction companies in the main cities of Palestine. To carry out the research, a randomly chosen sample of 174 managers and engineers from construction companies were selected to obtain their opinions on the identified most important problems and factors affecting quality.

From the respondents' answers, it is evident that the understanding of quality and implementing the Quality Systems (QS) is not sufficient. Also the current situation needs more attention. Furthermore participation of top management of these companies needs to be strengthened.

The principal outcome of this study is to develop a management model for the introduction of TQM in Palestinian construction companies which will be used as a tool to measure TQM and to assess a company’s strengths and weaknesses with regard to its use of Quality Management (QM). Applying this model will lead to the continuous improvement.

The results of the study indicate that awarding the tender on the basis of lower prices is the most important problem affecting QM then lack of expertise in Quality Management System (QMS), lack of education and training, and lack of owner's awareness about the importance of quality. Also, the most important factors affecting quality are: implement safety program, review drawings and specification before tendering and fetch materials in a timely manner. Clarity of work instruction, awarding tender to the most accurate bidder are also among the factors effecting quality. The results also indicate that there are twelve critical success factors with

47 critical sub factors were needed for the successful implementation of TQM in Palestinian construction companies.

It is recommended that raising awareness about QMS is required by giving special workshops and courses. And contracting and consulting firms must develop a QS. Also, using the developed model as a tool to measure quality and identify the weakness points that lower the degree of quality and improve it.

Chapter One

Introduction

1.1 Overview

Palestine is witnessing rapid changes and development in construction sector especially after the second intifada; accordingly most of construction projects are becoming larger and more complex (Al-Tayeb, 2008).

During any construction project the three inter-related factors of time, money and quality need to be controlled and managed. Good control means that all three factors could be improved simultaneously. Managers on a project must decide on acceptable targets for each of these factors and take action to ensure that they are achieved.

Also, rapid changes have made organizations adopt a clear vision, thus enabling them to see the future and force them to apply specific strategies to ensure that they can survive and grow.

To stay competitive, companies have to focus their strategies on strategic advantages through the enhancement of work excellence and performance. Quality Management (QM) provides an effective approach to achieving this goal. Companies are striving to adopt and implement different forms of Quality Management Systems (QMS) such as International Organization for Standardization (ISO) and Total Quality Management (TQM) (Al-Musleh, 2010).

Quality-based companies have become reputable and attract more customers through the provision of higher quality services and products in contrast with non quality-based companies (Low and Teo, 2004).

TQM is a QMS which pursues excellence in customer satisfaction through continuous improvements of products and process by the total involvement and dedication of everyone involved in the process or the products (Willar, 2012; Chase et al., 2001; McAdam and Kelly, 2002).

When applied effectively, TQM enables a company to improve long-term relationships, create a harmonious team spirit, enhance professionalism and skills in all spheres of the business sector, encourage open addressing of problems and help to achieve the intended project objectives and benefits (Lombard, 2006).

Other benefits to be gained from TQM implementation includes improved clients, consultants and supplier relation, reduced "Cost of Quality" (COQ), on time and within budget projection completions, reduction in delays in construction works, and increased profit (Love et al., 2000).

TQM is a management philosophy meant to establish a common culture which leads to a management that is more responsive to the requirements of rapid change and development in business through the provision of products or services that satisfy customers. Therefore, it is important to understand the administrative leadership of the strategic perspective of TQM in order to take advantage of the strengths and features provided by this strategy for their organizations in seeking for excellence (Dale, 2003).

1.2 Statement of the problem

The present study focuses on the TQM in a context of the construction industry. The main rationale for the selection of this area of study is the role that the construction industry plays in the development of any country and economy through the provision and development of the infrastructure of the countries. The construction industry has been one of the most important industries for the development of the Palestinian infrastructure and economy (PCU, 2003). TQM is considered one of the most important approaches to success of construction industry. However, there is a lack of understanding of the quality systems that could be implemented in the construction industry to improve not only the end products but also the processes and the overall system.

Quality in the construction industry needs to be applied to various areas such as workmanship, processes, and materials. Poor quality results in any of these areas can potentially lead to significant issues in the whole industry. Furthermore, having had some previous experience and knowledge of QM represents a powerful way for solving the problems related to bad quality that currently face the Palestinian construction sector. Therefore, it is important to adopt a system that offers a platform for this aspect to be addressed.

Also, in an era of technological development, and globalization there are huge demands from customers for better quality of work. In order to satisfy its customers, each organization has to develop itself according to its capabilities, and customer requirements. Every customer would like to

receive the final product according to the predefined requirements. Although these requirements may differ according to the product nature in general, they represent the customer's interests (Al-Musleh, 2010). Therefore, contractors and consultants are responsible to do their best to conform to these requirements according to the contractual agreement with their customers, otherwise, it will be considered as a breach of contract. So, this study provides some important issues associated with the implementation of TQM in the construction industry in Palestine.

However, according to Bryde and Robinson (2005), most contractors have failed in meeting stakeholders' needs on cost, quality and time objectives. The failure of these objectives are caused by design deficiencies, products failure and poor workmanship and these problems are common and faced by most countries irrespective of the differences in their economies (Metri,2005). Many researchers have written papers regarding the implementation of TQM in different industries while few have focused on the construction industry. Metri (2005) attributes it to the fact that construction industry has generally lagged behind other industries in implementing reform through TQM principles.

Low and Peh (1996) said that fifteen percent (15%) savings on total cost of construction can be achieved through eliminating re-work and wasted work with the introduction of QM and it should form the preliminary focus in rectifying the ills of the construction industry.

In construction industry, the quality is generally considered to be very costly, and some construction companies are established only as a result of

contractual requirements. In construction industry, production is different from factory production; therefore quality considerations need special care. Especially when the production (construction/installation) is not in place, cost of remedial works may go extremely high if attention is not paid to quality.

Against this background there is a need for all construction companies to be encouraged to be proactive in QM. This study seeks to fill this gap by identifying the critical success factors (CSFs) and develop a model for an effective TQM implementation in construction industry in Palestine.

Thus, this study is founded on a fact that if TQM has been implemented in some countries and are yielding enormous benefits, then its implementation in the construction industry in Palestine will improve quality practices and encourage continuous improvement and hence, effective QMS which will guide them in achieving quality in their products, services and higher organizational performance.

1.3 Outcome of the study

The principal outcome of this study is to develop a management model for the introduction of TQM in Palestinian construction companies which will be used as a tool to measure TQM and to assess a company's strengths and weaknesses with regard to its use of QM. Applying this model will lead to the continuous improvement.

1.4 Objectives of the study

The specific objectives of this study are:

- To assess current practices of QM in construction Industry from the perceptions of the main actors of the construction industry in Palestine;
- To identify any present quality problems and obstacles that exist in this sector.
- To identify CSFs drivers for TQM implementation in Palestinian construction sector. This serves as the basis and reference point for implementing quality model and quality improvement.

1.5 Questions of the study

The specific questions to the study include:

- What are the current practices of QM for construction industry in Palestine?
- What are the problems facing construction companies in QM implementation?
- What is the suitable model that can be used in Palestine with regard to its special conditions?
- Do contracting and consulting companies perceive quality main factors differently?
- Do contracting and consulting companies perceive quality sub factors differently?
- Do contracting and consulting companies perceive quality problems differently?
- Does the position of the respondent affect the ranking of the quality main factors?

1.6 Hypotheses of the study

In view of the above mentioned questions, the study tests the following hypothesis (H) using T-test according to type of organization and one-way ANOVA test according to respondent position:

- H1: A significant difference in perception between contracting and consulting companies with regard to main factors affecting quality.

  H□: There is no difference in perception of quality main factors between contracting and consulting companies.

- H2: A significant difference in perception between contracting and consulting companies with regard to sub factors affecting quality.

  H□: There is no difference in perception of quality sub factors between contracting and consulting companies.

- H3: A significant difference in perception between contracting and consulting companies with regard to problems affecting quality.

  H□: There is no difference in perception of quality problems between contracting and consulting companies.

- H4: A significant difference in ranking quality factors due to the position of respondent (Company Manager, Project Manager, Site Engineer and Supervision Engineer).

  H□: There is no difference between the company manager, project manager, site engineer and supervision engineer towards ranking quality main factors.

1.7 Significance of study

Based on the study problem, there is a need to develop a management model to measure TQM and to assess a Palestinian construction companies' strengths and weaknesses with regard of QM.

It is noticed that there are a number of problems in the construction industry caused by bad quality. Projects are frequently late, over budget and suffer from poor workmanship and materials. Conflict is increasing, resulting in litigation and arbitration with depressing regularity. Failure of many companies happened due to these problems. QM is a subset of management that includes the process required to satisfy the needs and complete in a specific time and budget. Quality is so important to achieve customer satisfaction and continues improvement, so understanding the quality criteria and its impacting factors will make it possible to handle the quality problems much better.

Finally, results obtained from this study will assist future efforts to develop and build a concrete TQM for construction sector in Palestine.

1.8 Outline of methodology

The study adopted both quantitative and qualitative approaches spanning on four processes. In the preliminary process, an extensive literature review on the subject matter of the study was undertaken.

The literature review covered the management structure of construction sector in Palestine, concepts of quality and TQM in the construction sector to surface and ultimately establishing constructs for implementation of TQM in the construction industry.

Based on the literature review, a standardized questionnaire is developed to collect data about the QM practices and the perception of factors contributing to the successful implementation of TQM. The targeted respondents were company managers, project managers and engineers of active construction companies.

Application of semi-structured interviews to a number of representatives from different areas within the construction industry to collect information about their claim of the most serious problems that they are facing in the current situation. These interviews were selected following a study carried out by Latham in the United Kingdom for similar purposes (Latham, 1994).

The third process is data analysis. The data are analyzed using Statistical Package for Social Scientist (SPSS) and ranking analysis.

The information which obtained, regarding the QM practices and CSFs contributing to the successful implementation of TQM was used to develop a model for TQM implementation, which is the outcome of this study.

The methods employed as well as the questionnaire design and development processes are detailed in chapters three, four and five of this thesis.

1.9 Organisation of the study

The study comprises of six chapters and these have been organized as follows:

Chapter one deals with the introduction to the research including background to the study, statement of the problem, outcome and objectives

of study, key questions, study hypotheses, significance of study, study methodology and organization of the study.

Chapter two addresses the Palestinian construction industry. It also reviews the fundamentals of TQM necessary for a greater understanding of the concepts and an in-depth review of the critical quality factors for TQM implementation.

Chapter three addresses the study methodology adopted. The study concept is described including the design of the instrument and method for collecting and analyzing the relevant data.

Chapter four represents data analysis of the results on QM, as currently practiced and critical factors for successful implementation of TQM. From these discussions a proposed model will be developed that can be used to implement TQM in Palestine.

In chapter five, design of appropriate QM model for implementation of TQM investigated.

Finally, chapter six presents the conclusions of this study, the recommendations, future research and the study limitations .

Chapter Tow

Literature Review

2.1 Introduction

This chapter provides an overview of the Palestinian construction industry, its significance in terms of Gross Domestic Product (GDP) on the economy and volume of labor force employed in this sector. This is followed by the general overview of concepts of quality and QM, previous research on TQM in general and in construction industry, benefits that will arise from effective implementation of QM, obstacles affecting the implementation of QM, CSFs necessary for TQM implementation, COQ and finally tools and techniques for TQM.

2.2 Palestinian Construction Industry

2.2.1 The Status of Palestinian Construction Industry

Khuzaimah and Hassan (2012) described the construction industry as a collection of industries. This could be the best description possible because any completed building is composed of materials and equipment produced from other industries. Therefore, understanding the nature of Palestinian construction industry and how its work is an important part of developing the construction process.

Palestinian construction includes all fixed structures, sewage treatment plants, houses and factories. According to Hinze (2001) the failure rate for construction companies is very high, it has been estimated that 20 percent of

all construction related businesses eventually fail. Failures result from many factors, including overextension of resources, subcontractor default, inadequate labor, managerial inexperience, and other economic causes.

The Palestinian construction industry is suffering from a number of issues, and most of these issues are in fact, serious and need a powerful and appropriate approach to overcome or at least to reduce their consequence, also a huge effort from all parties involved in this industry is needed to address them (Al-Tayeb, 2008). Therefore, the question as to whether TQM is the right approach to solve these issues was raised. To answer this, many issues will come under discussion in the following paragraphs.

The Palestinian construction industry is characterized by the participation of many parties and the existence of a proper management system becomes paramount to manage and direct those parties. The Palestinian construction projects usually consist of three primary participants: the client, the consultant or designer, and the contractor. The process of most construction projects is similar and starts with the client and the consultant's office where the client's requirements are transferred into drawings and specifications (the design stage). The project is usually placed out for bidding to contractors; each contractor attempts to provide better prices than its competitors, and usually, (through not always), the lowest price will win the project. There is a contract agreement that will be established between the client and the contractor under the umbrella of the consultant's office and during this stage, the consultant works as a supervisor for the project to

ensure that all work is implemented according to the project drawings and specifications.

Palestinian construction industry is characterized by custom-built projects, whereas standardized methods (mass production) are common in manufacturing. In most manufacturing or service sectors, all activities are implemented in-house, in other words in a closed and shaded area, while a construction project is usually implemented in an open area with a huge number of people, equipments and materials, unpredictable weather, the mentality of different people and a large number of activities on specific and limited time. Therefore, many researchers are working to find out how to apply a QMS which could offer a solution, such as: (Al-Tayeb, 2008; Al-Sehali, 2001; Lombard, 2006; Willar, 2012; and Dís Dagbjartsdóttir, 2012).

The Palestinian contractors may be classified as general contractors or subcontractors (specialty contractors). General contractors are responsible in all ranges of construction activities and they are responsible for executing most major construction projects. On the other hand, subcontractors limit their activities to one or more construction specialty activity, such as electrical works, air conditioning and excavation works.

Since the pace of Palestinian construction industry development is very fast, and in order to reduce redoing work, the needs for change become increasingly important. According to Love et al. (2000), the industry's problems will remain until each organization begins to take the responsibility for initiating changes within their own organizations. Such

change can be initiated through the effective implementation of TQM (Khalid, 2005).

2.2.2 Construction Contribution to GDP in Palestine

Palestinian economy, unlike other economies, lacks national strategic control and a self monitoring system, because it has never been under full Palestinian sovereignty. This economy has experienced dramatic changes, Some of these changes are linked to factors such as the volume of external donations, the repeated closures imposed on the movement of people and goods into the Palestinian territories, multiple challenges face Palestinian development efforts, whereby recovery and reconstruction must proceed (Osaily, 2010).

Construction industry occupies a huge economic segment for Palestine, and has a significant effect on the efficiency and development of other Palestinian industries. Its plays a powerful role in sustaining economic growth, in addition to producing structures that add to productivity and quality of life. This construction industry is large, complex, and diverse, it covers a wide range of business interests and activities (Al-Ostaz,M, 2004).

Palestine witnessed a growth in most economic activities, its construction sector recorded the second highest growth rate in 2012 of 6.5%, after the service sector. This sector in Palestine experienced a considerable growth in the aftermath of 1967; its share of GDP increased from less than 9 % in 1985 to more than 23 % in 1995. During that period this sector's contribution fluctuated in an upward long-run trend bounded by 9 % and 19 % from 1970 to 1980, and by 15.2 % - 23 % from 1989 to 1995. However,

it appears that in 2004 the contribution to the GDP was reduced to 9 % due to the second Intifada in Palestine (PCBS, 2012a). Due to increased demand from the first Intifada, and to accommodate Palestinian returnees from the Gulf following the first Gulf War, the construction sector experienced a steady increase from 1991 onwards (Shweiki et al, 2013).

The 1994 peace process accelerated this increase, particularly after the return of many Palestinians with the Palestinian National Authority (Amer, 2002). Palestinian construction sector became one of the key economic sectors and the main force motivating the Palestinian national economy, this sector has witnessed noticeable expansion and activities. This has resulted in the recovery of the construction profession and subsidiary industries by encouraging the investment of the Palestinian organizations in the local construction sector, and contributing in jobs creation for thousands of Palestinians (PCU, 2008). Table 2.1 below illustrates the construction share in GDP for the West Bank and Gaza Strip - (Million US$).

Table 2.1: Construction Share in GDP for the West Bank & Gaza Strip

Item \ years	G.D.P (Million US$).	Construction Share %
1972	276.2	9
1974	548.7	12
1976	650.5	16
1978	695.4	16
1980	1044	16
1982	1002	19
1984	998.8	18
1986	1536.7	16
1988	1789.9	16.7
1990	2220	21.6
1992	2486.6	22.4
1994	2975.23	26

Source: ICBS, National Accounts of Judea and Samaria 1968-1996 (PECDAR, 2007).

Building licenses are indicators that refer to the status of construction in Palestine. During 2012, building licenses increased by 6.9% compared with 2011 and these results indicate that the construction of new buildings was significant during 2012. Administrative records from the Ministry of Local Government indicated that about 59.3% of licenses were issued for new buildings. Figure 2.2 shows the number of building licenses issued in Palestine during 2004-2012; administrative records indicated a rise in the number of licenses issued during 2005, followed by a sharp decline in 2007. Figures began to rise after 2009 and reached their highest point during 2012 with 8,239 licenses (PCBS, 2012).

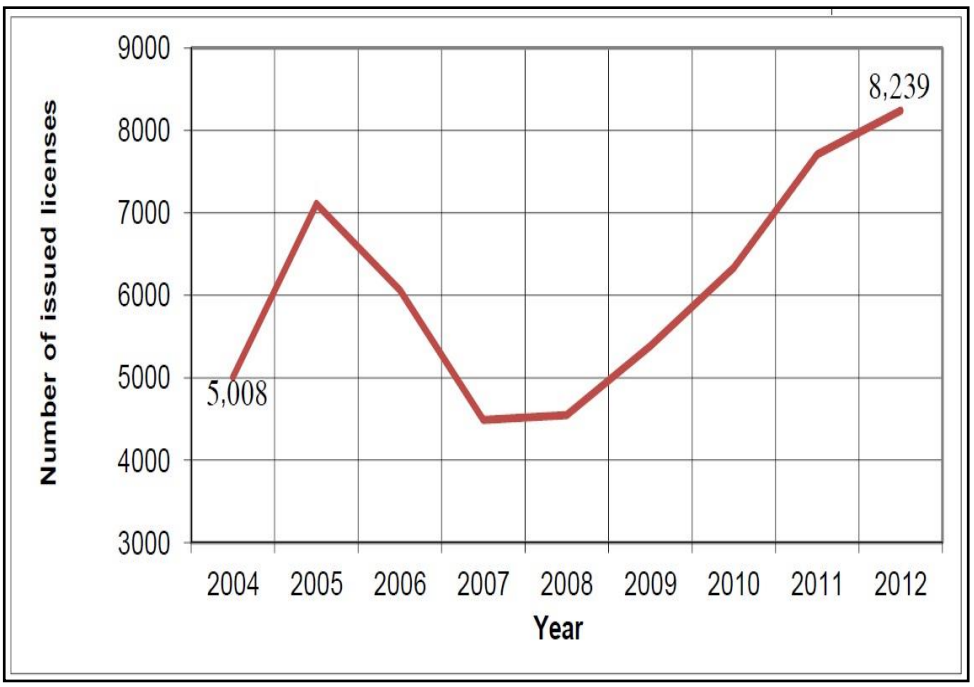

Figure 2.1: Building Licenses in Palestine 2004-2012

2.2.3 Volume of Labor Force in Palestinian Construction Sector

Palestinian construction sector is one of the most important sectors in the assimilation of labor force throughout Palestinian cities and towns. Prior to the Israeli re-occupation of the Palestinian territories on September 28,

2000, Table 2.2 illustrates that this sector used to employ an average of 22.3% of Palestinian labor force. However, this sector in 2001 employed 10.8% of the labor force only; also it employs about 30% of laborers indirectly in industries related to the construction sector and other services and productive sectors (PCBS, 2012).

Table 2.2: The Labor Force Volume in the Construction Sector in 1999-2001

Economic Activity	**1999**	**2001**
Agriculture, Hunting, Forestry & Fishing	13.2 %	16.9 %
Mining, Quarrying & Manufacturing	15.7 %	12.8 %
Construction	**22.3 %**	**10.8 %**
Commerce, Hotels & Restaurants	16.6 %	19.4 %
Transportation, Storage & Communication	5.3 %	4.9 %
Services & Other Branches	26.9 %	35.2 %

Source: Palestinian Central Bureau of Statistics (PCBS), Labor Force

In 2012, the number of Palestinian employees increased by 7.0% to 75 thousand. The nominal daily wage per worker was NIS 124.5, which is the highest nominal daily wage compared with other economic activities (PCBS, 2012).

2.3 Concept of Quality and Quality Management

2.3.1 Definitions of Quality

Quality is very important in the modern competitive business world; hence, defining it is significant for companies to reach quality improvement. Thus, it enables employees and management directing their efforts in their goals. However, there is no universally accepted definition for quality, its

definition has gone through a range of thoughts, one can find a variety of definitions of it (Dale, 2003; Dahlgaard et al., 2002).

In an ordinary dictionary the word “quality” is described as: Degree of excellence, the relative nature or kind of a thing; type; brand. And a “quality product” is described as: a superior article, a high-class article.

Many of the leaders of quality movement had their own individual definitions of quality, for example: W. Edward Deming defined quality as a product or service "that helps somebody and enjoys a good and sustainable market" (Deming, 2000). He focused on the improvement of conformance to specification by reducing variability and uncertainty in the design and manufacturing processes.

The American Society for Quality Control defines quality as "the total features and characteristics of a product or service made or performed according to specification to satisfy customers at the time of purchase and during use". The emphasis in this definition is that the quality is achieving the specification (Al-Musleh, 2010).

ISO defines quality as “the totality of features and characteristics of a product or service that bears on its ability to satisfy stated or implied needs”. This is the only definition that is internationally accepted and it is also the definition that is used when QSs are adopted (Landin, 2000).

Al-Musleh (2010), Abusa (2011), Al-Tayeb (2008), Al-Sehali (2001) and Dahlgaard et al (2005) suggested that it is possible to classify definitions of quality into five broad categories or approaches:

- **Transcendent (Excellence):** Walter Shewhart, (1931) defined quality as "the goodness of a product" this view referred to as the transcendent (transcends, to rise above or extend notably beyond ordinary limit) definition of quality. This definition is derived from Plato's philosophy of beauty. From this view point, quality is synonymous with innate excellence. It is clear that approach to defining quality is highly subjective (Al-Tayeb, 2008).
- **Product-based (Amount of desirable attribute):** Another definition of quality is that it is a function of a measurable variable and the differences in quality reflect differences in quantity of some product attribute. This view of quality based on a measurable characteristic of the product rather than on preferences, enables a more objective assessment of quality. As a result, quality is often mistakenly assumed to be related to price, the higher the price, the higher the quality. However, a product need not to be expensive to be considered as a quality one (Al-Sehali, 2001).
- **User-based (Fitness for use):** In the user-based definition, quality is the extent to which a product or service meets and/or exceeds customers' expectations. This approach is marketing-based. In 1951, Joseph Juran who was influential in Japanese industry in the late 1950s described quality with the phrase "fitness for use by the customer" (Juran and Gryna, 1993), and he conceptualized that quality was composed of two parts: the quality of design and the quality of conformance. But he emphasized that products should be fit-for-use rather purely conforming to specification. The "quality of design," in essence, referred to

providing satisfaction to customers by designing products that meet their needs. The “fitness for use” definition is driven by customer satisfaction, and has become the principal definition of quality in the manufacturing and service industries. The user-based definition is widely accepted and considered one of the key concepts of TQM (Rabaya, 2013).

- **Manufacturing-based (Conformance to specification):** Quality is defined as the desirable outcome of manufacturing practices, or conformance to specifications (Rabaya, 2013). Crosby has stated that quality is “conformance to requirements or standard” (Crosby, 1986). He focused on the COQ and non-conformance and claimed that many organizations do not know how much they spend on quality. This definition is a basis for statistical quality control. It has an internal focus, in contrast to the external focus of the user-based approach, and quality is considered an outcome of manufacturing practices. Deviations from design specifications result in inferior quality, and consequently increased costs due to scrap, rework or product failure. This definition allows for the precise and objective measurement of quality, although it has limited applicability for services (Sebastianelli and Tamimi, 2002).
- **Value-based (Satisfaction relative to price):** The value-based definition equates quality with performance at an acceptable price, or alternatively conformance at an acceptable cost. This definition is derived based on the notion that consumers consider quality in relation to price. In 1951, Feigenbaum introduced this idea when he defined quality as “best for certain customer conditions, the conditions being the

actual use and selling price of the product." Here, the notion of worth is incorporated into the definition of quality, making this more subjective than objective (Sebastianelli and Tamimi, 2002).

It can be seen that while all those quality definitions, the purpose was to improve the overall quality. Therefore, the varieties in quality definitions emphasis the Al-Tayeb study in (2008), Khalid study in (2005) and Rabaya study in (2013), as they stated that there is no single definition of quality that will apply to all companies in all industries.

The most applicable definitions in construction industry are fitness for use and conformance to specifications. It is generally true to say that one of the aims of every construction firm is to win the trust and acknowledgment of customers as a means of gaining business competitiveness and making greater profits, quality in construction refers to both of services provided and outputs (Al-Musleh, 2010).

2.3.2 Dimensions of Quality

There is a need for different definitions of quality, reliance on a single definition is frequently a source of problems. The diversity of definitions may be explained by "david garvin's eight principal quality dimensions" (Evans & Lindsay, 1992). The following is a summary of these dimensions presented by: Amer (2002); Abu Bakar et al (2011); Rabaya (2013); Lombard (2006); and Abusa (2011):

1. Performance: a product's primary operating characteristics, such as the clarity of machine speed.
2. Features: the properties of a product.

3. Reliability: the probability of a product's surviving over a specified period of time under conditions of use.
4. Conformance: the degree to which physical product match pre-established standards, this dimension considers objective measures that are not affected by the wishes of consumers, so limits are imposed on the specifications.
5. Durability: the amount of use one gets from a product before it physically deteriorates or until replacement is preferable, it shows the period during which the product can be exploited before its repair.
6. Serviceability: measured by speed of repairs and courtesy of repair person, this is the most important thing that confirms the quality assurance systems and ISO.
7. Aesthetics: how a product looks, feeds, sounds, tastes or smells, one example is external finishes in a building.
8. Perceived quality: subjective assessment resulting from image, advertising or brand names, so modern methods must be used in advertising.

2.3.3 Quality Management (QM)

QM refers to all activities of overall management functions, especially top management leadership, that determines quality policy objectives and responsibilities for all members of the organization. It includes all activities that managers perform in an effort to implement their quality policy. These activities include quality planning, Quality Control (QC), Quality Assurance (QA) and quality improvement, (Abusa, 2011). QM is also

defined as “coordinated activities to direct and control an organization with regard to quality" (ISO 9000:2000). Quality policy is the overall intentions and directions of an organization as regards to quality, as formally expressed by top management (McCabe, 1998).

Project Management Body of Knowledge (PMBOK), is a guide to the project management, states that project QM is a subset of project management that includes the process required to ensure that the project will satisfy the needs for which it was undertaken (Landin, 2000).

The activities are normally management driven and integrated into a system. This is known as the systems approach to managing quality and people are required to participate or are inspired to participate. Quality System is defined in BS, EN, ISO 8402 as “Organizational structures, procedures, processes and resources for implementing QM” (McCabe, 1998). The most common QM implemented in recent history is TQM and ISO Quality Management Systems.

2.3.3.1 Total Quality Management (TQM)

Companies in the construction industry provide infrastructure for the economy, yet they face problems of instability, low productivity, poor quality and lack of standards in the face of high fragmentation in the industry (Al-Musleh, 2010). TQM provides an effective approach to prevent or reduce these problems and provide higher quality services and products. Its management are designed to focus on the entire organization and all of the employees in providing products or services that satisfy the customers (Talha, 2004).

TQM, like quality, has many definitions, for example, ISO defined it as the management approach of an organization, based on the participation of its members which aims at long-term success through satisfaction and benefits to all members of the organization and society (ISO 8402, 1994). Dahlgaard et al., (2005) saw TQM as: "a corporate culture characterized by increased customer satisfaction through continuous improvement, in which all employees in the firm actively participate." Zhang et al., (2000) defined TQM as a management philosophy for continuously improving overall business performance based on leadership, supplier, vision and plan statement, evaluation, process control and improvement, product design, quality system improvement, employee participation, recognition and reward, education and training, and customer focus (Al-Tayeb, 2008).

Upon this study, TQM is based on a comprehensive management processes lead by top management to obtain involvement of all stakeholders in the continuous improvement of the performance of all activities as a whole.

Most of the literature indicates that the interest in the TQM concept began in USA as only theories, but implemented in practice in Japan after Second World War. One of the major reasons the Japanese have been so successful is their ability to take a concept from another culture and improve on it in a uniquely Japanese fashion, the growing intensity of global competition, led the US to follow Japanese strategy (Al-Musleh, 2012).

Al-Musleh (2012) discussed the implementation of TQM in construction firms, and concluded in his study that TQM has been recognized as a successful management philosophy in the manufacturing and service

industries, so can likewise be embraced in the construction industry to help improve quality and productivity.

2.3.3.1.1 Historical Evolution of TQM

It is widely believed that TQM evolved gradually and took place in four stages: Quality Inspection, QC, QA and TQM (Al-Tayeb, 2008; Dahlgaard et al, 2002; Al-Sehali, 2001; Talib, 2010; Abusa, 2011; Rabaya, 2013).

1. **Quality Inspection Stage**

   This stage started in the 1910s and began with craftsmen. During that period craftsmen were responsible for manufacturing and exclusively controlling the quality of their products (Dahlgaard et al., 2005). Craftsmen were grouped together and supervised by supervisors (foremen) for their quality work. Thus, the master foremen maintained a form of quality control by inspecting the finished products before selling them (Juran, 1991).The quality of the product depended largely on the skills of the craftsmen and the effectiveness of the master foremen. Under a simple inspection- based system, one or more characteristics of a product were examined, measured, tested and compared with specification or performance standards. The role of the quality professionals was mainly inspection, sorting, counting and grading of products. The work which does not conform to specifications may be reworked or causes claim (Al-Tayeb, 2008). This means, quality measurement at that time focused on the inspection process by eliminating bad products, it does not prevent the error, but it

is an attempt to detect and fix it, and depended on random inspection (Rabaya, 2013).

2. Quality Control Stage (QC)

This stage started with the Second World War, when manufacturing system was complex and quality thinking was essential. During that era quality was controlled through supervised skills, written specification, measurement and standardization. Thus, statistical QC like control charts and sampling methods was then developed to inspect the post-production effort by separating the good product from the bad product and contributing most in sampling inspection rather than complete inspection (Abdul-Rahman and Tan, 2005). QC is defined in BS, EN, ISO 8402 as "the operational techniques and activities that are used to fulfill requirements for quality"(McCabe, 1998). In construction, this process includes first, setting specific standards for construction performance, usually through the plan and specifications; second, measuring variances from the standard; third, taking action to correct or minimize adverse variance; and finally, planning for improvements in the standards themselves and conformance with the standards (Al-Tayeb, 2008).The primary objective of QC is to prevent mistakes and avoid them before they occur (Rabaya, 2013).

3. Quality Assurance Stage (QA)

This contains all the previous stages in order to provide sufficient confidence that a product or service will satisfy customers' needs (Dahlgaard et al., 2005). This stage came with the change away from

product quality towards system quality; it improves product quality by placing emphasis on product and process design (Al-Tayeb, 2008).

QA is widely known as a prevention-based system, during this stage, more emphasis was put on problem prevention rather than detection. Characteristics of this stage are the use of tools and methods such as quality manuals, procedures, work instructions, quality planning, quality audits, etc. (Abusa, 2011). Quality planning and improvement certainly begin when top management include prevention as opposed to detection in organizational policy and objectives, and start to integrate the improvement efforts of all departments (Dahlgaard et al., 2005).

According to BS, EN, ISO 8402: QA is defined as “all the planned activities implemented within the quality system, and demonstrated as needed, to provide adequate confidence that an entity will fulfill requirements for quality” (McCabe, 1998). Also according to "Manual of Professional Practice for Quality in the Construction Project" QA is a program covering activities necessary to provide quality in the work to meet the requirements, on the other hand QC is the specific implementation of the QA program and related activities" (Al-Musleh, 2012).

4. Total Quality Management Stage (TQM)

This stage evolved in the early 1980s through a dramatic increase in user quality requirements and quality as a competitive weapon for organizations. Western manufacturers recognized the inadequacy of the existing quality practices and techniques contributing to excessive

quality cost, due to inspection, testing, laboratory checks, scrapping and reworking imperfect products, and customer dissatisfaction (Dahlgaard et al., 2005).

TQM stage is the highest level, involving the implementation of QM principles to all aspects of the business (Al-Tayeb, 2008). It is accompanied by the use of sophisticated QM tools and techniques and increased emphasis on people and personal values. Various characteristics of the different stages in the development of TQM can be seen in Table 2.3 (Dahlgaard et al., 2005; Al-Musleh, 2010).

Table 2.3: Characteristics of different stages in TQM in construction

Stage	Characteristics
Quality Inspection (1910)	Salvage Sorting Corrective action Identify sources of non-conformance
Quality Control (1924)	Quality manual Performance data Self-inspection Product testing Quality planning Use of statistics Paperwork control
Quality Assurance (1950)	Third-party approvals Systems audits Quality planning Quality manuals Quality costs Process control Failure mode and effect analysis Non-production operation

Total Quality Management (1980)	Focused vision Continuous improvements Internal customer Performance measure Prevention Company-wide application Interdepartmental barriers Management and Leadership

2.3.3.2 ISO Quality Management System (ISO 9000 Series)

In 1987, the International Organization for Standardization released the ISO 9000 quality standard series. The ISO quality standards are a series of internationally accepted guidelines as to how companies should set-up QA systems (Willar, 2012). The standards are designed to guarantee a consistent level of quality of products and services provided by companies through the use of procedures, controls, and documentation, to identify mistakes and streamline its operations.

The ISO quality management system is generic in nature and applicable to all companies, regardless of the type and size of the business, including small and medium enterprises, it can be used successfully in construction companies and on their projects, even though every project is unique and involves different sub-contractors and suppliers and is being used by many organizations as a stepping-stone to TQM (Landin, 2000; Zhang, 2000; Al-Sehali, 2001).

The new ISO standards are based on eight principles that emphasize the core values and concepts of QM. The eight QM principles as defined by ISO are: customer focus, leadership, involvement of people who are the essence of an organization, process approach, system approach to

management, continual improvement, factual approach to decision-making and mutually beneficial supplier relationships. According to the studies conducted by Al-Musleh (2010) and Willar (2012), the main differences between ISO 9000 and TQM are summarized in Table (2.4).

Table 2.4: Main Differences between ISO 9000 and TQM

ISO 9000	TQM
Focus on the customer is something secondary	Focus on the customer is essential
Not integrated with corporate strategy	Integral to company strategy
Employee involvement not necessary	Employee involvement and empowerment is important.
Can be departmentally focused	Organization wide- all departments, functions and levels
Quality department responsible for quality	All employee are responsible for quality
Not necessarily continuous improvement	Definitely continuous improvement
Technical systems and procedures focused	Philosophy, concepts, tools and techniques focused

Source: Brown, A. & Wiele, 1996.

2.4 Previous Research on TQM

Numerous studies have been conducted in the field of TQM and its implementation, and as such different researchers have adopted different frameworks based on their own understanding and objectives (Zhang, 2000). However, these studies on TQM (e.g., Al-Musleh, 2010; Al-Tayeb, 2008; Amer, 2002; Khalid, 2005; Landin, 2000; Abusa, 2011; Al-Sehali, 2001; Black and Porter, 1996; Powell, 1995; Saraph et al., 1989; Flynn et al., 1994; Yosuf and Aspinwall, 1999) developed their ideas from quality leaders such as Deming, Juran, Crosby and Ishikawa. Their propositions

are the foundation for understanding the concept of TQM and have exerted an influence upon later studies; hence, literature on TQM has progressively developed from their initial contributions. The concepts of TQM as perceived by quality leaders are reviewed:

Deming transferred statistical process control to Japan after the First World War, and taught the Japanese the concepts and techniques of quality, that facilitated to rebuild their economy and modified the performance of whole sectors (Al-Musleh, 2010). The theoretical essence of the Deming approach to TQM concerns the creation of an organizational system which leads to continuous improvement of processes, products, and services as well as to employee fulfillment, both of which are critical to customer satisfaction, and ultimately, to firm survival. (Zhang, 2000)

Deming placed stress on top management taking responsibility in QM initiatives, process and systems. He advocated identifying and measuring customer requirements creating supplier relationship, and the use of functional teams. According to him, there are two causes of errors or variations: “common cause” and “special cause”. He defined “common cause” as errors or variations caused by operating machines or products or system and can be reduced by managements. With the “special cause “he said it relates with the employees, that is to say, it is caused by lack of knowledge or skills and poor performance and can be handled by the employees (Al-Sehali, 2001; Rabaya, 2013).

Deming prescribed TQM in 14 points, which he claimed to be a set of principles to remain competitive and encompasses continuous improvement

of product and service, leadership and commitment, supplier focus, training and zero defect (Zhang, 2000; Landin, 2000).

Juran accentuates that quality problems are due to management rather than employees and he emphasized that the focusing on statistical process control is not enough. Moreover, Juran's approach places much emphasis on teams, top management commitment and empowerment, participation, recognition and rewards. In addition to this, he proposed QM theories such as' trilogy' of management processes as in Table 2.5, he stressed that customers are the underlying factor of quality improvement (Dís Dagbjartsdóttir, 2012).

Table 2.5: Universal Processes for Managing Quality

Quality Planning (provides the operating forces)	• Identify who are the customers. • Determine the needs of those customers. • Translate those needs into company's language. • Develop a product that can respond to those needs. • Optimize the product features so as to meet the needs.
Quality Improvement (improve quality before problems arise)	• Develop a process which is able to produce the product. • Optimize the process.
Quality Control **(**prevention quality problems, correction of defects & product without deficiencies)	• Prove that the process can produce the product under operating conditions with minimal inspection. • Transfer the process to Operations.

He explained that every party in a process has three roles: supplier, processor, and customer, and these roles are carried out at every level of the

processes in a firm. He also introduces quality cost which can be used to evaluate the firm's costs related to quality as mentioned in section 3.9.

Ishikawa's approach to QM goes beyond the product and it includes after sales service, in fact the company itself. Like the others, he also suggested that customer focus, supplier focus, continuous improvement and employee management are the key to TQM implementation. He also developed the seven tools that consisting of: Pareto chart, Cause and effect diagram, Stratification chart, Control chart, Scatter diagram, Check sheet, and Histogram (Al-Sehali, 2001).

His concept encompasses the following principles: quality first not short term profits first; customer orientation-not producer orientation; customer-breaking down the barrier of sectionalism; using facts to make presentations-utilization of statistical methods; full participatory and Cross-functional management (Abusa, 2011).

Crosby explained his view related to a successful quality improvement program, which include management responsibility for quality, employee recognition, education, reduction of the COQ, his approach described the measurement of the COQ. He emphasized on prevention rather than after the event inspection, doing things right the first time, and zero defects (Zhang, 2000). To attain zero defects, Crosby suggested that prevention must be given preference over inspection. Quality in Crosby's approach is conformance to requirements and quality is free (Al-Musleh, 2010).

Even though the approaches to TQM are different, they share common points on the management of process: leadership and commitment, training

and education, using teams, planning and quality measures for continuous improvement and having the appropriate culture. They believe that it is the management's responsibility to provide commitment and leadership, empowerment through training and education, and the appropriate support to technical and human processes. It is necessary that management encourages the participation of the employees in quality improvement, and develops a quality culture by changing attitudes toward quality.

Again, all the authors emphasize that the customer defines quality which consequently creates the need for customer satisfaction which leads to an improved competitive position. Equally consistent is the view that the costs of waste and rework are high and should be eliminated. Similarly, employees should be recognized and rewarded for their quality improvement efforts. They also stressed on evaluation and feedback, prevention of products defects, and not inspection and detection of defective products. Sila and Ebrahimpour (2002) conducted a study on 347 published survey articles of TQM from 1989 to 2000. In their analysis, it was revealed that majority of these studies were conducted in USA, U.K and Australia.

2.5 Previous Studies on Tqm Implementation in Construction Industry.

With the globalization of economy, companies worldwide are actively engaged to achieve internationally accepted quality levels to ensure their position in the emerging international market. There are many researchers

who studied the implementation of QM in construction in many countries, below is some of them:

A study conducted by Al-Musleh (2010) identified the important issues related to the implantation of TQM in the construction sector in the State of Qatar. The main objective of his study was to develop a new model using EFQM elements as a data collection framework, while both qualitative and quantitative methodologies were used to measure the level of perceptions among employees of the "client" construction company towards those elements. Moreover, the CSFs were reviewed. The findings suggested that TQM can be successfully implemented among Qatar's construction companies. Furthermore, a framework was suggested for the Client, recommending the actions the Client should take to implement a TQM framework, which will increase productivity.

Also, a study on QM conducted by Abdul-Rahman H. and Tan C.K. (2005), explored the practices of QM, management commitment in QM and QM implementation problems in construction projects in Malaysian construction industry. The study applied semi structured interview approach with twelve project management practitioners. The findings indicated that the state of QM in construction projects in Malaysia needs to be strengthened and there are problems in relation to QM implementation that require attention and further research. Problems with subcontractors' works, problem with more paper works and increase of time were the three main problems.

Furthermore, Al-Tayeb (2008) conducted a study on TQM that aimed to determine the success factors and develop model necessary for the implementation of TQM at various phases of the project planning, design and construction in Gaza Strip. The questionnaire was used as a tool to data collection. The study determined 8 main factors with 81 sub factors. Pareto principle was used to identify the CSFs of TQM implementation on construction projects in Gaza Strip, Pareto principle will used in present study. The results indicated that there are seven CSFs with 38 critical sub factors were needed for the successful implementation of TQM.

The study conducted by Amer M. (2002) was intended to provide clients, project managers, designers, and contractors with information needed to better manage the quality of a construction building project in Gaza Strip. Nominal Group Technique (NGT) was used to identify CSFs and sub factors. Combining the results of NGT and literature review yielded 14 main factors and 60 sub factors affecting quality of a building construction project. A questionnaire was used as a study tool to identify most important factors affecting quality. It was concluded that the most important factors are: characteristics of site layout, skill and experience of site staff, characteristics of design documents, and using equipment, materials, quality and labor management systems and the owner quick response in taking decisions. It was recommended to develop a QS before starting the construction of a project, and to develop comprehensive management systems for equipment, materials, and labors.

The study conducted by Abu Bakar H., Ali K. and Onyeizu E. (2011) aimed to identify the level of effectiveness of the implementation of TQM principles by the construction contractors in the Sultanate of Oman in the top grade construction company as per classified by the Chamber of Commerce and Industry of Oman. Important factors were taken into account relating to the internal customers (the staff) of these companies. A quantitative approach was adopted.

The overall objective of the study for AL-Sehali J. (2001) was to develop a framework for implementing TQM in the construction industry in Bahrain, by developing a dynamic specifications model to improve performance in the construction industry, improve consultant-client- constructor- supplier chain relation, control the budget of the project and reduce disputes, claims and variations in the construction industry.

Dís Dagbjartsdóttir S. (2012) conducted a study to identifying the current status of the construction quality in Iceland. A questionnaire was designed and sent to both engineering firms and contractors firms. Also, interviews were conducted with quality professionals in organizations whom staff had participated in the questionnaire. The study suggested that quality is a problem for the construction industry in Iceland. And it revealed that quality professionals saw clear improvements in organizational operations after having implemented a QMS. Furthermore the QMS general employee had a very positive view towards applying and using the system. The training and teaching methods on using and implementing QMS was inadequate, especially amongst the contractors. The study revealed that the

training and teaching methods amongst engineering firms is in more comprehensive manner than among the contractor firms. The study supported the importance of improving QM within the construction industry in order to attain more systematic efficiency in its operation. Public project owners play a key role in increasing implementation of QM among construction parties.

The aim of the study by Landin A. (2000), was to investigate how the concept of QM is adopted in the Swedish construction process and the impact it has. It was studied in several companies and these companies were chosen from different categories in order to cover the whole construction process. The main methods used were collection of data by interviews and then sort these data into the same system as the ISO 9001 standard, and to use key-factors. The results was showed that QM appeared to be considered as a means of increasing effectiveness and enhancing competitive advantage. It was shown that the most common way to initiate QSs was by inspections, probably due to client requirements. These inspections were in many cases found to be rather meaningless because the companies had problems in finding resources for this type of work. However, over time, it was found that the degree of acceptance to the use of the ISO 9001 standard gradually increased. The various parts of the ISO 9001 standard were by the companies not regarded as equally important and were therefore not used to the same extent. In conclusion, quality systems based on the ISO 9001 standard in the construction sector was

used with varying degree and the acceptance of the standard was increasing.

Lombard F. (2006) study approach was to obtain expert opinion through a series of semi structured interviews on the best practices for managing the quality of engineering in the South African construction industry; comparing these practices to international best practices and determining if the experts believe fundamentally unique practices are required by the South African environment. The findings made a contribution to improving the quality of construction in South Africa by providing a number of best practices.

2.6 Benefits Of Quality Management

The potential benefits offered by QM techniques are varied and the consensus from various studies is that it has been successfully applied in other industries and can be very beneficial in the construction industry. The implementation of QM programs enables companies to improve long-term relationships, product and process improvement, create a harmonious team spirit, more customer focused, employee job satisfaction, increased revenues, reduction in quality costs, decreasing waste and rework, better coordination of activities, improved customer service and market competitiveness, enhance professionalism and skills in all spheres of the construction sector, encourage open addressing of problems, better control over the construction process, improved safety, subcontractors with proper QM systems, closer relationships with subcontractors and help to achieve

the intended project objectives (Abdul-Rahman and Tan, 2005; Landin, 2000; Abu Bakar, 2011; Low and Teo., 2004; Al-Tayeb, 2008).

All the above advantages cited for construction organizations are based on the lessons learned from the use of an effective QMS. An example cited in the study of Abdul-Rahman and Tan (2005) is that the majority of Malaysian constructors have been able to improve their company competitiveness by 80%, after having certified to ISO 9001. This clearly indicates that QMSs need to be developed and implemented for any construction company wishing to become a sector leader (Willar, 2012).

2.7 Obstacles To Implementing Qm

There is evidence of disappointing results in many organizations's attempt to implement QM due mainly to obstacles in implementation (Yusoff et al, 2006). Obstacles in implementation arise from improper attitudes and perception of management and employees, inadequate resources and training as well as inappropriate environments (Willar, 2012).

Yusoff et al (2006) enumerated obstacles to QM: High cost especially initial cost, resistance to change, loss of productivity of the workforce due to the effort exerted in learning the new system, management interference, limited ability of personnel, remote job sites making it hard to control, communication problems between personnel within the workforce.

Abdul-Rahman and Tan (2005) noticed several obstacles for implementing TQM on construction sites such as: too much paperwork, transient nature of workforce, field employees regard TQM as irrelevant, difficulty in measuring results, low bid, and subcontractors and suppliers not interested

in TQM. Dís Dagbjartsdóttir (2012) stating that the implementation of TQM requires a culture change and change in management behavior.

According to the study conducted in Malaysia, Tang and Kam (1999) found that the most difficult task in implementing quality in engineering consultancies in Hong Kong is to make engineers understand and accept the system, followed by the lack of strong support from the management, and lack of effective communication. Low (1994) found that most contractors in Singapore consider human-related problems are most critical in implementing quality. Kumaraswamy (2000) stated that the three most significant negative outcomes encountered by Hong Kong contractors are, more paperwork, more time spent in management, and increase of bureaucracy. In a study of QM of a large-scale infrastructure construction project in Hong Kong, Au and Yu (1999) found problems in the areas of documentation, control of quality inspection and process procedures. Lai, Weerakoon and Cheng (2002) noticed there are weaknesses in the implementation of QM for construction industry in Hong Kong in respect of the communication of improvement information, and teamwork structures for quality improvement. Abu Bakar (2011) argued that the construction industry is lacking open communications and mutual support that derived from trust-based relationships among project participants to effect substantive quality improvement. According to Abdul-Rahman and Tan (2005), all problems that were highlighted in literatures are relevant.

2.8 Critical Success Factors (Csfs) For Tqm

To successfully implement TQM it is important to identify the factors required for the implementation process. Saraph et al., (1989) in their study developed a QM instrument, identifying eight (8) CSFs of TQM (Shown in Table 2.5). Their study had considerable influence on later studies, and subsequent study has resulted in the development of different frameworks based on varying perceptions (Zhang, 2000). Although these frameworks have different TQM approaches, they all lay emphasis on leadership, strategic planning, customer and market focus, human resources focus, process management, continuous improvement and supplier management in one way or the other (Dale, 2003).

The study by Sila and Ebrahimpour (2002) reviewing 347 articles on TQM identified 76 studies that employed factor analysis to extract factors for successful implementation of TQM. Out of these, they compiled 25 TQM factors which are widely used by researchers to measure TQM implementation. Their study revealed eight common cores of the factors as shown in Table 2.5. Literature also reveals that different countries have adopted similar TQM factors as criteria for quality awards under different titles. However, the criteria for all quality awards are derived from three basic frameworks: the Malcolm Baldrige National Quality Award (MBNQA) in the United States of America, the European Quality Award (EQA) in Europe now called European Foundation for QM (EFQM) Excellence Award and the Deming Prize (DP) in Japan. A comparative description of the TQM factors derived from major studies on TQM, and the QM program (three basic award frameworks) in the MBNQA, EFQM, and DP is depicted in Table 2.6.

Table 2.6: Summary of Studies on CSFs for TQM Implementation.

RESEARCH / FACTORS	Management / Leadership	Role of the Quality Department	Training	Employee Relations	Information & Analysis	Supplier Quality Management	Product/ service design	Process Management	Customer Management	Teamwork	Continuous Improvement	Planning	Employee Involvements	Benchmarking	Vision and Plan Statement	Evaluation	Communication	Statistical process control	Learning	Recognition and Reward	Contract Documents	Materials & Equipments	Financial Issues	Site Layout	Systems	Surrounding Environment
Al-Musleh, (2010)	X		X	X		X		X			X		X				X			X	X					
Abdul-Rahman & Tan (2005)	X			X					X				X				X						X			
Al-Tayeb (2008)	X		X	X	X			X	X		X	X	X				X					X	X			
Amer (2002)				X				X		X											X	X	X	X	X	X
Khalid (2005)	X		X	X				X			X		X									X	X	X	X	X
Abu Bakar (2011)	X			X		X			X	X	X				X							X			X	
AL-Sehali 2001			X	X					X	X	X						X									
Dís Dagbjartsdóttir (2012)	X		X						X		X	X	X				X		X							
Landin (2000)								X	X										X				X			
Lombard (2006)			X			X	X		X		X				X						X	X				X
Saraph et al. (1989)	X	X	X	X	X	X	X	X																		
Flynn et al. (1994)	X			X	X	X	X	X	X																	
Ahire et al. (1996)	X		X	X	X	X		X	X					X				X								

Black & Porter(1996	**X**			**X**		**X**			**X**	**X**		**X**														
Zhang (2000)	**X**		**X**	**X**		**X**	**X**	**X**	**X**		**X**				**X**	**X**				**X**						
Kaynak (2003)	**X**		**X**	**X**	**X**	**X**	**X**	**X**																		
Conca et al (2004)	**X**			**X**		**X**		**X**	**X**		**X**	**X**					**X**		**X**							
Sila & Ebrahimpour (2005)	**X**			**X**	**X**	**X**		**X**	**X**			**X**														
Baidoum (2003)	**X**			**X**					**X**		**X**															
MBNQA (2000)	**X**			**X**	**X**			**X**	**X**			**X**														
EFQM model(2004)	**X**			**X**		**X**		**X**				**X**														
DP	**X**											**X**	**X**			**X**			**X**	**X**						
Abu-Hamatteh (2003				**X**	**X**								**X**							**X**						

2.8.1 Selection of Factors for Survey

From an extensive review of TQM literature from quality leaders, quality award models, QM research of construction industry a total of 26 critical factors indicated in Table 2.5 above. The factors were regrouped to ensure that factors addressing similar issues were combined into one main factor. A final list of the success factors of TQM implementation on construction projects for this study included the following main factors (Table 2.7).

Table 2.7: TQM CSFs for this study

No.	TQM CSFs for this study	CSFs from Table 2.5
1	Top management commitment and leadership	Top management commitment and leadership
		Vision and Plan Statement
		Planning
2	Human resource management	Employee relations
		Employee involvements
		Education and Training
		Learning
		Communication
		Role of the Quality Department
		Recognition and Reward
3	External Customer Focus	Customer management
4	Supplier quality management	Supplier quality management
5	Process management	Process management
		Product/service design
6	Information Analysis and Evaluation	Information and Analysis
		Evaluation
7	Continuous Improvement	Continuous Improvement
		Benchmarking
		Teamwork
		Statistical process control
8	Contract Documents	Contract Documents
9	Materials & Equipments	Materials & Equipments
10	Financial Issues	Financial Issues
11	Site Layout	Site Layout
12	Systems Used	Systems
13	Surrounding Environment	Surrounding Environment

1. Top Management Commitment and Leadership

The degree of support that management takes in implementing a total quality environment is critical to the success of TQM implementation. Without upper management involvement, commitment and leadership, a TQM program cannot succeed. Allocation of budgets, planning for change and provision of monitoring structures of progress of works are normally done by top management which clearly accentuate the importance of top management involvement in TQM implementation (Zhang, 2000). Baidoun et al., (2003) pointed out that success factor is consistent with all previous studies, literatures, and quality awards. Study has revealed that the major problem of QM implementation is a lack of top management commitment and participation, which eventual leads to its failure. Many researches discuss this success factor such as (Zhang, 2001); (Antony et al, 2002); (Sila & Ebrahimpour, 2005) and others as mentioned in table 2.4.

2. Human Resource Management

Management participation in quality activities is not enough to contribute to quality improvements. Employees are encouraged to show commitments to quality issues (Al-Tayeb, 2008). When workers themselves are committed to delivering quality, they take greater initiative towards meeting specifications; detecting and eliminating bottlenecks; improving designs and setting realistic yet challenging performance targets. This is better enhanced if resources are provided for employees.

With TQM, quality becomes everyone's responsibility and the training must be targeted for every level of the company (Landin, 2000) (Al-

Musleh, 2010). Customized training plans should be organized for management, engineers, technicians, office staff and field labour in line with quality objectives and goals of the organization.

3. Customer Management

In the TQM philosophy, customer satisfaction is the goal of entire system, and a persistent customer focus improves a firm's performance. The function of the construction organization is to provide customers with facilities that meet their needs. Customers may be either internal or external. The external customer is the owner. An internal customer is a second process or department within the organization, which depends on the product of the first (Abusa, 2011). For example, for a carpenter preparing formwork, the final customer may be the owner, but the internal customer is the crew that will use the forms when placing the concrete (Al-Musleh, 2010). However, in this study the focus is on external customer, that is the owner. The owner in construction has a greater and direct influence on the quality of project than the owner in manufacturing or service sectors. The main reason for this is that the owners have a greater input in many stages of pre-construction such as design, specification, while in manufacturing or service the input is restricted to standard.

4. Supplier Management

Supplier quality is an important dimension of QM as defective incoming materials and parts lead to process and product quality problems. Purchased materials often become the major contributors to quality problems. Most researchers identified good supplier relationship as a necessity of

maintaining competitive advantage such as: Abu Bakar et al. (2011), Lombard (2006), Al-Musleh, (2010) and others as mentioned in Table 2.7.

Suppliers have a large and direct impact on the cost, quality, technology, and time-to-market of products. So many different companies stimulate their engineers to learn the systems, procedures, and processes of suppliers in order to improve communication, reduce errors, and understand capabilities (Rabaya, 2013).

5. Process Management

A process is a way of getting things done. A process consists of the tasks, procedures and policies necessary to carry out the customer need. According to the TQM philosophy if the process is correct, so will be the end result (product). Thus the organization should work to improve the process so as to improve the end product or service.

6. Information Analysis and Evaluation

Documentation is an important element which facilitates the review process, assessment and attainment of QM in a firm. Review is an organized effort that promotes quality in designs and construction works.

It is systematic and independent examination to determine whether quality activities comply with planned arrangements, and whether these arrangements are implemented effectively and are suitable to achieve objectives. Quality audit can be used for QMS, processes, products, and services. The purpose of a quality audit is to evaluate the need for improvement or corrective action. The reviews can be focusing on procedures and practices in an organization, designs (aesthetics,

functionality capacity, calculations and capacity), standards, and construction processes.

7. Continuous Improvements

Continuous improvement is essential for survival of a company. The goal of continuous improvement is common to many managerial theories. This process consists of nine steps: Identify the process, Organize a multi-disciplinary team, Define areas where data is needed, Collect data on the process, Analyze the collected data and brainstorm for improvement, Determine recommendations and methods of implementation, Implement the recommendations outlined in step six, Collect new data on the process after the proposed changes have been implemented to verify their effectiveness, and Circle back to step five and again analyze the data and brainstorm for further improvement (Al-Sehali, 2001).

Furthermore, quality teams provide companies with the structured environment necessary for successfully implementing the TQM process. The eventual aim of the team approach is to get everyone, including contractors, designers, vendors, subcontractors, and owners involved with the TQM process. According to Abu Bakar et al. (2011), teamwork among construction parties such as structural, electrical, environmental, civil engineers, architects, and owners is essential to reach the quality goals.

8. Contract and Design drawings

Contract and design drawings are essential for improving the quality in construction. Contract is the prime contract between the owner and the contractor.

9. Material and equipment resources

This includes all things related to material and equipment, like: specifying the required material, using storage system, the best using of materials and the working equipments are suitable, safe and effective for the project.

10. Financial resources

The financial issues affect the implementation of quality in construction, such as: methodology of preparing budget, plans to increase income, cut down on expenditure, corrective action to control project cost and meet the budget.

11. Site Layout

It is important for quality to provide good site working conditions and doing all the planning of the project site area (Abdel-Razeq, et al., 2001).

12. Systems used

This include: using computer software, using cost control system, using applied resources management system, using and implementing time schedule and implement a safety program.

13. The Surrounding environment

Environment can be considered as all external influences on the construction process. Broadly, these may be grouped as physical, economic, socio-political, and industrial relations, and they act at national or local level, and in different ways in the public and private sectors. There have been dramatic changes in attitudes to the environment over the past 30 years. These changes can create uncertainty, not regarding prices, but also

in terms of investment in the work of an organization, which will affect the demand of quality (Amer, 2002).

2.9 Cost of quality (COQ)

COQ can be divided into two parts: costs related to not doing things right, and costs related to trying to prevent them from going wrong, as shown in formula: Cost of Quality = Cost of Non-conformance + Cost of Prevention. The cost of non-conformance includes the direct and indirect costs and emerges from not doing things right the first time (Al-Musleh, 2010). COQ in construction is not limited to the cost of re-work or spending extra money, but it goes beyond that to establishing the company's reputation amongst current or future clients and it becomes very difficult if a bad reputation is earned (Al-Sehali, 2001).

Quality costs can be used for measuring progress, analyzing problems, or budgeting. By analyzing the relative size of the cost categories, the company can determine if its resources are properly allocated. Quality costs can help management track the success of its quality improvement efforts. Ideally, the total cost of quality will decline over time. Better prevention of quality will generate larger savings in all other cost categories (Amer, 2002). Table 2.8 provides a guide of more commonly encountered quality cost elements (Landin, 2000; Abusa, 2011; Al-Ali, 2010; Oakland 2006).

Table 2.8: Quality Cost Elements

No.	Category	Elements
1	**Prevention costs:** All of the costs expended to prevent errors from occurring.	1. Quality planning 2. Process control planning 3. Design review 4. Quality training
2	**Appraisal costs:** Costs incurred in measuring and controlling current production to assure conformance to requirements.	1. Receiving inspection 2. Laboratory acceptance testing 3. In-process inspection 4. Quality audits 5. Calibration
3	**Internal Failure costs:** Costs generated before a product is shipped as a result of nonconformance to requirements.	1. Rework 2. Scrap 3. Process troubleshooting 4. Material review and activity 5. Re-inspection or retest
4	**External Failure costs:** Costs generated after a product is shipped as a result of nonconformance to requirements and associated with defects that are found after using the product.	1. Processing of customer complaints 2. Unplanned field repair 3. Recalls 4. Processing of returned material 5. Warranty

Many studies recognize that COQ in construction projects can be budgeted, measured and analyzed (Oakland, 2006). A detailed knowledge of recording the COQ is relatively important as it is the major factor of performance measurements and the roadmap towards continuous improvement.

Also, quality in construction is directly related to time and cost, and vice versa (Lombard, 2006). A poor quality managed project can result in extra cost and time extensions; a poor time and cost controlled project can affect the conformance of requirements, which is: quality.

Furthermore, improving the quality of goods and services will help to improve productivity, lower costs and increase profitability. The United States and Europe have woken up little late, after the competitiveness of Japanese manufacturing in the early 80's. There is no doubt that most of Japanese products are better quality, and lower cost than US and European products, which may be a result of Japanese manufactures understanding the TQM concepts earlier than others (Khalid, 2005).

2.10 Tools and Techniquesfor TQM

TQM has been developed around a number of critical factors. However, TQM is much more than a number of critical factors; it also includes other components, such as tools and techniques for quality improvement (Al-Musleh, 2010). Therefore by using the tools and techniques, one can investigate problems, identify solutions and implement them in work practices by measuring and analyzing the outcome. It is evident that some firms fail when they implement TQM because tools and techniques for quality were not used (Zhang, 2000). From the literature review, it was found that there are different classifications for TQM tools and techniques, such as:

Tools classified as Qualitative tools include flow charts, cause-and-effect diagrams, affinity diagram, brainstorming, and task list, whereas Quantitative tools include Shewaryt cycle (PDCA), Pareto charts, control chart, histogram, run chart, and sampling. Researchers found that quantitative tools are used more by those organizations that are more

successful, so the proposed model for this thesis will based on Pareto analysis.

The distinguishing between tools and techniques are as follows: tools are described as a device with a clear function and usually applied on its own, such as Pareto analysis. whereas a technique resulting in the need for more thought, skill and training to be used effectively, and has a wider application and is understood as a set of tools, such as benchmarking. The tools in table below are only examples and there may be more, the number of TQM tools is close to 100 (Musleh, 2010). Hence, Ishikawa (1985), Dale (2003), identify tools and techniques most widely used by firms as shown in table 2.9.

Table 2.9: Commonly Used Tools and Techniques

Seven basic QC tools	**Seven management tools**	**Other tools**	**Techniques**
Check-sheet	Affinity diagram	Brainstorming	Benchmarking
Check list	Arrow diagram	Control plan	Quality costing
Histogram	Matrix diagram	Flow chart	Design of experiments
Pareto Diagram	Matrix data analysis method	Force field analysis	Failure mode & effects analysis
Cause-and-Effect Diagram	Process decision Programme chart	Questionnaire	Problem solving methodology
Scatter Chart	Relations diagram	Sampling	Poka yoke
Flowchart	Systematic diagram		Quality function deployment

Source: (Musleh, 2010).

Chapter Three

Methodology

3.1 Introduction

This chapter discusses the methodology adopted for the precent study. It includes information about the research design, methods and procedures used in the study and how to determine the population and sample size. Also it describes the way the questionnaire is designed. It also demonstrates how the validity and reliability of the questionnaire ensured.

3.2 Study procedures

As noted earlier in chapter one, the main outcome of this study is to develop a model for the introduction of TQM in construction companies in Palestine. One of the important areas to consider is the kind of method that is adopted. For this reason, methodology adopted in this study is in three phases complementary to each other which are as follows:

- Preliminary phase which presents different sources of information;
- Second phase which presents development of questionnaire and;
- Finally, data collections, statistical processing and measurement of validity and reliability phase.

3.3 Preliminary phase

Information on TQM was gathered from literature. The sources of the reviewed literature were desk reviewed of both published and unpublished material including internet, journals, articles and reports on quality and QM, also textbooks on construction management and QM.

The purpose of this phase is to enhance the understanding of theoretical concepts of QM in the construction industry and also to give an overview of the study statement and helps to meet the objectives highlighted. The information gathered from this phase helped guide the second phase, which is questionnaires development and data collection from key respondents.

3.4 Second phase

The second phase of the study includes the method employed, design of instrument then data collection and sampling technique.

3.4.1 Strategy and Approach to Data Collection

Study strategy is the way in which study objectives can be questioned. There are two types of strategies which are quantitative and qualitative. For this study, both quantitative and qualitative approaches are considered to be the most suitable and convenient to fulfill the study objectives and helps in comparison and statistically collecting of data.

The approach to be adopted for collecting data in social science research includes experimental, archival, case study, problem –solving and survey. This study was based on survey because it enabled the researcher to use smaller groups of people to make inferences about larger groups which was prohibitively expensive to study.

3.4.2 Questionnaire Development

The questionnaire was design base on an extensive review of TQM literature from quality leaders, quality award models, other QM study, and study of local construction industry and together with input, revision and

modifications by local experts. The data for this study was collected through the use of questionnaires:

i. to evaluate the current level of the implementation of QM in the construction sector in Palestine.
ii. to identify any present problems that affecting the implementation of QM;
iii. to identify CSFs in TQM;
iv. to assess how quality managers in construction industry perceive these CSFs and;
v. Finally to develop a model that can be implemented in the construction industry in Palestine.

The Questionnaire was in four sections:

- Section one was developed to elicit information about the respondents
- Section two was developed to address objective one (i),
- Section three was developed to address objective two (ii) and,
- Section four was developed to address objectives three (iii), four (iv) and five (v).

Section one of the questionnaire: identify the types of organizations and the kind of personnel from whom information is being sought and indeed this to establish the credibility of data. The information included in section one was: type of company, position of personnel in company, qualification, years of work experience, volume of work in the last three years, types of construction works performed, company location and years in business.

Section two of the questionnaire: covers eleven questions to evaluate the current level of QM implementation in the construction sector in Palestine and this includes perception of quality, quality policy, ISO certificate, design conformance to standards, quality training, contractors choosing process, role of supervisor and contractor engineers, storing of project's materials, and finally identify the most commitment parties to achieve quality.

Section three of the questionnaire: covers question on obstacles and problems in QM implementation.

Section four of the questionnaire: regarding the development of the instrument for the quality factors, the method adopted by Zhang (2000) was chosen for the study. For this study, the method was pursued in two stages:

Stage 1: involves carrying out review of literature in order to identify CSFs on TQM. Thirteen (13) factors were developed with seventy three (73) preliminary quality items selected.

Stage 2: involves ensuring that the instrument covers all the relevant spheres of QM and the whole proposed survey instrument is well worded and understood. Thus, content validity as discussed in section 3.5.1. The final questionnaire had 73 initial quality sub factors for evaluation. In all, Seventy three items or questions were developed and measured within a five point Likert scale of 1-5; see Table 3.1.

Table 3.1: Likert scale

Item	exceedingly significant	very significant	moderately significant	slightly significant	not significant
Scale	5	4	3	2	1

The questionnaire was developed in both English and Arabic language as shown in Appendix (A) and Appendix (B), to be understood by all respondents and to help in documenting this study.

3.4.3 Data Collection

3.4.3.1 Sampling Technique

The Population of the Study:

In order to achieve the objectives of the study, managers and engineers of construction companies in the main cities of Palestine were selected to be the population. The repetitive nature of the process in the construction makes the choice suitable, the design and construction process will make lessons easily learnt to be incorporated in construction practices. Two different involved parties are targeted in this study as in the studies conducted by Sandra Dagbjartsdóttir (2012) and Al-Tayeb (2008), the parties include consulting engineering offices, and contractors companies.

1. **Consulting Engineering Offices:**

The first party is represented by the consulting engineering offices, which were registered by the engineering association in West Bank at year 2014 when the study was undertaken, which have a valid registration of 1st class consultants in the following fields: building, roads, project management, water and sewage. Therefore, engineering offices that are registered under

other classes were neglected due to limited practical and administrative experience of their companies in the CSFs of TQM implementation. There were 100 consulting offices as shown in Table 3.2.

2. Contractors Companies

The second population is represented by the contractors companies, who have a valid registration on the PCU recent list in its latest classification in 31 Mar 2014 for the following fields: building, water and wastewater, and roads. Specifying the numbers of the contractors was not easy because each can have several classifications in different specializations, so one company may be counted several times. The researcher decided to calculate each company once according to its highest classification. According to PCU in its latest classification in April 2014; number of classified companies in West Bank for all fields and all classifications from first to fifth are 307 companies.

The selected contractors are classified under the first, second and third degrees. The first three degrees of the registered classified contractors have the most effect on the execution of the projects in West Bank (Shweiki, 2013). Thus, the researcher decided to focus on the contractors of these three degrees. That will be the contractors' population group of this study. According to the PCU records, (218) contracting companies were classified first, second and third degree, distributed on main cities in West Bank in Palestine as shown in Table 3.2.

Table 3.2: Distribution of study population in West Bank by district

NO.	District / City	*No. of Contracting Companies	Percent	**No. of Consulting Offices	Percent
1	Ramallah	51	23%	36	36%
2	Hebron	45	21%	20	20%
3	Nablus	43	20%	20	20%
4	Bethlehem	15	7%	10	10%
5	Jenin	33	15%	6	6%
6	Tulkarem	9	4%	4	4%
7	Salfit	9	4%	2	2%
8	Qalqiliya	7	3%	2	2%
9	Jericho	5	2%	0	0%
10	Tubas	1	1%	0	0%
	Total	218	100%	100	100%

*** .(Source: Palestinian Contractors Union in West Bank, April 2014)**

****(Source: Engineering Association in West Bank, April 2014)**

Table 3.2 illustrates that the largest percentage of consulting offices and contractors exists in the city of Ramallah and this may be due to the reality that largest projects are released in this city. The second and third portions respectively are in the main largest cities in West Bank; Hebron and Nablus. Consequently, the total number of the population from the two parties was 318 companies.

The Sample Size Determination of the Study:

Sample size is defined as a subset of the total population. It was selected by random stratified method and chosen according to first and second population (consultant and contractor). As in the study conducted by Al-Tayeb (2008), to determine the minimum sample size, the formulas 3.1 and 3.2 shown below were used for unlimited population.

$$SS = \frac{Z^2 \times P \times (1-P)}{C^2} \quad \text{..... (3.1)}$$

Where:

SS = Sample Size

Z = Value (for example: 1.96 for 95% confidence level),

P = Degree of variance between the elements of population (0.5),

C = Confidence interval (0.05).

$$SS = \frac{1.96^2 \times 0.5 \times (1-0.5)}{0.05^2} = 385$$

The formula below was used for correction for finite population:

$$NewSS = \frac{SS}{1 + \frac{SS-1}{POP}} \quad \text{..... (3.2)}$$

Where: POP= Population, $NewSS = \frac{385}{1 + \frac{385-1}{318}} = 174$

Sample size was also calculated using the following web site: http://www.surveysystem.com/sscalc.htm, sample size calculator, with Confidence Level =95% and Confidence Interval=5, (See Appendix C).

Sample Selection for Present Study:

The samples were selected randomly with respect to district from the two populations. The two populations consist of ten classes according to main cities in West Bank in Palestine as in Table 3.2. Due to this formation, the stratified random sampling was used to identify the number of companies needed for each population.

Table 3.3: Sample Distribution by District for Consulting Offices.

NO	District / City	No. of Offices	Percent	Sample Size of each city
1	Ramallah	36	36 / 318 = 11%	11% x 174 = 20
2	Hebron	20	6%	11
3	Nablus	20	6%	11
4	Bethlehem	10	3%	6
5	Jenin	6	2%	3
6	Tulkarem	4	1%	2
7	Salfit	2	1%	1
8	Qalqiliya	2	1%	1
9	Jericho	0	0%	0
10	Tubas	0	0%	0
	Summation	100	31%	55

There were 55 Consulting Offices sample size. This sample size presents 31% of the total number of population. Figure below shows the sample distribution for the consulting offices by district.

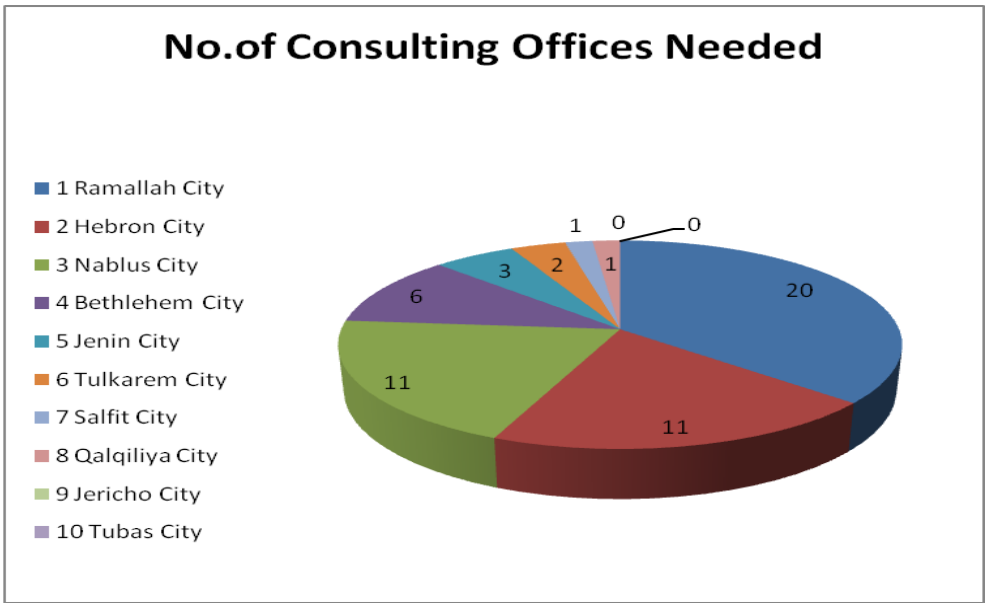

Figure 3.1: Sample Distribution by District for Consulting Offices.

Table 3.4 below shows the calculations of sample size for the contracting companies with respect to location.

Table 3.4: Sample Distribution by District for Contracting Companies.

NO	District /City	No. of Contracting Companies	Percent	Sample Size of each city
1	Ramallah	51	51 / 318 = 16%	16% x 174 = 27
2	Hebron	45	14%	25
3	Nablus	43	14%	23
4	Bethlehem	15	5%	8
5	Jenin	33	10%	18
6	Tulkarem	9	3%	5
7	Salfit	9	3%	5
8	Qalqiliya	7	2%	4
9	Jericho	5	2%	3
10	Tubas	1	0%	1
	Summation	218	69%	119

There were 119 contracting companies sample size. This sample size presents 69% of the total number of population. Figure below shows the numbers of sample size for the contracting companies with respect to district.

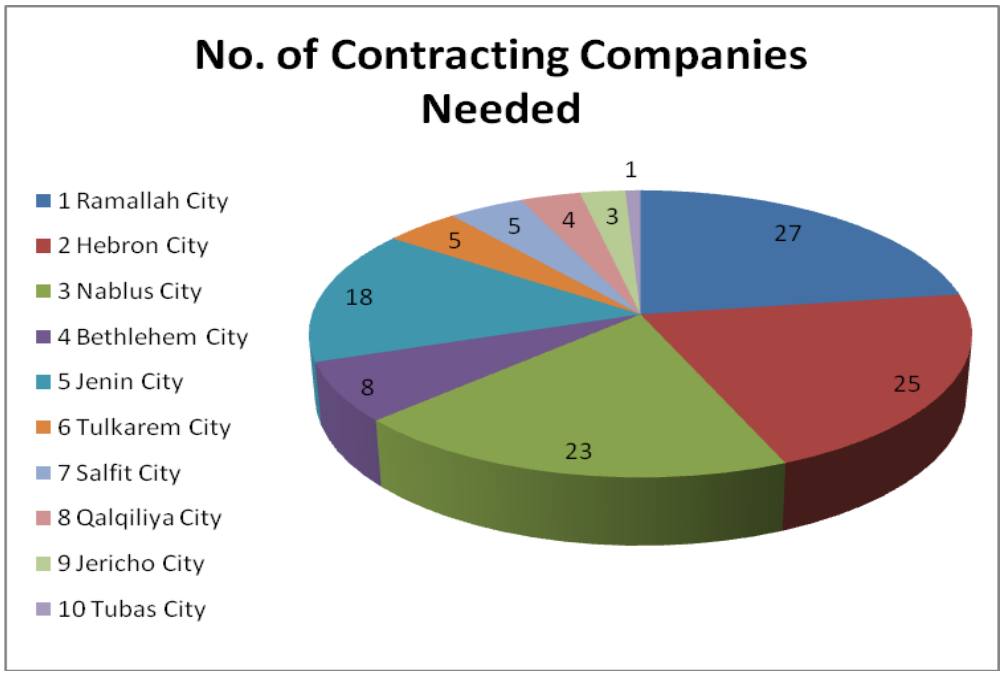

Figure 3.2: Sample Distribution by District for Contracting Companies Survey Participant in Present Study:

The survey participants in this study are project managers, site and supervisor engineers and the manager of the construction companies. These respondents are selected because of the fact that they have the widest exposure to construction projects, and are involved in various project phases including planning, design, and construction, also they have knowledge about the problem and subject area being studied into. Indications are that their responses will minimize response error.

Distribution of the Questionnaires and Collection of Data:

The developed questionnaires were distributed using many ways and techniques as mentioned as follows:

- Making an electronic questionnaire to be filled electronically through website link, questionnaire sample was phoning to ask their email addresses to send the link for them, all replies returned directly in excel sheet. But many of the targeted samples do not have email or cannot use the email.
    - Direct distributing by hand, but many of them do not have time for meeting.
    - Sending questionnaire by fax.
    - Telephone calls to ask for meeting appointments, emails and faxes.

Some of the questionnaires were collected back on the same day while others were collected later from the respondent. Data collection is a term used to describe a process of preparing and collecting data and the purpose of these processes is to obtain information to keep on record, to make decisions about important issues, and to pass information on to others.

Out of the 240 questionnaires distributed, 187 were returned. However, 13 were found to be invalid for analysis as a result of improper filling -some of them filled all questionnaire items with the same likert scale or left many items unfilled- yielding an effective response rate of 100%. The respondents who agreed to cooperate in filling the questionnaire are detailed in Table 3.5.

Table 3.5: Number of the Questionnaire Respondents

Respondent Type	No. of Sample Size	No. of Respondents	No. of Excluded Questionnaires	No. of Valid Questionnaire
Engineering Consulting Offices	55	60	5	55
Contracting Companies	119	127	8	119
Total	174	187	13	174

Semi-Structured Interviews:

Application of semi-structured interviews to a number of representatives from different areas within the construction industry in order to collect information about their claim of the most serious problems that they are facing in the current situation. These interviews were selected following a study carried out by Latham in the United Kingdom for similar purposes (Latham, 1994).

3.5 Phase three

3.5.1 Statistical Processing

To analyze data in this study, Microsoft Office Excel and Statistical Package for Social Sciences (SPSS.17) were used. Frequencies,

percentages, means and standard deviations were used to provide a comprehensive description of the acceptable degree of the study sample on the different questionnaire statements.

1. Frequencies and percentages for analysis answers of the study sample regarding section one that gives information about the respondents.
2. Means as one of central tendency measures, and standard deviation as one of dispersion measures to identify the extent of dispersion of respondents' answers in the various questionnaire statements.
3. T-test of independent samples.
4. One-Way ANOVA Test.

Measurement for validity was determined. Also reliability was done, using internal consistency method with the Cronbach coefficient, Alpha, as the relevant coefficient. The following sections explain how validity and reliability measurements were done.

1. Validity of Questionnaire

Validity has a number of different aspects and assessment approaches. Pilot study and structure validity were used to evaluate instrument validity.

A. Pilot Study

A pilot study was made before collecting the final data to test the word of the questions, identify ambiguous questions, test the techniques which used to collect data and measure the effectiveness of standard invitation to respondents.

Furthermore, it was used to improve the questionnaire, filling in gaps and determining the time required for completing the questionnaire. In addition, it was important to ensure that all information received from consultant and contractors were useful to achieve this study objectives. Ten questionnaires

were sent and distributed to experts on the subject who have sufficient experience to amend and correct the questionnaire. The selected arbitrators list is attached in Appendix (D), who was selected as: an academician well versed in QM studies, a statistical specialist, project managers in a construction companies and a QM consultant.

B. Structure Validity of the Questionnaire

Structure validity is statistical test that is used to measures the validity of each field and the validity of the whole questionnaire by a scouting sample, which consisted of 15 questionnaires through measuring the correlation coefficients between one field and all the fields of the questionnaire that have the same level of Likert scale. As shown in Table 3.6 below, the p-values (Sig.) are less than 0.01 for all factors, so the correlation coefficients of all fields are significant at $\alpha = 0.01$. So it can be said that the paragraphs of all fields are consistent and valid to be measured.

2. Reliability of the Study

Reliability refers whether you get the same answer by using an instrument to measure more than once. For the purpose of this study internal consistency method is used in measuring reliability. The internal consistency of each factor was determined by examining each factor inter correlation and computing the Cronbach's Alpha. The minimum advisable level is 0.7. The proposed success factor whose calculated Cronbach's α greater than the critical point of 0.70, is said to be highly reliable and internally consistent. Table 3.6 shows the values of Cronbach's Alpha for the main factors and tables from 4.14 to 4.26 in the next chapter show the values of Cronbach's Alpha for all sub factors. Values of Cronbach's Alpha were in the range from 0.936 and 0.938. This range is considered high; the

result ensures the reliability of each field of the questionnaire. Cronbach's Alpha equals 0.936 for the entire questionnaire, which indicates an excellent reliability of the entire questionnaire.

Table 3.6: Cronbach Alpha and Correlation Values for Each Questionnaire Field

Major Factor	Alpha	Spearman Correlation Coefficient	P-Value (Sig.)
1. Top Management Commitment & Leadership	.936	0.599**	0.000**
2. Human Resources Management	.936	0.695**	0.000**
3. External Customer Focus	.937	0.454**	0.000**
4. Process Management & Execution	.937	0.635**	0.000**
5. Supply Management	.936	0.658**	0.000**
6. Information Analysis and Evaluation	.936	0.639**	0.000**
7. Contract Documents	.936	0.627**	0.000**
8. Materials & Equipments	.936	0.715**	0.000**
9. Financial Issues	.936	0.673**	0.000**
10. Site Layout	.936	0.754**	0.000**
11. Systems	.938	0.690**	0.000**
12. Surrounding Environment	.936	0.691**	0.000**
13. Continuous Improvement	.936	0.703**	0.000**

**** Correlation is significant at the 0.01 level**

Thereby, the questionnaire was valid, reliable, and ready for distribution for the population sample.

3.5.2 Sample Distribution Table

The following Table represents the sample due to its main characteristics while figures were represented in the next chapter.

Table 3.7: Sample Distribution due to its main characteristics.

Type of Organization	Frequency	Percentage
Consulting Office	55	31.6%
Contracting Company	119	68.4%
Respondent Position		
Company Manager	47	27%
Project Manager	66	37.9%
Site Engineer	39	22.4%
Supervision Engineer	22	12.6%
Respondent Scientific Qualification		
Higher Studies	42	24.1%
Bachelor	127	73.0%
Diploma	1	0.6%
High School	4	2.3%
Respondent Years of Experience		
Less than 5 years	32	18.4%
From 5 years to 10 years	63	36.2%
From 11 years to 20 years	47	27.0%
21 years and above	32	18.4%
Dollar Value of Projects During the Last Three Years (Millions Dollar)		
Less than 1	15	8.6%
From 1 to less than 5	82	47.1%
From 5 to less than 10	45	25.9%
More than 10	32	18.4%
Type of Projects in the Company		
Building	113	65%
Infrastructure	27	15.5%
Building and Infrastructure	34	19.5%
Company Location		
Ramallah City	47	27%
Hebron City	36	20.7%
Nablus City	34	19.5%
Bethlehem City	14	8%
Jenin City	21	12.1%
Tulkarem City	7	4%
Salfit City	6	3.4%
Qalqiliya City	5	2.9%
Jericho City	3	1.7%
Tubas City	1	0.6%
Year of Establishment		
Before 1994	41	23.5%
From 1994 to 2008	122	70.1%
After 2008	11	6.4%
Total	174	100%

Chapter Four

Data presentation, analysis and discussion

4.1 Introduction

This chapter focuses on analyzing the gathered data from respondents through interviews and questionnaire. The descriptive statistics of the data provide quantitative insight to this investigation and as such provides an invaluable contribution to the aims of this study. To this regard, the analyses presented here are based on data from the demographics of respondents' firms and QM practices of respondents' firms.

Also, an in-depth analysis is presented to understand the factors which are critical in the implementation of TQM in construction industry in Palestine. The results are actually structured to determine the CSFs and assess the level of importance of the CSFs. The findings have been presented here in a statistical format such as charts and tables to enable examination and description on the pattern of the responses.

4.2 Questionnaire sample characteristic analysis

Sample characteristics of the person who filled the questionnaire and the employed company were analyzed. The respondents' characteristics provide descriptive information on the individual respondents. Specifically, it provides information on position, educational level and experience. While companies' characteristics provide information about the company where the respondent work, such as: type of company, the dollar value of construction project performed during the last three years, type of projects

in the company,location of the company, and year of establishment for the company. This information was necessary to confirm the validity of the results obtained and to develop an understanding of the background respondent with accompanying experience in construction sector in Palestine. The sample distribution will be presented with respect to the following questionnaire respondents' and companies' characteristics:

4.2.1 Type of Organization:

Type of organization was the first question in this section. This question identifies the percentage of each type of organization (consulting office and contracting company) related to the overall respondents.

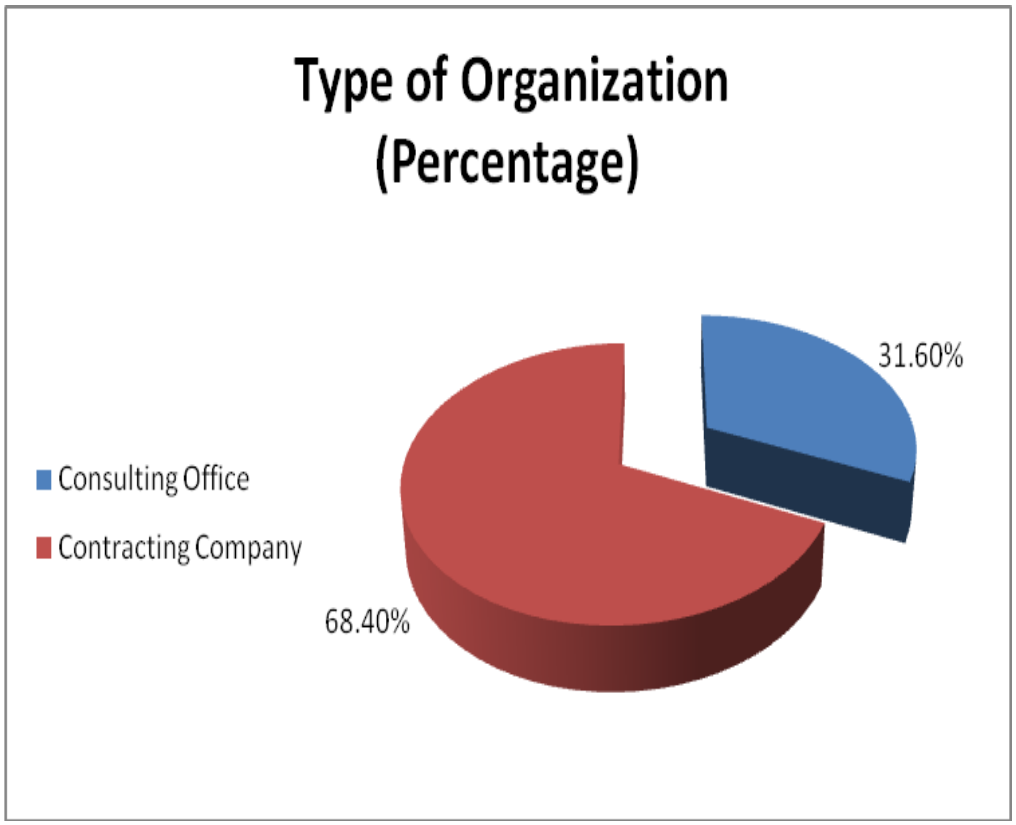

Figure 4.1: Distribution of Organization Based on Type

In Figure 4.1, Respondents were asked to specify the type of organization that they work in. 31.6% of the respondents indicated that they work in

consulting office, while 68.4% indicated that they work in contracting company. These results show that the contracting companies with 1st, 2nd and 3rd grades was more widespread than the consulting office in Palestine.

4.2.2 Respondent Position:

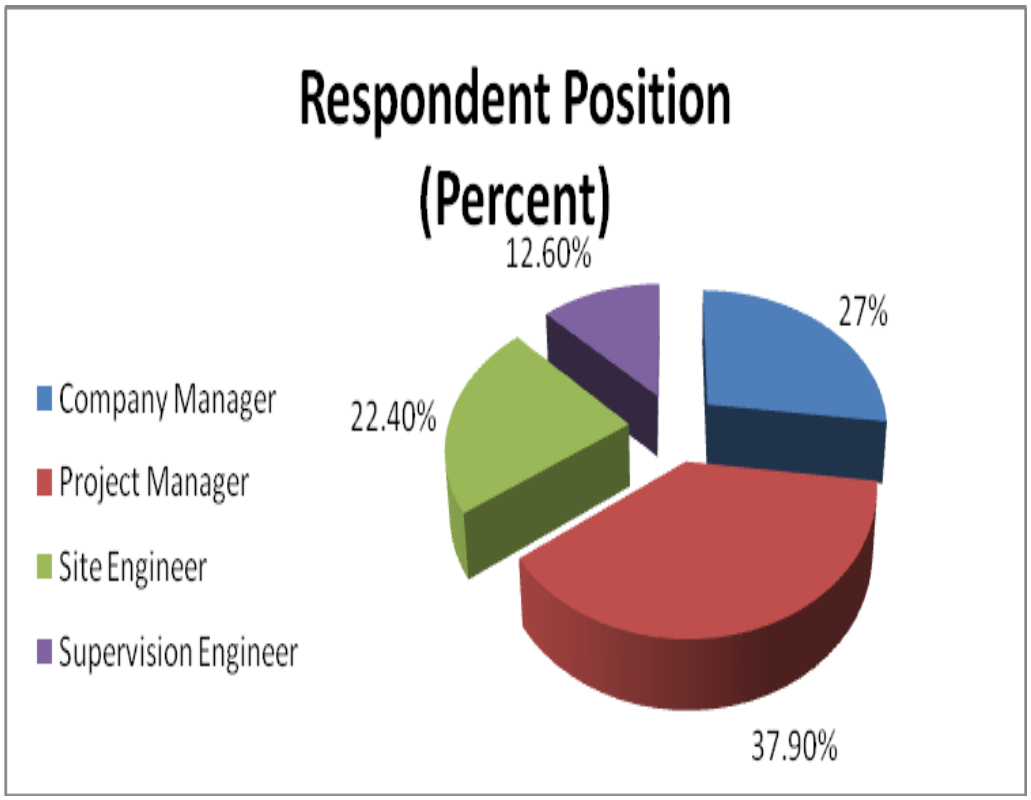

Figure 4.2: Respondent Position

It can be seen from Figure 4.2 that 27% of the respondents were company managers, 37.9% of them were project managers, whereas 22.4% of them were site engineers, and 12.6% were supervision engineers. This is an indication that the questionnaire respondents were key persons in their firms. The evaluation of position by respondent was necessary to confirm the validity and reliability of response and to understand the perspective of respondents.

4.2.3 Respondent Level of Education:

The Figure 4.3 below provides the educational background of the respondents. The educational background ranges from: less than high school to higher studies. Majority, thus, 73% had bachelors degree, 24.1% of them hold certificate of advanced studies, and 0.6% of them had just completed a diploma degree, while 2.3% of them have high school certificate. For that matter it is accurate to conclude that the majority of those who responded to the survey are sufficiently experienced in construction industry and are well educated persons to provide data which is reliable and valid.

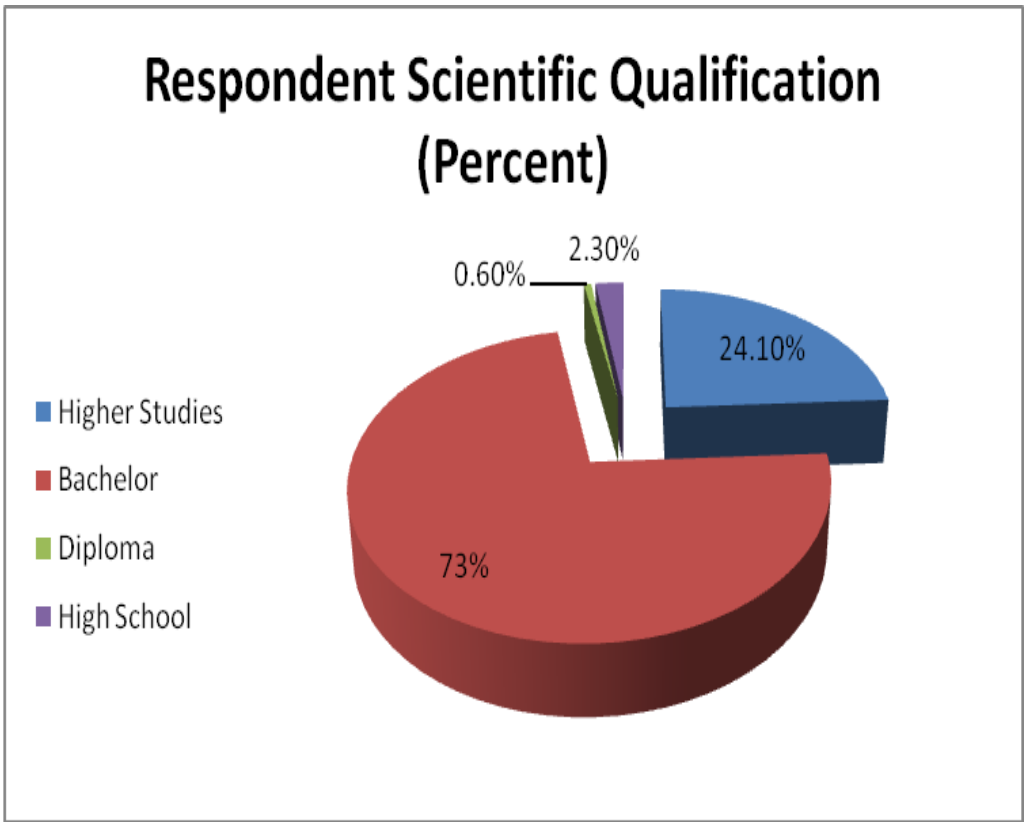

Figure 4.3: Respondent Level of Education

4.2.4 Respondent Years of Experience:

The greater the experience of the respondent in this sector the greater the understanding of the questions and necessary requirement for this sector. The highest frequency for the response was (5-10 years) as shown in Figure 4.4. This group accounted for 36.2 % of the respondents. Critically looking at Figure 4.5, 81.6% of the respondents have over 5years of experience, and 18.4% have less than 5 years experience. This result is logical, since the organizations that have been targeted are that of higher classification, and broad experience.

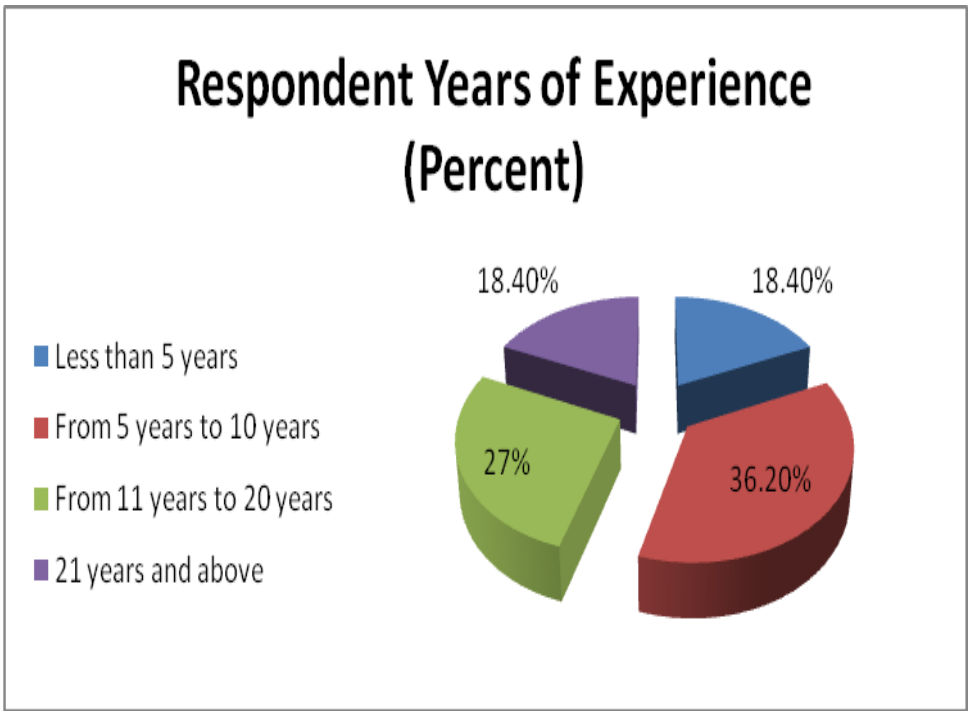

Figure 4.4: Percentage of Respondents Related to Experience Years

4.2.5 Construction Dollar Value:

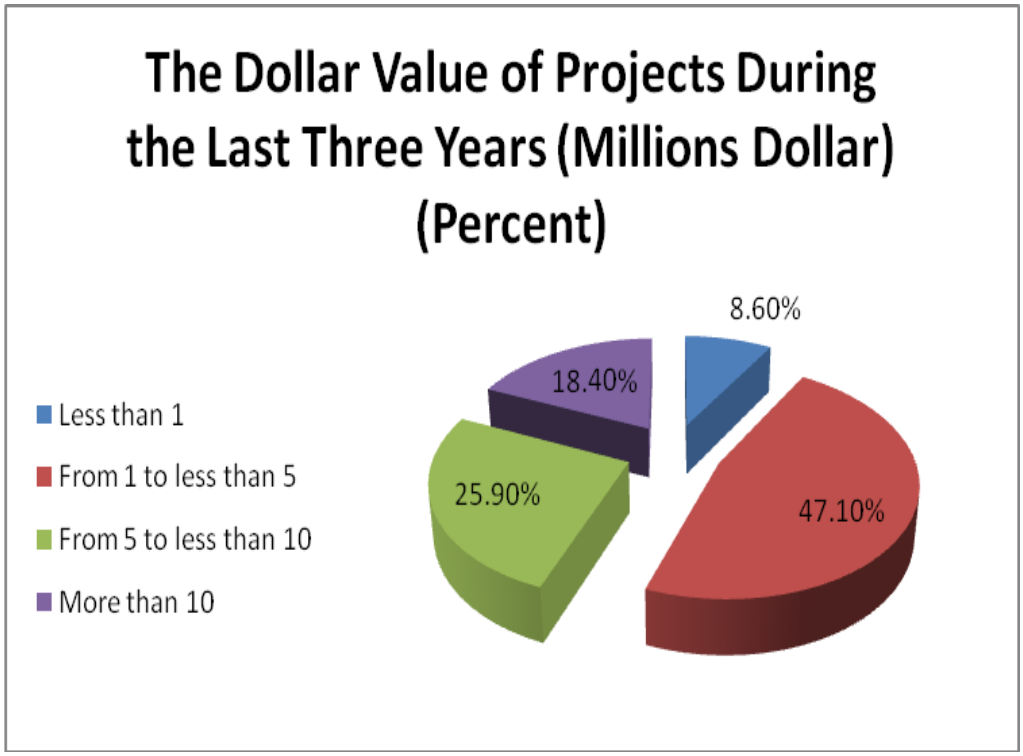

Figure 4.5: Dollar Value of Construction Projects

This question refers to the dollar value of construction projects performed between 2011 and 2013. Figure 4.5 shows that the majority (47.1%) of the projects implemented during this period have a dollar value from 1 to less than 5 million dollars and 25.9% from 5 to less than 10 million dollars. This means that most accomplished projects by Palestinian construction companies are medium projects. Local construction projects are mainly small to medium projects compared to wide world construction projects. Also this indicates that these companies have a very good experience that enables them to identify the most important problems and factors affecting quality.

4.2.6 Type of Projects the Companies are dealing with

Figure 4.6 shows that the majorities (65%) of the surveyed companies are dealing with building construction projects, 15.5% of them are dealing with infrastructure projects, while19.5% of them are dealing with both building construction and infrastructure projects as those two fields are the prevailing construction fields in Palestine.

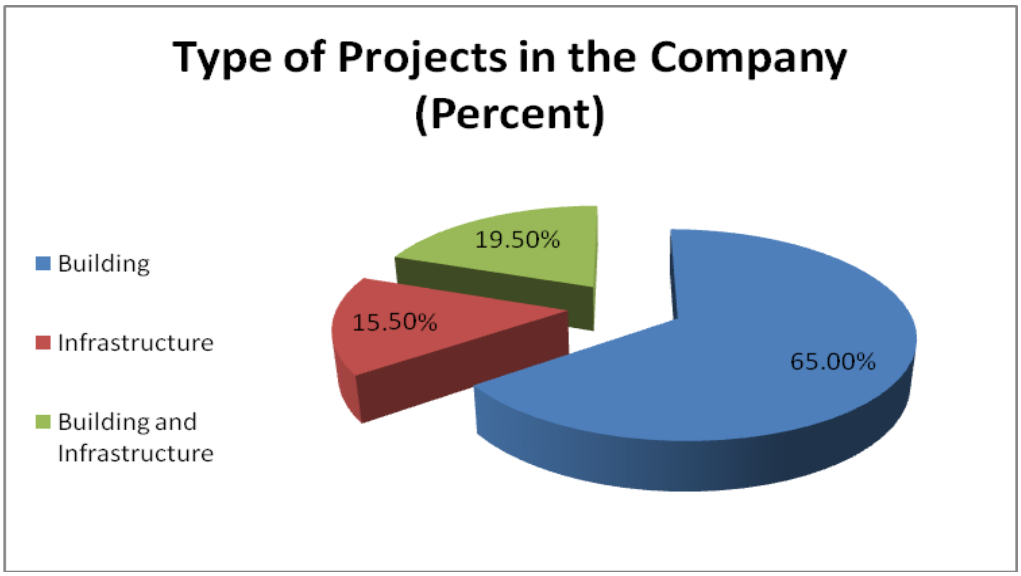

Figure 4.6: Type of Projects

4.2.7 Company Location in the West Bank

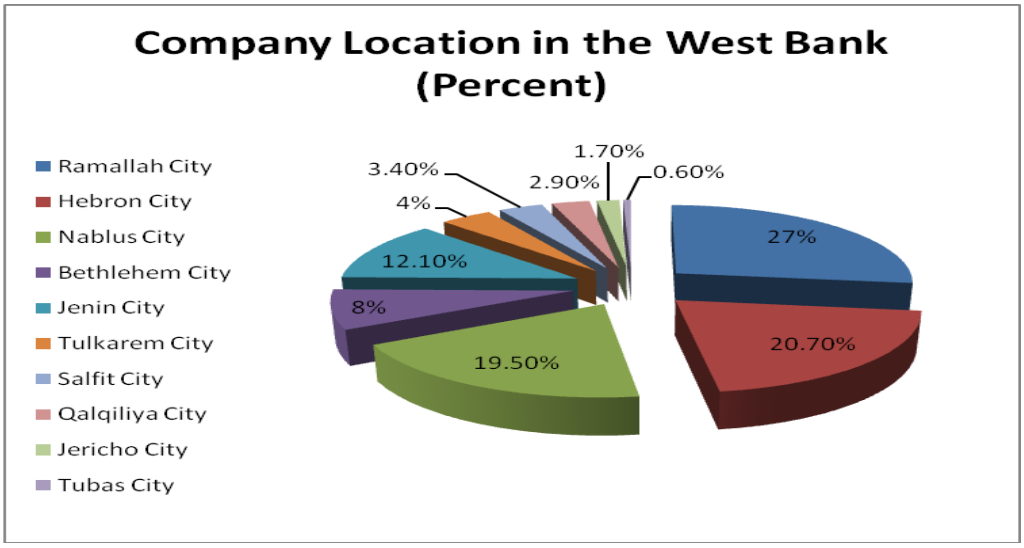

Figure 4.7: Company Location in the West Bank.

Figure 4.7 shows that most of the companies in the sample 27% were in Ramallah City, 20.7% of the companies in the sample were in Hebron City, 19.5 of them were in Nablus City. And just 32.8% were distributed to other cities in the sample. This demonstrates the construction concentration in the West Bank middle cities, especially in Ramallah.

4.2.8 Year of Company Establishment

As depicted in Figure 4.8, it is clear that most of the surveyed companies (70.1%) were established between 1994 and 2008, 23.5% of them were established before 1994, and only 6.4 % of them were established after 2008.

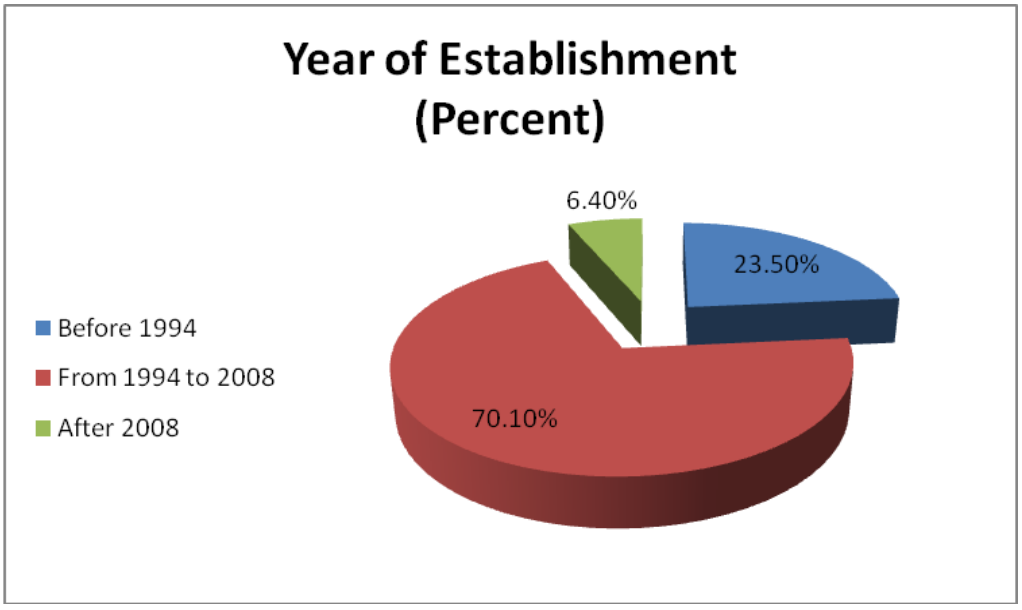

Figure 4.8: Year of the Company Establishment

It is clear that the establishment of the Palestinian Authority in the year 1994 created opportunity for many new projects. Thus, it is clear from Figure 4.8 that the greatest portion of companies' year establishment was after the year 1994. While, by the year 2008, due to the global financial crises influences, inflation, and intense competition, many companies

declare bankruptcy, thus the lowest portion of companies' year of establishment was after 2008.

4.3 Evaluate current level of qm implementation in palestenian construction sector.

The following are the results gathered from the section two. There were 11 questions for respondents to respond.

4.3.1 Respondents Perception of Quality.

The question was asked to evaluate the respondents' perception of quality. The results are as shown in Table 4.1 and Figure 4.9.

Table 4.1: Response to Perception of Quality

Item	Frequency	Percentage
Inspection and Corrective Actions	37	21.3%
Elimination of Defects	34	19.5%
Continuous Improvement	63	36.2%
A Tool to Increase Profits	3	1.7%
Increase Productivity	5	2.9%
A Competitive Advantage	21	12.1%
Customer Satisfaction	8	4.6%
Others	3	1.7%
Total	**174**	**100%**

And

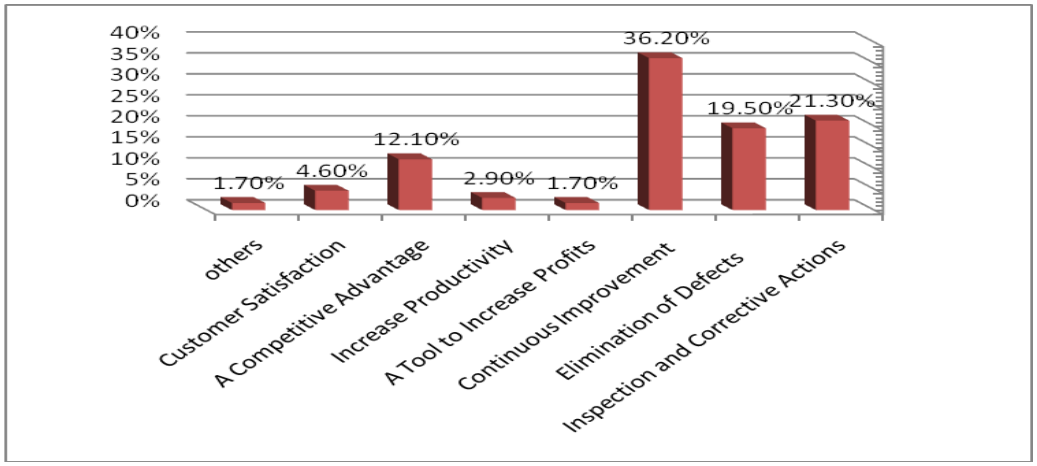

Figure 4.9: Response to Perception of Quality

The survey found that 21.3% of respondents (37 out of 174) perceive quality as inspection and corrective actions, 19.5% constituting (34) of the respondents gave elimination of defects as their response. The Table further shows that (63) respondents representing 36.2% gave a response to the same question as continuous improvement. However, (21) respondents representing 12.1% stated that a competitive advantage is their perception while the remaining (19) respondents representing 10.9% gave a tool to increase profits, increase productivity, customer satisfaction and others as the answers to the question.

According to majority of respondents, their perception of quality is by the continuous improvement, then inspection and corrective actions, then elimination of defects. This means that, emphasis is placed on quality improvement and CSFs that lead to these improvements. In view of this, quality is improved leading to cost reduction, productivity enhancement, profit margins increment and achievement of customer satisfaction.

4.3.2 Quality Policy in respondent's organization.

The question was asked to check the quality orientation of these organizations, and evaluate the existing of quality policies, manuals or documents in respondent's organization.

Table 4.2: Response on Quality Policy

Item	Frequency	Percentage
Yes	48	27.6%
No	71	40.8%
Partially Existing	55	31.6%
Total	174	100%

Quality policy is the directions of an organization's relationship to quality as formally expressed by top management. It outlines how management intends achieving quality. Almost half (40.8%) of the respondents responded that, there is no quality policy, manual or document but 27.6% said there is availability of quality policy, manual or document. Surprisingly, most companies do not have quality documents. This suggests that, the existing of quality policies, manuals or documents in respondent's companies is not sufficient and they do not follow any laid down policy. Also this indicates the lack of commitment of top management towards the implementation of QM in construction projects.

4.3.3 Companies having ISO Certificate.

The respondents were asked question about ISO certificate. As shown in Table 4.3, Just 19 construction companies out of 174 have ISO certificates. The high cost and complicated procedures of getting ISO certificate limited the number of companies who have this certificate.

Table 4.3: Response on ISO Certificate.

Item	Frequency	Percentage%
Yes	19	10.9%
No	155	89.1%
Total	174	100%

4.3.4 Conformance to Standards of Design Drawings

The question was asked in this section to evaluate the organizations' quality auditing and reviewing procedures.

Table 4.4: Response on Design Conformance to Standards.

Item	Frequency	Percentage%
Do not Check it Out	7	4.0%
After Every Design	36	20.7%
Before Commencement of Project	75	43.1%
During Construction	56	32.2%
Total	174	100.0

Majority of respondents representing 43.1% said they check for design conformance to standard before commencement of project while 32.2% said during construction. Also 20.7% said it is done after every design.The best answer for this question to achieve high quality is: after every design, and from the responses given, it can be deduced that majority of companies check for design conformance to standard before commencement of project and during construction. This means that this companies need more efforts to improve the quality.

4.3.5 Training

The question was asked to evaluate the organizations' training program.

Table 4.5: Response on Formal Training Given to Employees.

Item	Frequency	Percentage
No Training is Given	52	29.9%
On-Site	100	57.5%
Workshops on Quality Improvement	10	5.7%
Short Courses	12	6.9%
Total	174	100.0

Training is an important indicator of how well a company is prepared for QM. Table 4.5 shows that out of the 174 respondents, 52 representing 29.9% indicated that no training is given to the employees. Majority of the respondents (57.5%) pointed out that employees are trained on–site. Ten

(10) of the respondents representing 5.7% said they trained by organizing workshops while 6.9% provide short courses.

When interviewed, most managers stress that when employees are formally trained, they do not stay for a long time to enable the firm to enjoy the benefits of their investment, hence, only on- site training is given to the employees and it is once, usually for a new worker, though they conceded that employee training and education are important.

With reference to the respondents who answered this question, employee training plays a vital role in any company's quality building efforts. Training programs attempt to teach employees how to perform activities. Education, on the other hand, is much more general and attempts to provide employees with general knowledge that can be applied in many different settings.

4.3.6 Contractors choosing process and basis of awarding the tender.

The question was asked to evaluate the process of choosing contractors to execute the project works and basis of awarding the tender.

Table 4.6: Response on process of choosing contractors

Item	Frequency	Percentage
Based on the Minimum Price	81	46.6%
Based on Technical Evaluation	7	4.0%
Based on Technical & Financial Evaluation	86	49.4%
Total	174	100.0%

Table 4.6 shows that out of the 174 respondents, 81 representing 46.6% indicated that the process of choosing contractors based on the minimum

price while 4% of them said that the process based on technical evaluation only. (49.4%) respondents pointed out that the process based on technical and financial evaluation.

According to the above result, the large number of the respondents who answered that: "the process of choosing contractors is based on the minimum price" indicate that a large part of the existing projects are given to contractor whose price is the lowest. Interviews with a number of company managers in the studied sample illustrate that, financial situation is the basis of quality, there is no one working for the quality at the expense of losing his money.

4.3.7 Role of the Supervisor in the Work Site.

The question was asked to evaluate the role of the supervisor in the work site.

Table 4.7: Response on the Role of the Supervisor in the Work Site

Item	Frequency	Percentage
Yes	99	56.9%
No	10	5.7%
Sometimes	65	37.4%
Total	174	100.0%

Analytical results show that 56.9% of the respondent said: "supervisor engineer is doing his role and control comprehensivly and ensure the rightness of the work", and 5.7% said: "No". But 37.4% said: "sometimes" which considered large proportion, so improving the implementation processes of quality is important.

4.3.8 The presence of site engineer in the work site.

The question was asked to evaluate presence of site engineer in work site.

Table 4.8: Response on the Existence of Site Engineer in Work Site.

Item	Frequency	Percentage%
Yes	119	68.4%
No	46	26.4%
Don't Know	9	5.2%
Total	174	100.0%

It can be seen from Table 4.8 that most of respondent (68.4%) agreed that site engineer exists at the site work permanently which is good indicator.

4.3.9 The role of site engineer to achieve quality in the work site.

The question was asked to evaluate the role of site engineer to achieve quality in the work site.

Table 4.9: Response on the Role of Site Engineer to Achieve Quality

Item	Frequency	Percentage%
Yes	105	60.3
No	48	27.6
Don't Know	21	12.1
Total	174	100

Table (4.9) indicates that most of the respondent (60.3%) agreed that the site engineer does his role in achieving quality at the site.

4.3.10 Storing of project's materials in the work site.

The question was asked to evaluate the quality of materials in the work site.

Table 4.10: Response on Material's Storing in Safety Places

Item	Frequency	Percentage%
Yes	128	73.6%
No	34	19.5%
Don't Know	12	6.9%
Total	174	100.0%

According to the questionnaire responses, 73.6% of the sample subjects that the project materials are storing in suitable places for its safety.

4.3.11 The most commitment parties to achieve quality.

The question was asked to evaluate the parties that achieve quality in the construction projects.

Table 4.11: Response on Most Commitment Parties to Achieve Quality

Item	Frequency	Percentage
Governmental institutions	13	7.5%
Donor institutions	107	61.5%
Engineering offices	44	25.3%
Contracting Companies	10	5.7%
Total	174	100.0%

According to Table (4.11), 61.5% of respondents say that donor institutions is the most commitment parties to achieve quality, 25.3% say: engineering offices, 7.5% for governmental institutions and 5.7% for contracting companies. Results showing that there is lack of commitment by the contracting companies and governmental institutions to achieve quality. They should work hard and hard in this field in order to improve QMSs in their companies.

It is evident from the respondents' answers of section two that the understanding of quality and implementing the QMSs is not sufficient.

Also the current situation needs more attention and studies in this subject to clarify the quality concept to all parties of the construction industry.

Furthermore, this is an indication of the necessity of having QMSs in construction companies. Unfortunately, respondents cannot distinguish between TQM, QC, and QA concepts.

4.4 Problems and obstacles affecting qm implementation

The respondents were asked if they encounter problems as highlighted in the literatures as for the implementation of QM is concerned. They were also asked to state other problems of the implementation of QM faced if there is any. The following are the results gathered from the section three of questionnaire:

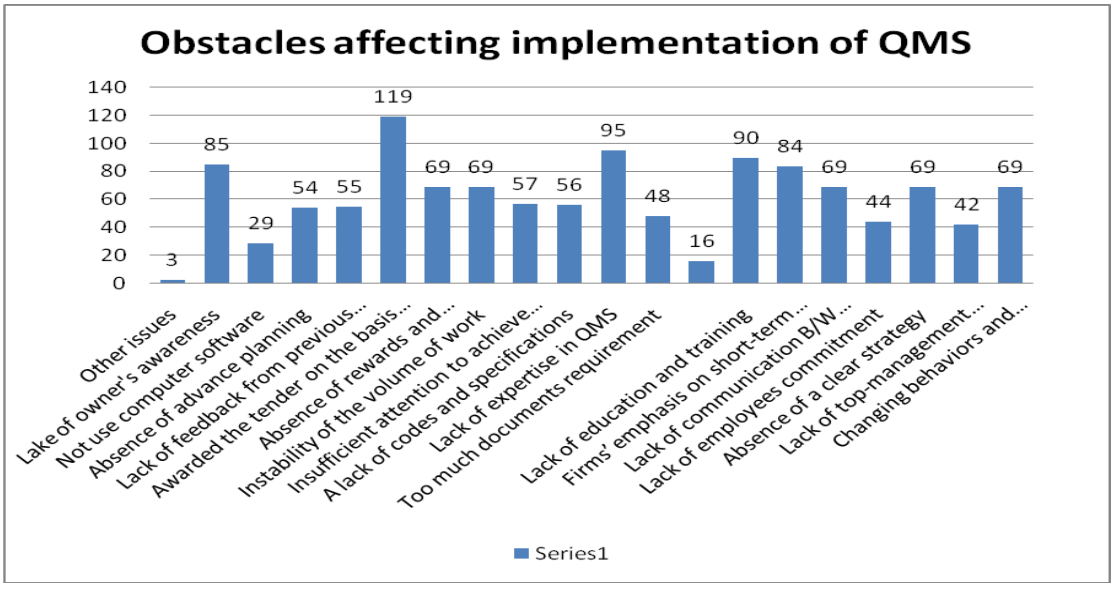

Figure 4.10: Frequency of Problems Affecting Implementation of Q.M

The problems affecting the implementation of Q.M as indicated by the respondents and as shown in Figure 4.10 above are listed in order of priority (based on total number of responses received against each option) in Table 4.12 below:

Table 4.12: Analysis of Problems on implementation of QM

Problems of Q.M implementation	Frequency	Mean	Std. Deviation
15. Awarding the tender on the basis of lower prices and not efficiency.	119	0.68	0.466
10. Lack of expertise in QM System.	95	0.55	0.499
7. Lack of education and training to drive the improvement process.	90	0.52	0.501
19. Lake of owner's awareness about the importance of quality in projects.	85	0.49	0.501
6. Firms' emphasis on short-term objectives	84	0.48	0.501
1. The difficulty in changing behaviors and attitudes related to quality.	69	0.4	0.491
5. Lack of communication between project's parties.	69	0.4	0.491
13. Instability of the volume of work and the instability of the national economy.	69	0.4	0.491
14. Absence of rewards & appreciation of the achievement of employees	69	0.4	0.491
3. Absence of clear strategy for QM in the company	69	0.4	0.491
12. Insufficient attention to achieve quality by workers in projects.	57	0.33	0.471
11. A lack of codes and specifications.	56	0.32	0.469
16. Lack of feedback from previous projects and take advantage of them.	55	0.32	0.466
17. Absence of advance planning for projects.	54	0.31	0.464
9. Too much documents are required which lead to difficulty on documentation ability.	48	0.28	0.448
4. Lack of employees' & workers' commitment /understanding & resistance to quality programs	44	0.25	0.436
2. Lack of top-management commitment / understanding of quality issues.	42	0.24	0.429
18. Not use computer software to manage projects effectively.	29	0.17	0.374
8. Loss of part of the productivity of workers	16	0.09	0.29
20. Other issues	3	0.02	0.131

From Table 4.12, results show that problem (15), “Awarding the tender on the basis of lower prices and not efficiency”, is the most important problem affecting QM implementation in construction companies in West Bank.

Interviews with a number of contract parties in the studied sample indicate that, the lowest evaluated bids mainly which values are under the project's estimated cost, may be occurring due to the lowest evaluated bidder poor experience or faults. And then, referring to that bidders may lead to delay in project execution, inability in paying obligations to suppliers, contractor financial losses or bankruptcy which adversely affecting the level of quality in projects.

On the other hand, one interviewer said: "The intense competition between contractors and the low number of tendered projects make contractors tight percentage of their profits and thus their prices are low, which affect the quality of the projects".

The second important problem is No.(10) which is: “Lack of expertise in QM System”. This is associated so much with awareness of the importance of quality and, also, this means the importance of spend efforts in spreading the culture of quality among all parties,

The resulted frequency and mean of problem (7) equal 90 and 0.52 respectively which means that it’s of third importance, so the training courses must be done.

The Other issues that respondent said were as below:

- Lack of the profit from the project
- Sometimes weakness of the supervisor engineer

- Lack of the interests from the supervisor and owner about quality, because they chose the lowest price for the contractor.
- Evaluation based on the lowest prices, and sharp fluctuations in the availability of projects because of the loss of the trained stuff.
- And favoritism.

4.5 Surveying Csfs for construction sector in palestine.

In this study, CSFs in managing the construction sector in West Bank were surveyed, sorted and classified into thirteen major factors, in order to facilitate this study, every major factor includes several minor factors related to the major one.

These factors have been surveyed and compiled through making interviews with some related contract parties, including: contractors and consultants, also by reviewing some publications that reflect factors for improving the implementation of QM in the construction sector.

4.6 Ranking importance of CSFS for tqm implementation in construction sector in palestine.

Having identified factors critical for successful implementation of TQM in construction industry, it is necessary to rank these factors according to their importance from the construction companies respondents view point.

In order to analyze each factor, each statement had been ranked for each major factor according to the value of its average, starting from the largest average to the smallest average by giving the value 1 for the statement that has the largest average value, 2 for the statement that has the second largest average value, and so on.

According to the SPSS analyzing by the five-point Likert scale, when the statement mean's increase, its importance will be increased. The statement that has the ranking number of value (1) means that it has the highest importance among the other statements in the main one. In order to understand the findings of the study, the mean key in Table 4.13 shown below will be useful.

Table 4.13: Mean Key for the Findings of the Study

No.	Mean	Level of Importance
1	1 – 2.33	Low
2	2.34 – 3.67	Moderate
3	3.68 – 5	High

Analyze each major factor and its included miner factors' (sub factor) statements, and determining their importance ranking are as following:

4.6.1 Analysis of factors related to “Top Management Commitment and Leadership”

Table 4.14 below shows that under the group of "top management commitment and leadership" sub-factors, "Procedures of selecting contractors and awarding the tender to the most accurate bidder not to the lowest evaluated bidder" is the most important factor related to the other factors. It ranked as first according to the overall opinion of respondents with a mean of 4.44.

Table 4.14: Ranking of top management commitment and leadership factors according to overall respondents opinions from the highest important one.

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	5.Procedures of selecting contractors and awarding the tender to the most accurate bidder not to the lowest evaluated bidder.	4.44	.877	.936	High
2	6.Development & implementation of plans on the basis of the company's capabilities readiness.	4.08	.843	.936	High
3	4. Regularity and speed of the owner in decision making.	4.01	.997	.936	High
4	2.Attachment of importance to quality by top management in relation to cost and schedule	3.86	.970	.936	High
5	3.Reviewing quality issues in the top management meetings.	3.70	.934	.936	High
6	1.Management establishing clear definition of quality in the mission.	3.65	1.036	.936	Mod.
	Average	**3.96**		**.936**	**High**

"Procedures of selecting contractors and awarding the tender to the most accurate bidder not to the lowest evaluated bidder" is a CSF for TQM implementation. Interviews with a number of contract parties in the studied sample indicates that, the lowest evaluated bids mainly which values are

under the project's estimated cost, may be occurring due to the lowest evaluated bidder poor experience or faults. And then, referring to that bidder may leads to poor quality in project execution, contractor financial losses or bankruptcy which adversely affecting the general financial situation in Palestine.

The overall respondents ranked the sub factor (5) "Development and implementation of plans on the basis of the company's capabilities and readiness" as the second most important factor under the group of top management commitment and leadership, this factor is essential blocks in building to effective TQM implementation in construction sector. "Regularity and speed of the owner in decision making" was ranked by the overall respondents in the third position under this main factor, this sub factor is also a CSF for TQM implementation.

The overall respondents ranked "attached to quality by the top management in relation to cost and schedule objectives" as the fourth important factor. Traditionally, construction performance was evaluated in terms of the “iron/golden” triangle, which refers to meeting cost, schedule, environment, and safety related criteria. Construction management researchers have explored the factors that influence cost, time and quality related criteria that make up the iron/golden triangle. Links between TQM and the iron/golden triangle have also been explored. (Bryde and Robinson, 2007) considered the impact of the iron/golden triangle in the TQM implementation in UK. The results in West Bank, Palestine were supported by Bryde results. This is logical especially due to the difficult conditions in Palestine that directly affect the schedule and cost of the project. The

results of these factors are consistent with (Antony et al, 2002) results in Hong Kong.

4.6.2 Analysis of Factors related to "Human Resource Management".

The following Table (4.15) showing all the Human Resource Management sub factors allocating the ranking numbers according to their importance.

Table 4.15: Ranking of factors related to human resource management according to overall respondents opinions from the highest important one.

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	5.Skill and experience of contractor's staff, and using labors with high experience	4.31	.750	.936	High
2	7.Cooperation and effective coordination between Supervision and Contractor's staff.	4.30	.784	.936	High
3	4.Skill and experience of Supervision staff, and their authority in the project site.	4.24	.860	.936	High
4	6. Skill and experience of designers.	4.20	.899	.936	High
5	2. Using Motivation System for employees and labors.	4.02	.931	.936	High
6	3. Training courses for employees in quality improvement skills and technical skills.	4.00	.906	.936	High
7	1. Income level and wages of employees and labors.	3.95	.875	.936	High
8	8.Absence of past disagreements between contract parties	3.83	1.102	.936	High
	Average	**4.11**		**.936**	**High**

Analysis in Table 4.16 shows that the mean of the factors related to human resource management factor equal 4.11 which mean that it is of high importance. It is clear that all sub factors are high importance according to the means. It is important for managers to understand that the training is essential to get skilled persons that are likely to perform more accurate works. The result for this factor is supported by the study conducted in UK by Oakland and Aldridge, (1995), and in Jordan by Abu- Hamatteh et al (2003). They identify it as an important factor in TQM implementation.

4.6.3 Analysis of factors related to “External Customer Focus”

The following Table (4.16) showing all sub factors related to external customer focus allocating the ranking numbers according to their importance. From the table below, it can be noted that the sub factor (6)" Price and budget specified by the owner" is the most important sub factor related to the owner factor. Also the sub factor (5) is the second important one with high level of importance. While the other sub factors has moderate level of importance.

Table (4.16): Ranking of factors related to External Customer Focus

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	6. Price and budget specified by the owner.	4.22	.894	.936	High
2	5. Using the facilities & buildings properly by the owner.	3.96	.915	.936	High
3	3. Responding effectively to owner's enquiries & complaints.	3.54	.941	.936	Moderate
4	4.Corrective actions undertaken to delight customers.	3.44	.999	.936	Moderate
5	1. Owner's requirements are used as the basis for quality.	3.26	1.116	.937	Moderate
6	2. Owner organization nature	3.11	1.219	.938	Mod.
	Average	**3.58**		**.937**	**Mod**

4.6.4 Analysis of factors related to "Process Management and Execution".

Table 4.17 below, showing all the "Process Management and Execution" sub factors; allocate the ranking numbers according to their importance.

Table 4.17: Ranking of factors related to "Process Management and Execution"

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	4. Clarity of work or process instruction giving to employees, artisans and site staff.	4.58	3.089	.944	High
2	1.Testing and inspection of incoming products or work for specification compliance.	4.37	.784	.936	High
3	3.Using of a comprehensive and continuous supervision system	4.28	.780	.936	High
4	2. Preparing of shop drawings.	4.28	.718	.936	High
5	6. Clear procedure for accepting performed activities.	4.26	.713	.936	High
6	5. Process flow chart and inspection for activities that affect quality.	4.06	.820	.936	High
	Average	**4.31**		**.937**	**High**

From the table above, it can be noted that the three most highly ranked factors are: clarity of work or process instruction giving to employees, artisans and site staff, testing, reviewing and inspection of incoming products or work for specification compliance, using a comprehensive and continuous supervision system, with means 4.58,4.37, and 4.28 respectively. This importance come from the fact that the limited

employees' understanding of the overall work lead to limit recognize of problems when they occur.

4.6.5 Analysis of factors related to “Supplier Management”.

Ranks of each sub factors related to "Supplier Management" are presented in Table 4.18:

Table 4.18: Ranking of factors related to “Supplier Management”.

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	5. Supply materials for the project in a timely manner.	4.29	.798	.936	High
2	2. Provide clear specification to suppliers.	4.24	.832	.936	High
3	1. Reliance on suppliers who are evaluated and selected based on capability and commitment to product and service quality.	4.10	.995	.936	High
4	4. Suppliers having programs to ensure quality of products.	3.93	.922	.936	High
5	3. Providing technical assistance of suppliers by contractor companies.	3.89	.843	.936	High
	Average	**4.09**		**.936**	**High**

Table 4.18 shows that the most important factor is (5) "supply materials for the project in a timely manner". It ranked according to the overall respondent and with mean equal 4.29. Regardless of which factor of

supplier management is more effective, all factors are essential for TQM implementation.

4.6.6 Analysis of factors related to "Information Analysis and Evaluation".

The following Table 4.19 shows all information analysis and evaluation factors allocating the ranking numbers according to their importance.

Table 4.19: Ranking of factors related to "Information Analysis & Evaluation"

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	1.Review of drawings & specification before tendering	4.39	.809	.936	High
2	5.Continuity audit to ensure high quality work.	4.22	.744	.936	High
3	4. Documentation of project	4.20	.853	.936	High
4	2. Document procedures for reviewing disposition of nonconforming products.	4.08	.779	.936	High
5	3. Documentation of corrective and preventive actions.	4.05	.747	.936	High
	Average	**4.19**		**.936**	**High**

The result in table 4.19 shows the rank and average for sub factors related to "Information analysis and evaluation", the respondents ranked the "Review of drawings and specification before tendering process " as the most important factor under this main factor that because accurate

drawings and specification will decrease the unforeseen and contingency cost. Regardless of which sub factor is more effective, all factors are essential for TQM implementation. The result for these factors is supported by the study conducted in Jordan by Abu-Hamatteh et al. (2003).

4.6.7 Analysis of factors related to "Contract Documents".

The following Table 4.20 shows all factors related to "Contract Documents" allocating the ranking numbers and their level of importance.

Table 4.20: Ranking of factors related to "Contract Documents"

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	4. Completeness & consistency of design drawings.	4.40	.696	.936	High
2	1. Absence of a conflict between the tender documents.	4.38	.843	.936	High
3	3. Bill of quantity is very detailed and accurate.	4.32	.705	.936	High
4	2. Conditions of written contract are clear and fair, also responsibilities distribution is clear.	4.30	.747	.936	High
5	5. Using modern techniques in designing and conformance to codes.	4.17	.746	.936	High
6	6. A competent authority or party to audit drawings of design.	4.11	.801	.936	High
	Average	**4.28**		**.936**	**High**

Analysis shows that the mean of the factors related to contract documents factor equal 4.28. Also, analysis shows that sub factor (4), "Completeness and consistency of design drawings", is the most important sub factor among this main factor with mean equal (4.40). Also factor (1), "Absence of a conflict between the tender documents" is the second important sub factor with means equal (4.38). The third important one is "Bill of quantity is very detailed and accurate" with mean equal (4.32). Some interviewers said: “During the actual construction, changes are likely to delay the project and lead to inordinate cost increases, and focus of cost control is on fulfilling of the original design plans”.

4.6.8 Analysis of factors related to “Materials and Equipment”.

The following Table 4.21 showing all the materials and equipments sub factors allocating the ranking numbers according to their importance.

Table 4.21: Ranking of factors related to Materials and Equipments.

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	3. Laboratories competence for samples testing and approval.	4.20	.865	.936	High
2	5. Good utilization of equipment & regular maintenance.	4.07	.910	.936	High
3	4. Optimal use of materials	3.99	.903	.935	High
4	1. Using storage & handling system for materials	3.68	.852	.936	High
5	2.Palestinian Standards Institution role.	3.59	1.168	.936	Mod.
	Average	**3.91**		**.936**	**High**

From the table above, it can be noted that the sub factor (3) "Laboratories competence for samples testing and approval" is the most important sub

factor related to the materials and equipments factor. While the sub factor (2) "Palestinian Standards Institution role" has moderate level of importance and the last one according to the importance.

Interviews with a number of contract parties indicates that, not specifying Palestinian specifications for materials and equipments to be adopted in projects, leads to consultants diversity in describing the required equipment and material according to their experience. Also, difficulties appear in tender pricing due to the lack of clarity in specifying items properly. On the other hand, many consultants avoid precise describing so as not to be accused by bias to specific company products. Therefore, if there is a clear description in the Palestinian specifications, then consultant's embarrassment will be avoided in such cases.

4.6.9 Analysis of factors related to "Financial Issues"

Table 4.22 below, showing all the "Financial Issues" sub factors; allocate the ranking numbers according to their importance.

Table 4.22: Ranking of factors related to Financial Issues.

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	4. Provision of the appropriate budget required for project implementation before tendering	4.24	.860	.936	High
2	2. Non delay of interim payments.	4.21	.877	.936	High
3	1.Amount of contractor's cash flow	4.10	.925	.936	High
4	3. Achieving bank facilities to the contractor.	3.80	.956	.936	High
5	5. Advanced payment is paid to contractor to facilitate his work.	3.69	1.084	.936	High
	Average	**4.01**		**.936**	**High**

From the table above, it can be noted that the three most highly ranked factors are: Provision of the appropriate budget required for project implementation before tender launching, the non delay of interim payments, the amount of contractor's cash flow respectively. Results are supported by a number of other studies such as those conducted by (Zhang, 2001), and by (Abu-Hamatteh et al, 2003) which identify this factors as one of the most important factors that effect in TQM implementation.

4.6.10 Analysis of factors related to "Site Layout".

Ranks of each factor related to "Site Layout" are presented in Table 4.23:

Table 4.23: Ranking of factors related to "Site Layout".

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	5.Achieve the requirements of safety	4.28	.863	.936	High
2	2. Site layout is organized well	3.96	.882	.935	High
3	4. Site is clean and getting rid of projects waste in an organized ways.	3.90	.865	.936	High
4	3. Site layout has storage areas	3.86	.878	.936	High
5	1. Site layout is large & suitable for movement of labors and equipments.	3.56	1.011	.935	Mod.
	Average	**3.90**		**.936**	**High**

Table 4.23 shows that under the group of site layout sub factors, the most important factor is (5) "Achieve the requirements of safety in the site layout". It ranked according to the overall respondent and with mean equal

4.28, while the lowest indicating factor is " Site layout is large and suitable for movement of labors and equipments" with means equal 3.56.

4.6.11 Analysis of Factors related to Systems Used.

The following Table 4.24 showing all “Systems used” sub factors allocating the ranking numbers according to their importance.

Table 4.24: Ranking of factors related to “Systems Used”.

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	4. Implement a safety program.	4.41	3.954	.936	High
2	2. Implement Time Schedule.	4.13	.787	.936	High
3	1. Using computer software	3.98	.949	.935	High
4	3. Using cost control system.	3.96	.842	.948	High
5	5. Using a complete applied resources management system	3.88	.855	.935	High
	Average of "Systems Used"	**4.07**		**.938**	**High**

From the Table 4.24, it clearly shows that "Implement a safety program" was ranked first with mean 4.41. Regardless of which sub factor is more effective, all factors are essential for TQM implementation.

4.6.12 Analysis of factors related to "The Surrounding Environment".

Table 4.25: Ranking of factors related to Surrounding Environment.

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	4. Israeli restrictions on imports.	3.98	1.062	.936	High
2	3. Barriers & closure of the roads affecting cost of materials transfer	3.97	.997	.936	High
3	2. Stability of Political environment.	3.83	1.054	.935	High
4	5. Cooperation of nearby residents to projects in implementation of works	3.55	1.051	.936	Mod.
5	1. The socio-economic environment.	3.44	.946	.936	Mod.
	Average	**3.75**		.936	**High**

Analysis shows that sub factor (4) "Israeli restrictions on imports", is the most important sub factor among this main factor with means equal (3.98). It is clear that all sub factors are high importance according to the means.

4.6.13 Analysis of factors related to "Continuous Improvement".

The following Table 4.26 showing all "Continuous Improvement" sub factors allocating the ranking numbers according to their importance.

Table 4.26: Ranking of factors related to "Continuous Improvement".

Rank No.	Sub Factors	Mean	Std. Deviation	Alpha	Level
1	3.Teamwork	4.25	.741	.936	High
2	2. Identification of areas for quality improvement and implementing it.	4.09	.715	.936	High
3	1. Finding the root causes in the diagnosis of problems and defects.	4.07	.783	.936	High
4	6. Tracking Cost of quality process for continuous improvement.	4.02	.779	.936	High
5	5. Identification of quality tools.	3.88	.754	.936	High
6	4. Change the company's policy in relation to quality gradually.	3.79	.884	.936	High
	Average	**4.02**		.936	High

From the table above, it can be noted that the sub factor (3) "Teamwork" is the most important sub factor. From interviews, teamwork lead to the determination of many key issues, it is vital in the management of continual improvement. Effective management of any project requires the formation and development of teamwork. Without teamwork, then conflict situations may be more common or pronounced. With the use of teams, the business will receive quicker and better solutions to problems. Teams also provide more permanent improvements in processes and operations. In teams, people feel more comfortable bringing up problems that may occur, and can get help from other workers to find a solution and put into place. All

factors are essential for TQM implementation. This result is consistent with the result of the study conducted in Hong Kong by Antony et al, (2002).

4.7 Ranking of main critical sucsess factors (CSFS)

From the previous analysis, the means of the main factors were calculated, their degree of importance were allocated, and these factors were ranked according to their importance from the higher rated. Results are as shown in Table 4.27 and presented in Figure 4.11.

Table 4.27: Ranking of Critical Success Factors

Rank No.	Critical Success Factors & Numbers	Mean	Level
1	4. Process Management & Execution	4.31	High
2	7. Contract Documents	4.28	High
3	6. Information analysis and Evaluation	4.19	High
4	2. Human Resources Management	4.11	High
5	5. Supply management	4.09	High
6	11. Systems Used	4.07	High
7	13. Continuous Improvement	4.02	High
8	9. Financial Issues	4.01	High
9	1. Top management commitment & leadership	3.96	High
10	8. Materials & Equipments	3.91	High
11	10. Site Layout	3.90	High
12	12. Surrounding Environment	3.75	High
13	3. External Customer Focus (The Owner)	3.58	Mod.

Figure 4.11: Ranking of Critical Success Factors

4.8 Bi-variate analysis

In this part of analysis, main questionnaire analysis will be linked together for getting some useful relationships among variables. Bivariate means linking two questionnaire variables together, to study the effect of one variable on the others. Many Bivariate analyses had been conducted, according to questionnaire variables, to investigate some useful results. Some distinctive results obtained from the Bivariate analysis will be addressed as follows:

4.8.1 Bi-variate Analysis of the Respondent Position:

Responses will be analyzed according to the position of respondent, whether he is a company manager, project manager, site engineer and supervision engineer. Many related relations were conducted, but only the ones who have distinctive relations will be included.

Respondent Position vs. Education Level

The following Figure 4.12 shows the respondents' education level of the different respondent position.

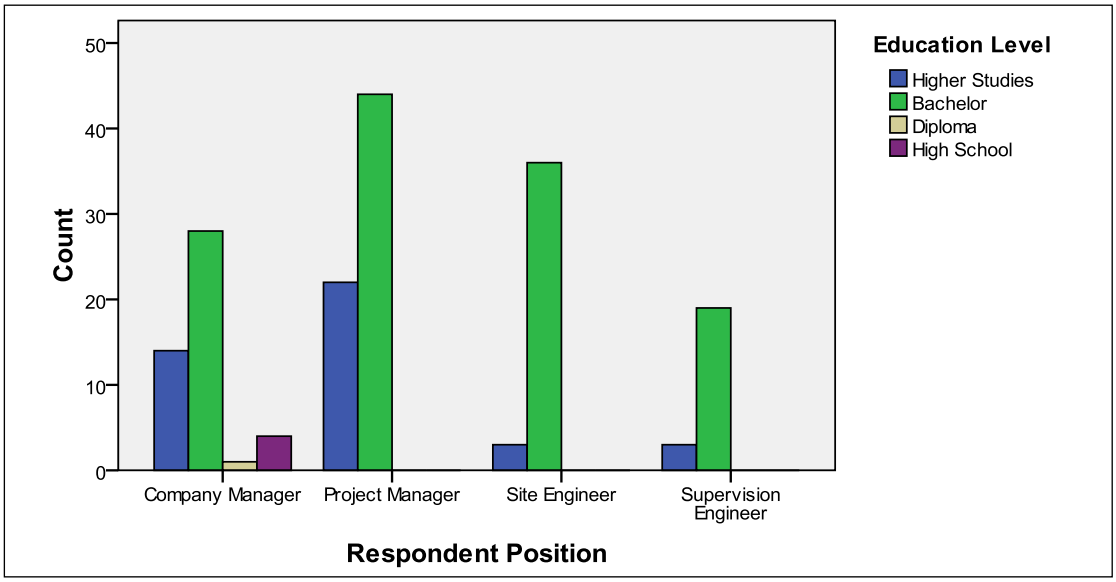

Figure 4.12: Respondent Position vs. Education Level

According to Figure 4.12 it can be concluded that most of the sample subjects (consultants and contractors), their qualification is bachelor degree. This means that the construction community is educated well. It is worth noting that most of the company managers are highly educated, who have a bachelor or postgraduate certificates, so they have positive influence in improving quality in their organization.

Respondent Position vs. Perception of Quality

The following Figure 4.13 shows the respondents' perception of quality of the different respondent position

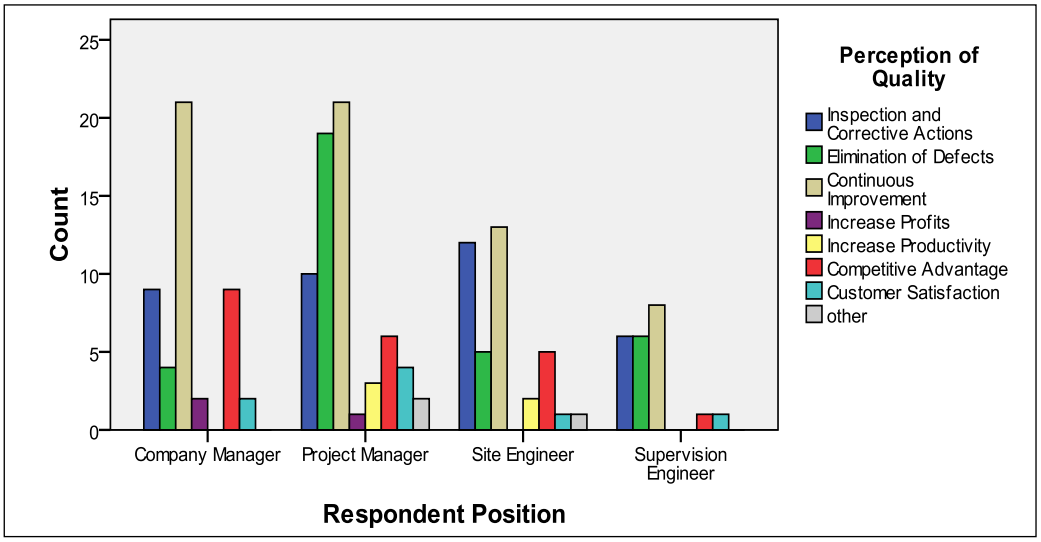

Figure 4.13: Respondent Position vs. Perception of Quality

The figure shows that all respondents, specially the manager, perceive quality as continuous improvement. This helps in improving quality because they are decision makers in their organizations.

4.8.2 Bivariate analysis of the Organization Type:

Responses will be analyzed according to their organization type, whether they are consultants or contractors. Many related relations were conducted, but only the ones who have distinctive relations will be included.

Organization Type vs. Respondent Position

The following Figure 4.14 shows the respondents' position of the different organization types. The majority of the consulting office respondents are company managers, whereas the majority of the contracting companies' respondents are project managers.

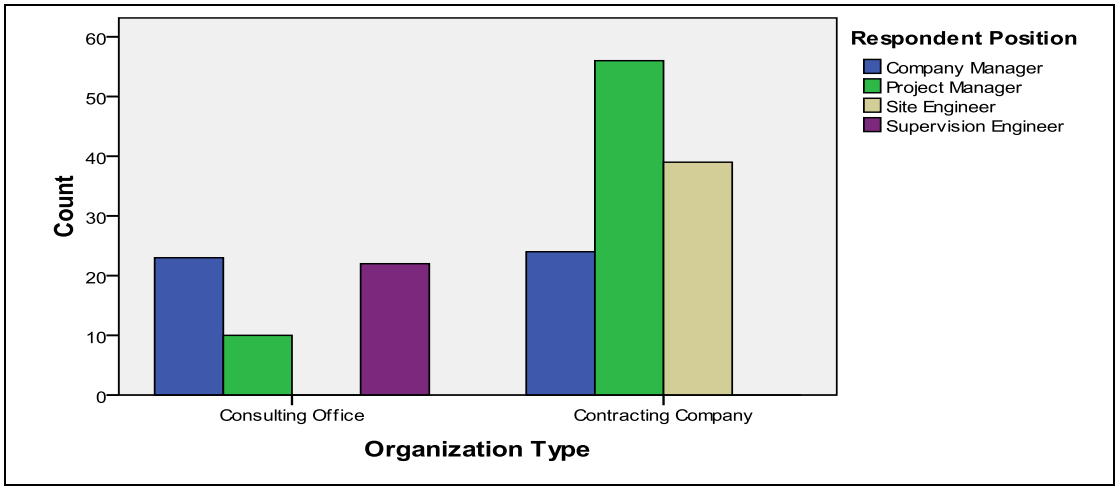

Figure 4.14: Respondent Position vs. Type of Organization

Organization Type vs. Construction Dollar Value

The following Figure 4.15 shows the respondents' type of organization vs. the dollar value of construction project performed during the last three years.

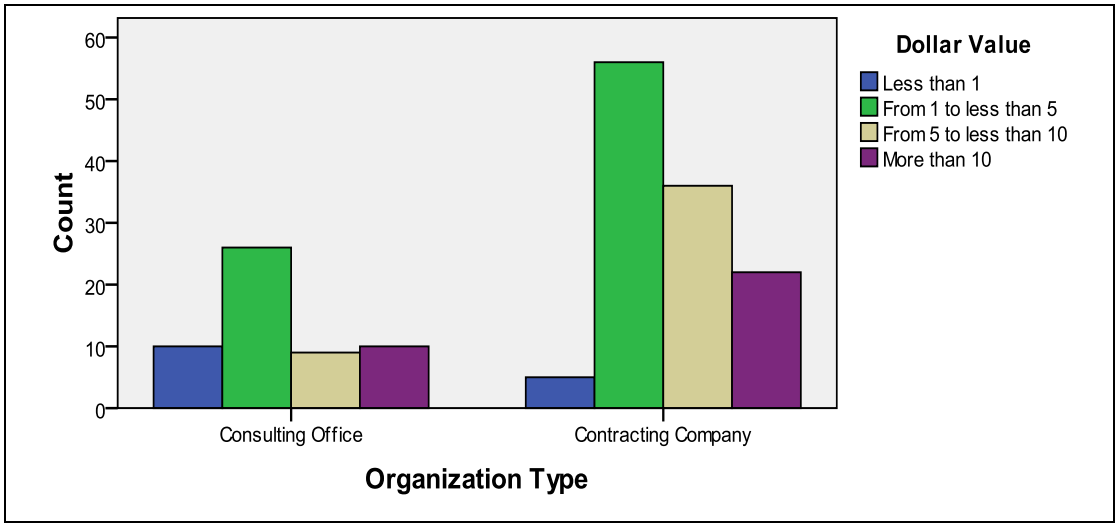

Figure 4.15: Type of Organization vs. Dollar Value

The above figure indicates that the local construction projects are mainly small to medium projects compared to worldwide construction projects.

Organization Type vs. Perception of Quality

The following Figure 4.16 shows the respondents' perception of quality in the different types of organizations.

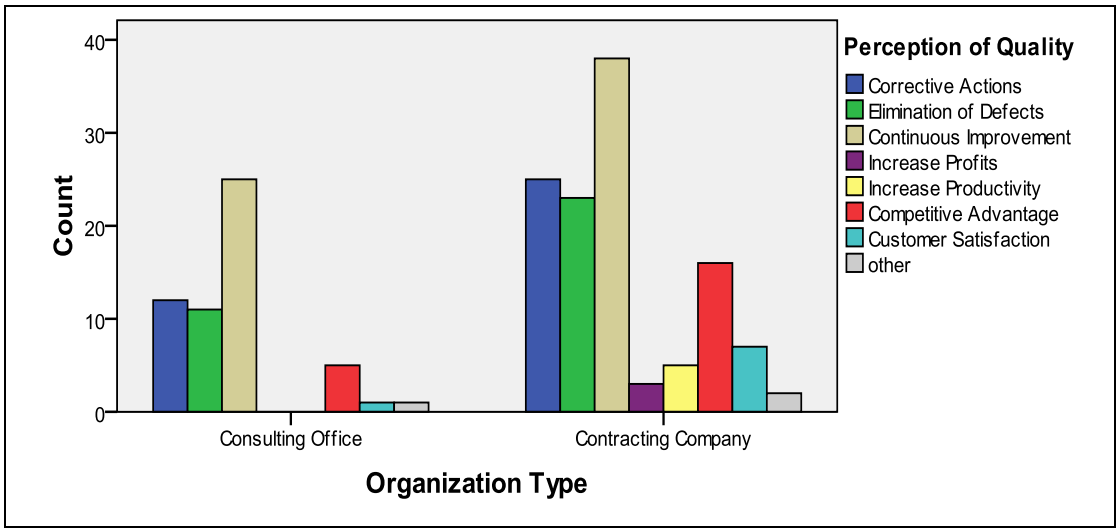

Figure 4.16: Type of Organization vs. Perception of Quality

The results show that the highest three concepts of quality related to consulting office organizations and contracting companies respectively are: continuous improvement, inspection and corrective actions, and then elimination of defects. It is clear that their awareness of the concept of quality have reached the stage which shows the importance of existing quality systems in the organizations to achieve continuous improvement.

Organization Type vs. Checking Design Drawings Conformance

The following Figure 4.17 shows the organization type vs. checking design drawings conformance to standards.

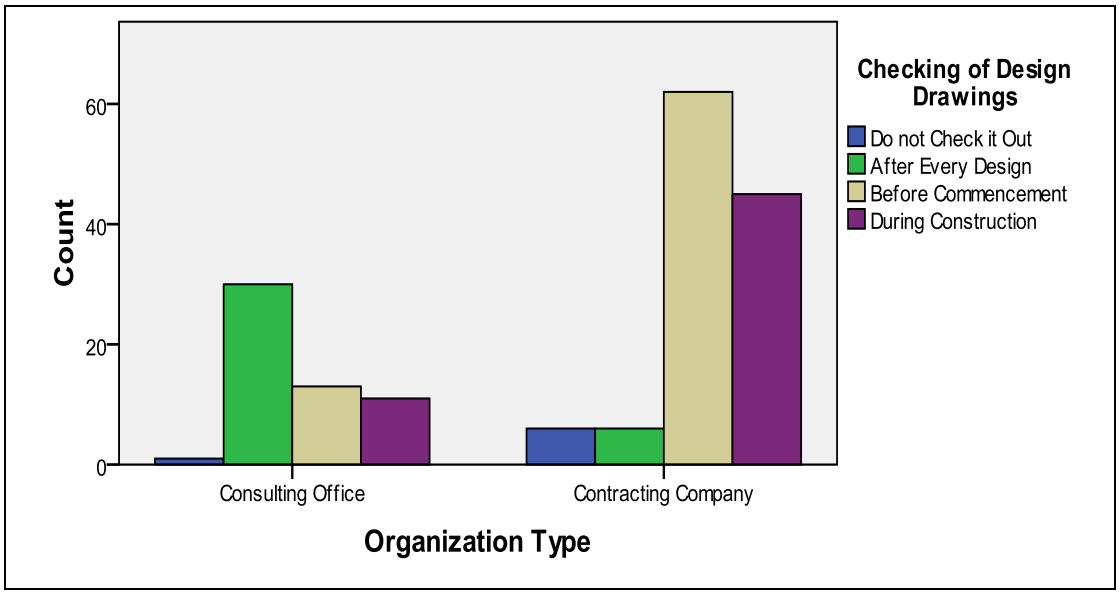

Figure 4.17: Type of Organization vs. Checking of Design Drawings.

The figure shows that the highest level of consulting office respondents make checking of design drawings conformance to standards after every design, while contracting company respondents said they do this checking before commencement of project.

Organization Type vs. Train the Employee for Quality

The following Figure 4.18 shows the organization type vs. train the employee for quality.

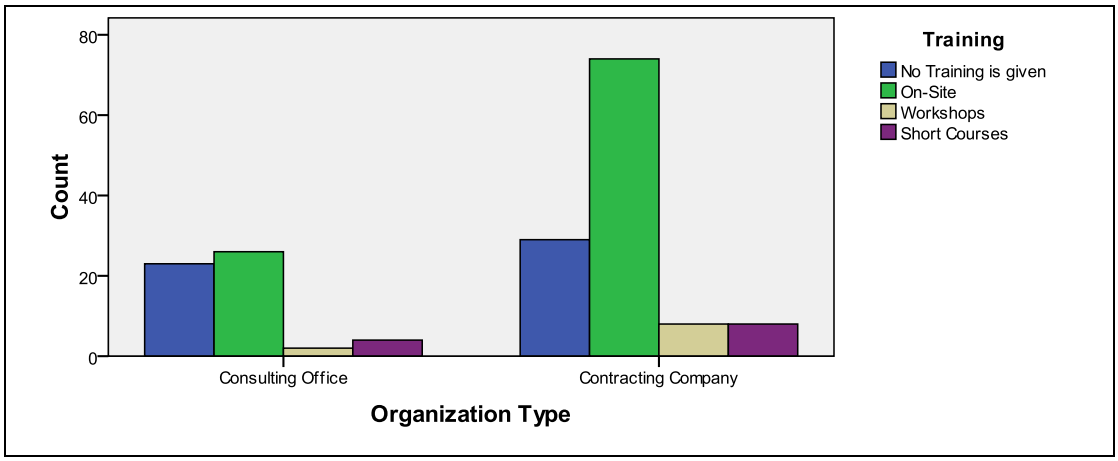

Figure 4.18: Type of Organization vs. Training for Quality.

It can be concluded that majority of both sample subjects (consultants and contractors) said that training of employees about quality conduct on site. Also Figure 4.18 shows that there is a big problem about workshops and short courses.

Organization Type vs. Process of Selection the Contractor

The following Figure 4.19 shows the organization type vs. awarded the tender basis.

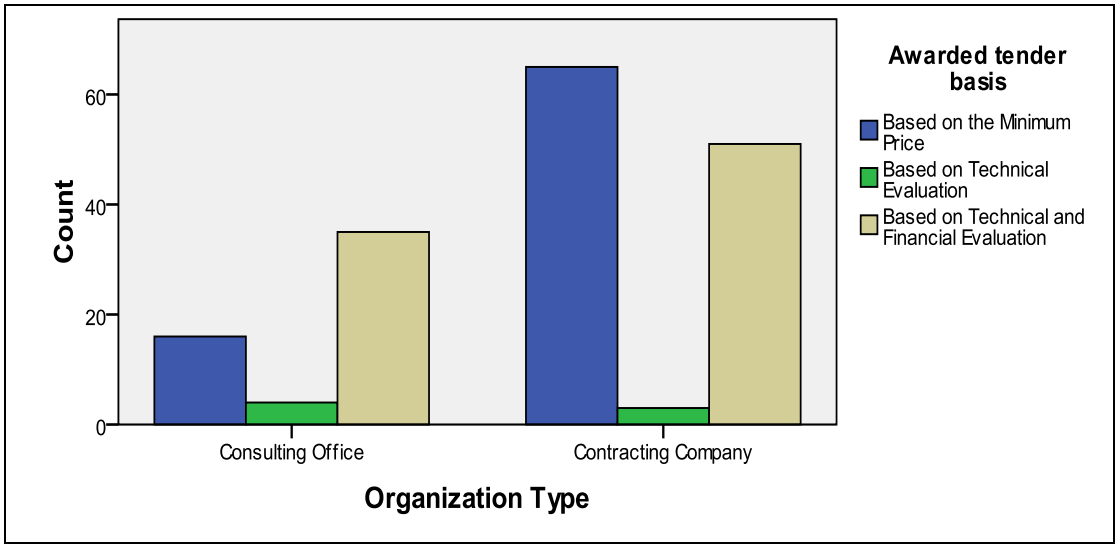

Figure 4.19: Type of Organization vs. Awarding Tender Basis.

According to the above figure, the majority of the consulting office respondent said they choose the contractor based on technical and financial evaluation. On the other hand, the most contracting companies in the sample said they are chosen according to the minimum prices. This means that the consultant is fully aware of the most suitable process to choose the contractor to execute the works. Also, this is an indicator that the situation in private sector is much better than it in public sector.

Organization Type vs. Obstacles which affecting QM implementation.

The following Table 4.28 and Figure 4.19 show the organization type vs. obstacles affecting QM implementation and its ranking from the respondents' point of view in detail.

Table 4.28: Ranking of obstacles affecting the implementation of quality management from the respondents' point of view.

Problems	Organization Type					
	Consulting Office			Contracting Company		
	Mean	Std. Deviation	Rank	Mean	Std. Deviation	Rank
1. The difficulty in changing behaviors and attitudes related to quality.	.62	.490	4	.29	.458	10
2. Lack of top-management commitment / understanding of quality issues.	.27	.449	14	.23	.421	14
3. Absence of a clear strategy for QM in the company.	.49	.505	7	.35	.480	8
4. Lack of employees' commitment, and resistance to quality programs.	.29	.458	13	.24	.426	13
5. Lack of communication between project's parties (contractor and consultant).	.47	.504	8	.36	.482	7
6. Firms' emphasis on short-term objectives	.56	.501	6	.45	.499	4
7. Lack of education and training to drive the improvement process.	.60	.494	5	.48	.502	3
8. Loss of part of the productivity of workers as a result of the effort in training.	.09	.290	17	.09	.291	16
9. Too much documents are required which lead to difficulty on documentation ability.	.20	.404	16	.31	.465	9

10. Lack of expertise in QM System.	.65	.480	3	.50	.502	2
11. A lack of codes and specifications.	.25	.440	15	.35	.480	8
12. Insufficient attention to achieve quality by workers in projects.	.45	.503	9	.27	.445	12
13. Instability of the volume of work and the instability of the national economy.	.33	.474	12	.43	.497	5
14. Absence of rewards and appreciation of the achievement of employees and workers.	.49	.505	7	.35	.480	8
15. Awarding the tender on the basis of lower prices and not efficiency.	.73	.449	1	.66	.474	1
16. Lack of feedback from previous projects and take advantage of them.	.38	.490	10	.29	.454	11
17. Absence of advance planning for project.	.36	.485	11	.29	.454	11
18. Not use computer software	.20	.404	16	.15	.360	15
19. Lake of owner's awareness about the importance of quality in projects.	.69	.466	2	.39	.491	6
20. Other issues	.05	.229	18	.02	.129	17

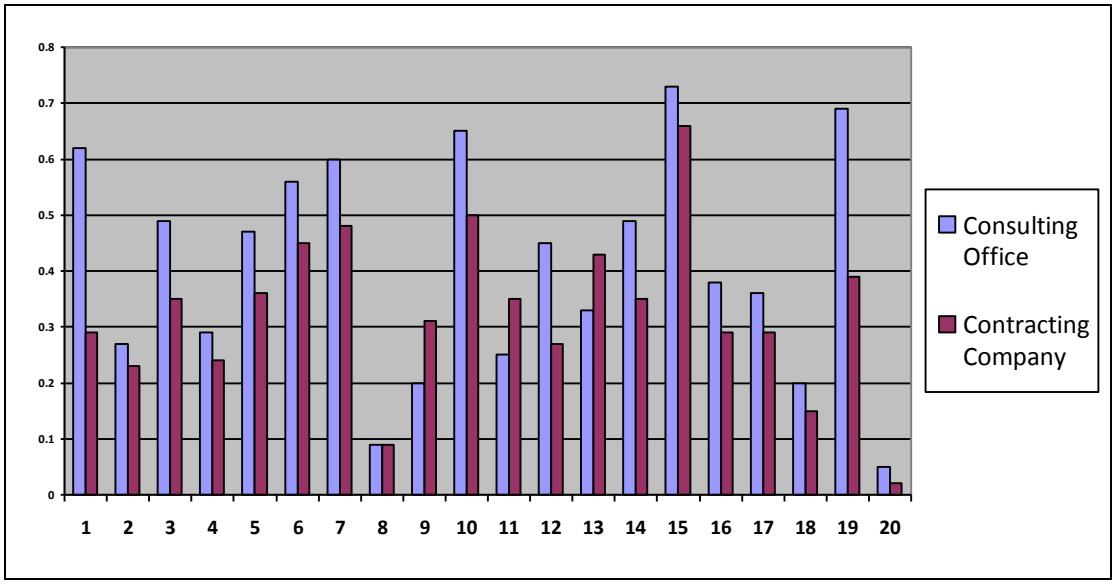

Figure 4.20: Type of Organization vs. Quality Problems and Obstacles.

It is clear that respondent from contracting companies and consulting offices view that: awarded the tender on the basis of lower prices is the big problem related to quality implementation in Palestine.

Type of Organization vs. Critical Success Factors

This section clarifies relation between the "organization type" and some CSFs that have significant differences in views according to the respondent organization type as shown in the following table.

Table 4.29: Organization Type vs. Critical Success Factors.

Factors	Organization Type							
	Consulting Office				Contracting Company			
	Mean	Std. Deviation	Level	Rank	Mean	Std. Deviation	Level	Rank
1.Top management commitment & leadership	4.03	0.56	high	7	3.92	0.69	high	9
2.Human Resources Management	4.20	0.52	high	4	4.06	0.62	high	5
3.External Customer Focus	3.50	0.73	mod	13	3.63	0.63	mod	13
4.Process Management &Execution	4.36	0.47	high	1	4.28	0.83	high	1
5.Supplier management	4.20	0.68	high	5	4.04	0.64	high	6
6.Information analysis &Evaluation	4.29	0.48	high	3	4.14	0.62	high	3
7.Contract Documents	4.30	0.53	high	2	4.27	0.59	high	2
8.Materials & Equipments	3.89	0.76	high	11	3.91	0.68	high	10
9.Financial Issues	3.97	0.73	high	10	4.03	0.73	high	7
10.Site Layout	3.97	0.69	high	9	3.88	0.68	high	11
11.Systems Used	4.08	4.08	high	6	4.07	1.22	high	4
12.Surrounding Environment	3.76	0.84	high	12	3.75	0.76	high	12
13. Continuous Improvement.	4.03	0.60	high	8	4.01	0.55	high	8

From Table 4.29 it is clear that the consultant and contractor are highly affected by the factors related to the process management & execution, contract documents, information analysis and evaluation, it is clear that ranking of CSFs is the same at the two company types, that is because the respondents in two companies are working under the same conditions, they are facing the same issues, and they are passing almost the same experience.

4.9 Analysis of the highest disparity, the highest and lowest importance factors.

4.9.1 Factors that have the highest disparity in responses

Factors that have the highest and lowest standard deviations have the highest disparity in responses views. A distribution for the sample with respect to the factors that have the highest disparity was prepared in order to analyze these factors and to know the disparities reasons in considering the importance ratings of these factors. The following table shows the factors that have the highest disparity, their arithmetic means and standard deviations.

Table 4.30: Factors that have the highest disparity.

No.	Factor	Mean	Std. deviation
1	4. Implement a safety program.	4.41	3.954
2	4. Clarity of work or process instruction giving to employees, artisans and site staff.	4.58	3.089
3	2. Owner organization nature (Public or Private).	3.11	1.219
4	2. Palestinian Standards Institution role.	3.59	1.168
5	1. Owner's requirements are used as the basis for quality	3.26	1.116

In this section, the relation between "organization type" and "factors that have the highest disparity" will be studied to examine the differences in views of respondent's organization type that causes the highest disparity in responses.

A. Organization type vs. implement a safety program

The following figure shows the different views of organization types about the importance of the sub factor "Implement a safety program".

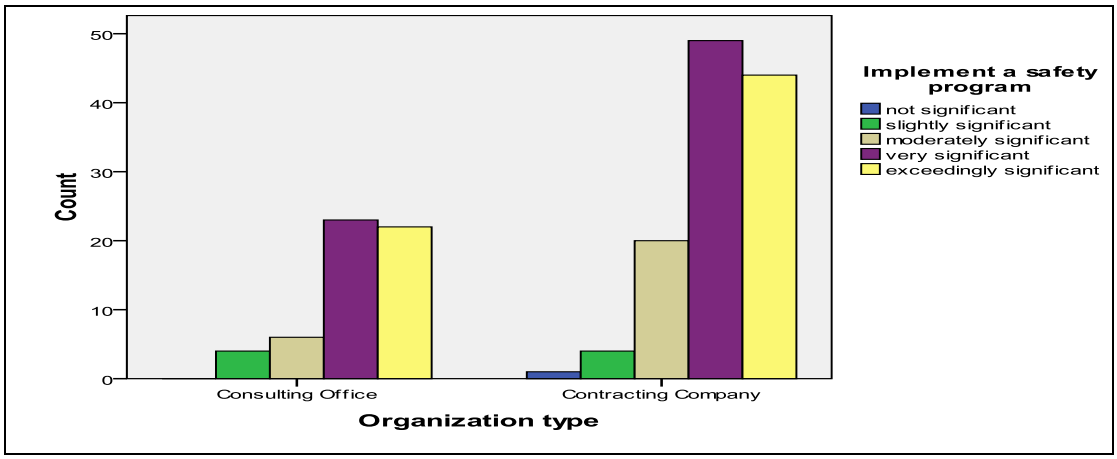

Figure 4.21: Organization Type vs. Implement a safety Program.

B. Organization type vs. clarity of work instruction giving to employees, artisans and site staff.

Figure (4.22) represents the different views of organization types about the importance of "Clarity of work or process instruction giving to employees, subcontractors and site staff" problem.

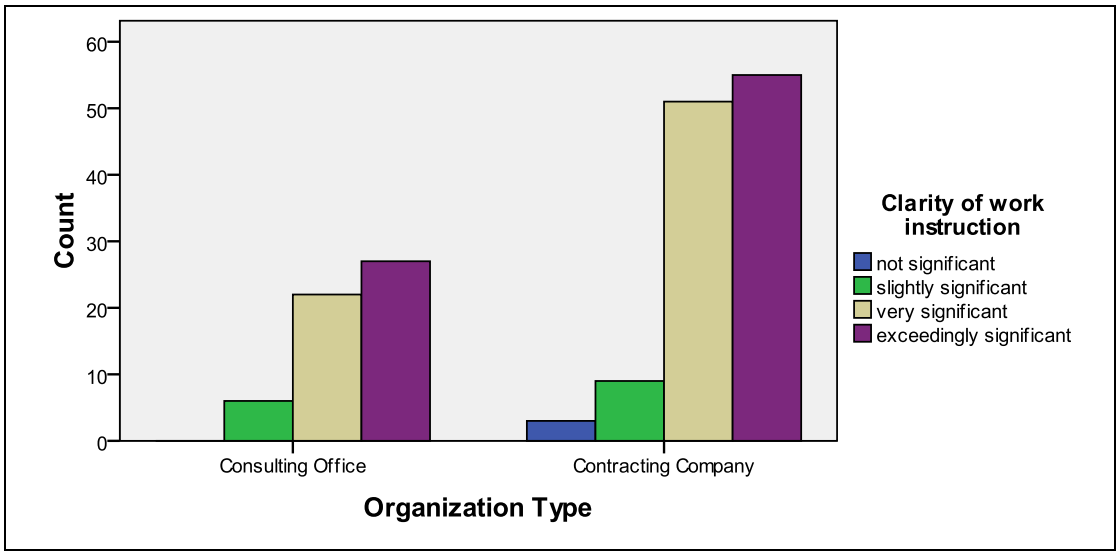

Figure 4.22: Organization Type vs. Clarity of Work Instruction.

C. Organization type Vs. Owner organization nature.

The different views of organization types about the importance of the factor "Owner organization nature" are presented in Figure (4.23).

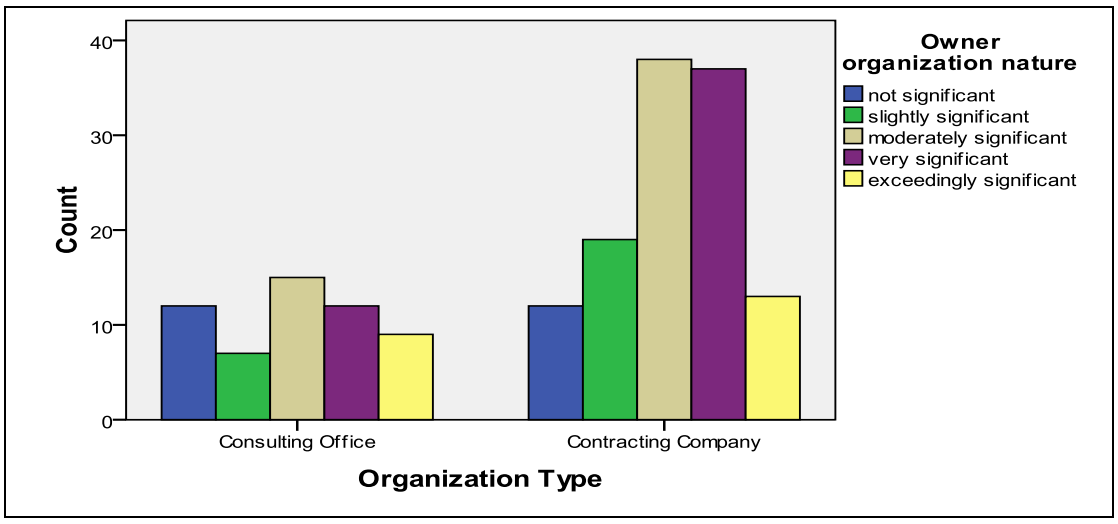

Figure 4.23: Organization Type vs. Owner Organization Nature.

D. Organization type vs. Palestinian Standards Institution Role.

The different views of organization types about the importance of the factor "Palestinian Standards Institution role." are shown in the following figure.

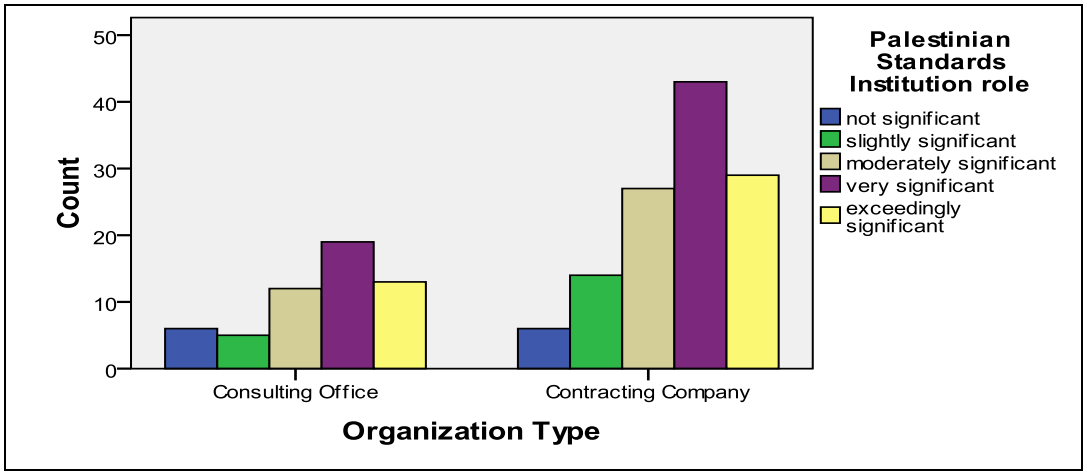

Figure 4.24: Organization Type vs. Palestinian Standards Institution Role.

E. Organization Type vs. Owner's requirements are basis for quality.

Figure 4.25 shows the different views of organization types about the importance of the factor "Owner's requirements are used as the basis for quality".

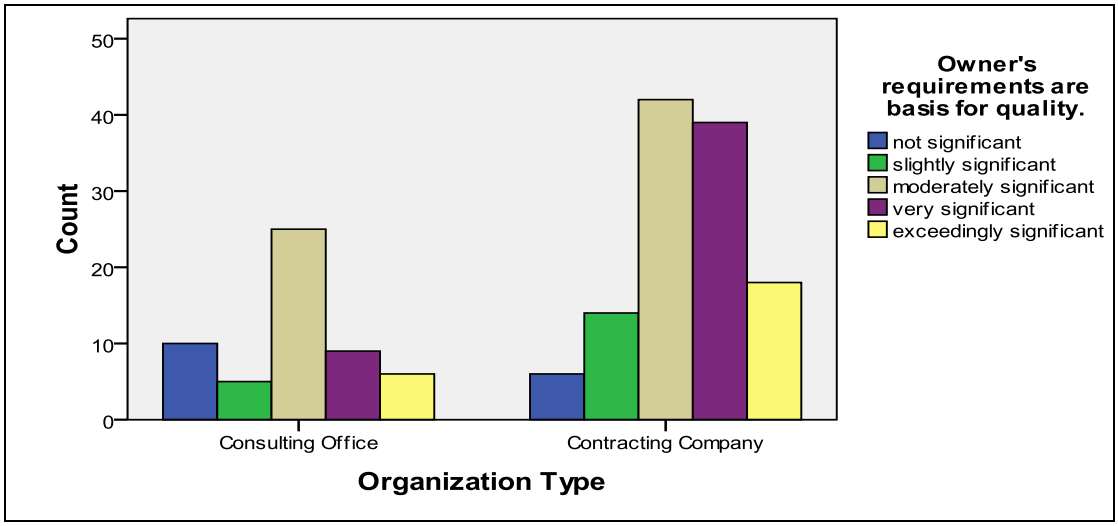

Figure 4.25: Organization type vs. Owner's requirements are basis for quality.

It can be obviously seen from Figures (4.21), (4.22), (4.23), (4.24) and (4.25), the wide variation among the different respondents organization types in rating the importance of the different previous factors. This wide

diversity in responses indicates contract parties' lack of awareness of some main construction terminologies. So the importance of a raising awareness for the important terminologies must be done by training courses and publications.

4.10 inferential statistics, (hypotheses testing)

This section outlines the statistical difference between participants in this study. Independent Samples Test (T-Test for Equality of Means) and one-way ANOVA Test are used to explain these differences; these two tests are used because correlations between qualitative and quantitative factors will be tested, as well as the need to highlight whether the means of several variables are equal or not.

T-test method compares means of qualitative independent variable which has two levels, where as one-way ANOVA compares means of qualitative independent variable which has more than two levels. In this case, the dependent variables are quantitative. Summary of these tests are shown below:

4.10.1 (T-Test)

T-test was conducted to find if there is a significant difference between the ranking of contracting and consulting companies towards the importance of quality factors. T-test was carried out on the average weighted factors resulted from ranking the sub-factors affecting quality in section 4 of the questionnaire.

1. T-Test According to Main Factors and Type of Organization

Study question No. 1: Do contracting and consulting companies perceive quality main factors differently?

H1: There is a significant difference in perception between contracting and consulting companies with regard to main factors affecting quality.

H_0**1:** There is no difference in perception of quality main factors between contracting and consulting companies.

Table 4.31 shows that there is a high correlation in ranking of the two samples. Hence, the null hypothesis ($H_0$1) can be accepted concluding that the contracting and consulting companies do not perceive main factors affecting quality differently, both of them have the same attitude towards ranking the quality main factors. So there isn't a significant difference in ranking these factors (P-value more than 0.05).

This may be attributed to the fact that they are working under the same conditions and they are passing almost the same experience through implementing the several stages of the construction projects.

Table 4.31: T-Test Results Comparing the Ranking of Quality Main Factors from the Respondents' Point of View.

Main Factors	Consulting Office		Contracting Company		F-value	t-value	P-value
	Mean	Std. Dev.	Mean	Std. Dev.			
1. Top management commitment & leadership	4.03	.56	3.92	.69	1.43	.968	.334*
2.Human Resources Management	4.20	.52	4.06	.62	.778	1.421	.157*
3.External Customer Focus	3.50	.73	3.63	.63	.458	1.152	.251*
4.Process Management & Execution	4.36	.47	4.28	.83	.905	.624	.533*
5.Supply management	4.20	.68	4.04	.64	.115	1.452	.148*
6.Information analysis & Evaluation	4.29	.48	4.14	.62	1.737	1.540	.125*
7.Contract Documents	4.30	.53	4.27	.59	.656	.369	.713*
8.Materials & Equipments	3.89	.76	3.91	.68	.149	.157-	.875*
9.Financial Issues	3.97	.73	4.03	.73	.095	.469-	.640*
10. Site Layout	3.97	.69	3.88	.68	.172	.826	.410*
11.Systems Used	4.08	.60	4.07	1.22	1.596	.043	.966*
12.Surrounding Environment	3.76	.84	3.75	.76	.157	.055	.956*
13.Continuous Improvement	4.03	.60	4.01	.55	1.217	.159	.874*

*** Significant at 0.05 level**

2. T-Test According to Sub Factors and Type of Organization

Study question No. 2: Do contracting and consulting companies perceive quality sub factors differently?

H2: There is a significant difference in perception between contracting and consulting companies with regard to sub factors affecting quality.

H_0**2:** There is no difference in perception of quality sub factors between contracting and consulting companies.

There is a high correlation in ranking of the two samples. Hence, the null hypothesis ($H_o 2$) can be accepted concluding that the contracting and consulting companies do not perceive main factors affecting quality differently, with an exception of this hypothesis in regard to the sub factors present on Table 4.32 that shows a significant difference in ranking these sub factors (P-value less than 0.05).

Table 4.32: T-test exception results comparing the ranking of quality sub factors from the respondents' point of view.

Sub Factors	F-value	t-value	P-value
Owner's requirements are used as the basis for quality.	.001	2.577	.012*
Using of a comprehensive and continuous supervision system.	.926	2.441	.016*
Reliance on suppliers who are selected based on their capability & commitment to product quality.	.004	2.137	.035*
Review of drawings & specification before tendering process.	4.509	2.416	.017*

*** P-value less than 0.05, there is a significant difference between contracting and consulting companies in ranking these sub factor.**

It is seen that there is a significant difference in ranking the above sub factors between contracting and consulting companies. This can be interpreted by the fact that the owner and consulting company have a direct relationship during implementation of the construction projects also the supervision system and revision of drawings and specification are related to the consulting, while the relation between the owner and contracting

company is usually passing through the consultant and suppliers relation. This makes the consulting company perceives the role of these sub factors towards improving quality different from the contracting company.

3. T-Test According to Problems of Quality and Type of Organization

Study question No. 3: Do contracting and consulting companies perceive quality problems differently?

H3: There is a significant difference in perception between contracting and consulting companies with regard to problems affecting quality.

H_o**3:** There is no difference in perception of quality problems between contracting and consulting companies.

Table 4.33 shows that there is a high correlation in the ranking of the two samples. Hence, the null hypothesis (H_o3) can be accepted concluding that the contracting and consulting companies do not perceive problems affecting quality differently problems except two problems which are: "The difficulty in changing behaviors and attitudes related to quality" and "Lake of owner's awareness about the importance of quality in projects".

This may be attributed to the fact that they work under the same conditions and they are passing almost the same experience.

Table 4.33: T-test results comparing the ranking of quality problems from the Respondents' Point of View.

Problems	F-value	t-value	P-value
1. The difficulty in changing behaviors and attitudes related to quality	4.254	4.246	.00**
2. Lack of top management commitment of quality	1.605	.654	.514*
3. Absence of a clear strategy for quality management in the company.	5.099	1.735	.085*
4. Lack of employees' and workers' commitment / understanding, and resistance to quality programs.	2.250	.782	.436*
5. Lack of communication between project's parties	4.106	1.396	.164*
6. Firms' emphasis on short-term objectives			
7. Lack of education and training to drive the improvement process.	4.074	1.486	.139*
8. Loss of part of the productivity of workers as a result of the effort in training.	.004	-.032-	.974*
9. Too much documents are required which lead to difficulty on documentation ability.	11.178	1.524	.129*
10. Lack of expertise in Quality Management System.	12.385	1.966	.051*
11. A lack of codes and specifications.	7.933	1.290	.199*
12. Insufficient attention to achieve quality by workers.	13.347	2.454	.015*
13. Instability of the volume of work and the instability of the national economy.	7.761	1.269-	.206*
14. Absence of rewards and appreciation of the achievement of employees and workers.	5.099	1.735	.085*
15. Awarded the tender on the basis of lower prices.	3.117	.833	.406*
16. Lack of feedback from previous projects.	5.095	1.266	.207*
17. Absence of advance planning for project.	3.573	1.030	.304*
18. Not use software to manage projects effectively.	2.441	.799	.425*
19. Lake of owner's awareness about the importance of quality in projects.	5.632	3.755	.00**
20. Other issues	7.776	1.385	.168*

*** Significant at 0.05 level**

**** P-value less than 0.05, there is a significant difference between contracting and consulting companies in ranking these problems.**

4.10.2 One-Way ANOVA Test according to Respondent Position

One-Way ANOVA test was done to find if there is a significant difference due to the position of the respondent who filled the questionnaire. One-Way ANOVA test is used when there is more than one group belonging to one variable, as in this case the groups of company manager, project manager, site engineer and supervision engineer are related to one variable which is position. The average weighted factors resulted from ranking the sub-factors affecting quality are used in this test.

Study question No. 4: Does the position of the respondent affect the ranking of the quality main factors?

H4: There is a significant difference in perception between the company manager, project manager, site engineer and supervision engineer towards ranking quality main factors.

H_o **4:** There is no difference between the company manager, project manager, site engineer and supervision engineer towards ranking quality main factors.

As shown in Table 4.34, P-value is greater than 0.05 in all factors except the first main factor "Top management commitment & leadership". This result means that there is no significant difference between the means of ranking of four groups but one exception related to "Top management commitment & leadership" main factor. The null hypothesis (H_o4) can be accepted for the problems which have p–value more than 0.05. It is obvious that the position of the respondent who filled the questionnaire did not affect their attitude towards ranking the quality factors except "Top management commitment & leadership" main factor.

Table 4.34: One- Way ANOVA Results

Main Factors	Description	Sum of Squares	df	Mean Squares	F	P-value
1. Top management commitment& leadership	Between Groups Within Groups Total	3.437 70.046 73.482	3 170 173	1.146 .412	2.780	.043**
2.Human Resources Management	Between Groups Within Groups Total	1.757 58.171 59.928	3 170 173	.586 .342	1.712	.166*
3.External Customer Focus	Between Groups Within Groups Total	1.856 74.237 76.093	3 170 173	.619 .437	1.417	.240*
4.Process Management & Execution	Between Groups Within Groups Total	.742 91.967 92.708	3 170 173	.247 .541	.457	.713*
5.Supply management	Between Groups Within Groups Total	2.925 71.041 73.965	3 170 173	.975 .418	2.333	.076*
6.Information analysis & Evaluation	Between Groups Within Groups Total	2.218 56.834 59.052	3 170 173	.739 .334	2.212	.089*
7.Contract Documents	Between Groups Within Groups Total	1.955 53.545 55.499	3 170 173	.652 .315	2.068	.106*
8.Materials & Equipments	Between Groups Within Groups Total	.570 84.522 85.092	3 170 173	.190 .497	.382	.766*
9.Financial Issues	Between Groups Within Groups Total	1.387 90.998 92.385	3 170 173	.462 .535	.864	.461*
10. Site Layout	Between Groups Within Groups Total	1.540 79.377 80.917	3 170 173	.513 .467	1.100	.351*
11.Systems Used	Between Groups Within Groups Total	7.038 186.958 193.996	3 170 173	2.346 1.100	2.133	.098*
12.Surrounding Environment	Between Groups Within Groups Total	.464 106.186 106.650	3 170 173	.155 .625	.248	.863*
13.Continuous Improvement	Between Groups Within Groups Total	.737 54.544 55.282	3 170 173	.246 .321	.766	.515*

*** Significant at 0.05 level**

**** P-value =0.043 less than 0.05, there is a significant difference between contracting and consulting companies in the top management commitment & leadership factor.**

Chapter 5

Proposed solutions and model development

5.1 Introduction

From the previous chapter, it was found that many significant and important problems and factors require effective actions to be avoided, solved and applied, so as to enhance the performance of this effective construction sector. Thus, searching for some important highlights to be adopted in this sector is useful in solving or avoiding most important problems and trying to improve this sector performance.

Thus, in this chapter proposed problems solutions, obstacles avoiding procedures and model development will be presented. Then, a solution listing and a model will be performed to represent and summarize.

5.2 Proposed solutions for the top ten rated problems and obstacles related to qm implementation.

The resulted top ten most important problems and obstacles that affecting the implementation of QM were discussed in the previous chapter. Set of proposed solutions were conducted, trying to solve such related problems and obstacles. The top ten most important problems associated with the related conducted solutions are discussed below:

5.2.1 Awarding the tender on the basis of lower prices.

For overcoming this problem, there must be a complete and accurate study for prices by the owner representative, determining properly the tender

price before tendering and awarding the tender to the nearest price of the real estimated one.

Moreover, tenders' commissions may conditioned prequalification of contractors, for assessing the suitability of contractors on a basis of factors such as: firm's experience, equipments' availability, financial and managerial ability, reputation and work history. So as develop a list of qualified bidders before inviting them to bid. Also, tenders' commissions are recommended to condition receiving of all tenders' offers during bidding in two envelopes; technical proposal envelope and bill of quantity envelope, so as to assure offers technically responding first, then those best technical's offers can be competed according to their offered prices. Adopting the application of this procedure will assure awarding the lowest price and technically the best. Where, the technical proposal contains projects' related technical aspects including: time schedule, safety plan, cash flow, method of statement, similar projects, concerned institutions and the bidder company history.

Furthermore, offers examination commissions should be instructed to comply with bid referring to the best evaluated offers that having the most appropriate prices. Taking into account the bidder ability to confirm the required quality degree, execute the project within the specified period, and perform the required work according to the conditions and specifications. Also, the commission has to make sure of price moderation of "the lowest price offer" which corresponding to the conditions and specifications. In addition, the commission must be guided by the latest prices used in former deals, market prices and the competition guiding estimated prices.

On the other hand, legislation should be enacted that obligate tenders opening committees rejecting any tender offer reduced by more than 25% from the estimations.

5.2.2 Lack of expertise/ resources in QMS.

Renowned experts from academia should be hired to train the managers on the concepts of TQM operations. The experts will help in drafting the critical parameters to quality features that are specific to the need of company, hence, defining a system that is fit for purpose and addresses the quality at all levels. It is extremely important that top managers should be put through a rigorous training program at different quality levels.

On the other hand, experts from academia should give special courses for students in the faculty of engineering before graduation, focusing on QMSs.

5.2.3 Lack of education and training for the improvement process.

It is important to conduct training courses by engineering association and contractors union for the contract parties "mainly consultants and contractors" to increase their qualifications and knowledge in the different QM related matters.

Also, raising awareness among the contract parties about QMS is required to ensure the quality of works. This can be gained by giving special workshops focusing on QMSs and how to use these systems. Also, issuing regular publications and distributing them to contractors, engineers and consulting offices.

5.2.4 Lack of owner's awareness about the importance of quality.

The exaggerated owner interference in the details of the project is at the expense of quality, the owner wants to reduce the costs of project while he drawn image of excellent output before starting the work. This leads to the restriction of the supervisor engineer and prevent him from performing his role properly.

In this regard, financial planning before starting the implementation of the project is required to prevent any change during the works, and it should be on the top of the owner's priorities due to the negative impact of the absence of it on many aspects including; the construction process and the quality. Here, it can be said that project's owner is the main responsible for quality problems and hence, they are recommended not to start any activity of project before ensuring its required budget and not to impose their opinions on projects without conscious study.

On the other hand, spreading the awareness of quality in every work is very essential, especially for all society members, starting from homes and schools, and making it as a culture in the society.

5.2.5 Firms’ emphasis on short-term objectives/gains.

The researcher suggests the need to recognize the impact of good quality on the overall value of the business, value in financial terms and also value in reputation, these values appears as long term objectives of the companies. Also, conducting discussions about quality in the companies is important issue to recognize the impact of high quality.

The managers suppose that the focus on quality is something that increases costs, while literatures proves that it reduce costs specially cost of reworks and cost of rejected works. In this regard, giving special training courses and workshops for these firms, focusing on COQ and how to reduce reworks if doing the right things right at the first time is essential.

However, the lessons learnt during the implementation of projects with regard to quality need to be fully documented and evaluated systematically.

5.2.6 The difficulty in changing behaviors and attitudes related to quality

It appears that employees are afraid to change their behaviors and attitudes which they are habitual due to fears of losing their job. Therefore, it is essential to understand that top management's role is to reduce such fear and provide a safer environment for their employees. This could be done by providing encouragement to allow employees or workers to work with the new rules and quality system.

Furthermore, the unwillingness of employees to seek improvement is due to a misunderstanding of the benefit of improvement and the fear of change. Therefore, it is recommended that employees be informed of any changes the company intends to make with a clear description of the aim of the improvement and the benefit employees will gain from this improvement or changes before being ordered to implement them. Also, sanctions must be done for disobeying the quality rules.

Then, understanding and diffusing an awareness of the concept of TQM is essential and is to be considered as a critical first stage if the organization is

successfully adopt the TQM philosophy. Therefore, it is recommended that the concept of TQM be propagated within the organization and among employees by providing suitable training that focuses on the importance of the concept of TQM.

5.2.7 Lack of communication between project's parties.

It is important to clarify the project's parties complementary relationship and its importance for success of the project and the whole construction sector**.** According to this matter, periodic meeting must be conducted between project's parties to understand each other. It is recommended that a common language be used in communication among parties. Although, it is difficult to communicate in English especially at the laborer's level, it is recommended to speak Arabic and common language that the labor can understand it. Furthermore, communication skills should be enhanced by recommending to communication skill courses.

5.2.8 Instability of the volume of work and the instability of the national economy.

In this regard, heads of Engineering Association and Palestinian Contract Union should intensify their efforts for solving this problem by calling the Prime Minister and the Ministry of Finance to work on including in the country general budget sufficient fund provisions to launch adequate capitalist projects in the construction sector.

Also, they have to intensify its efforts trying to limit the negative effects of the global financial crises and the bad economic situation due to occupation and debts, and searching for solutions to provide opportunities and new

working areas for the sector. The government is required to deal with this sector as a real and a fundamental partner in decision making, planning and enacting the sector governing legislations. In addition, the government is required to increase the capital investment in new projects that open job opportunities for contractors and at the same time enhance the national development.

5.2.9 Absence of rewards and appreciation of the achievement of employees and workers.

Such problem can be avoided by special rewards and appreciation that should be given to the employees and workers by top managers in the companies. Also, contractors must perform the required work according to the conditions and specifications, and if they do this carefully and in saving time it is recommended to give them rewards and appreciation.

5.2.10 Absence of a clear strategy for QM in the company.

The top management structure requires overhauling, since top management is very often not qualified to even understand the exact processes due in part to an inadequate qualification. Therefore, it is recommended that the top management be more educated and should continually update their knowledge by attending training courses that especially focus on the QM concepts. According to this matter, top management must be commitment on all issues related to quality and included a strategy for QM in their companies.

5.3 Framework to resolve previous problems

According to the above quality problems and solutions, the following Figure 5.1 shows framework to resolve the top ten highest rated important quality problems in construction sector problems in Palestine. EFQM elements are used as a data collection framework as in the study conducted by Al-Musleh (2010).

Education and training are important element which directed towards top management and organization people. Top management is driven through entire organization's strategy by spreading the awareness and changing the organization culture to understanding TQM philosophy. The communication criteria go well beyond the organizational environment by including the customer involvement as an integrated part of the system, and besides these resources and processes are directed towards continuous improvement, which is an integral and important element of TQM.

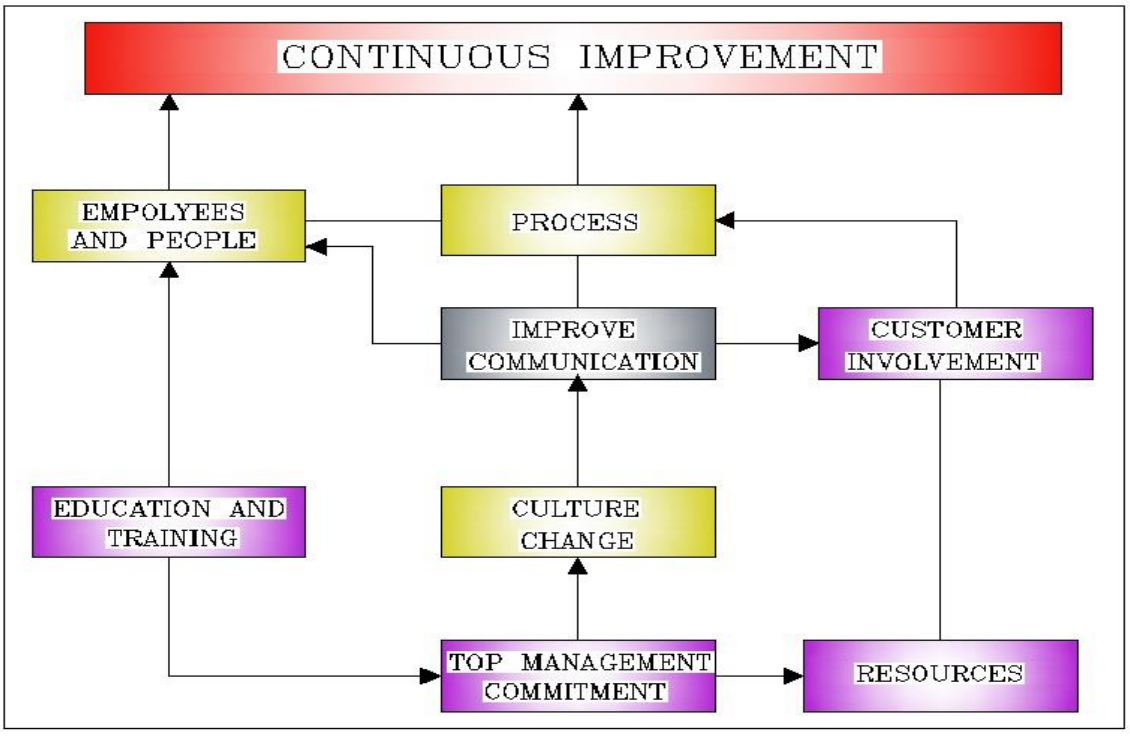

Figure 5.1: Framework to resolve some TQM problems according to EFQM

5.4 Model Development

There is a consensus among researchers and construction industry experts that one of the principal barriers to promote improvement in construction projects is the lack of quality management model. Through this study, a model representing local quality factors is developed and used as a tool to measure TQM and to assess a company's strengths and weaknesses with regard to its use of quality in construction projects in Palestine. Applying this model will lead to the continuous improvement.

Different approaches were conducted to develop such a model. (Abdel-Razek, et al., 2001) and (Al-Tayeb, 2008) studied the factors affecting quality of construction projects in Egypt and in Gaza strip respectively, and developed a model based on average weighted approach for the different factors affecting quality. Also, (Chan and Tam, 2000) studied the factors affecting quality of construction projects in Hong Kong. They developed a model through applying factor analysis and multiple regression technique.

In this study the Pareto approach was used to develop the model. Pareto - Italian economist- created a mathematical formula to describe the unequal distribution of wealth in his country, observing that twenty percent of the people own eighty percent of the wealth, which means 20% of factors, achieves 80% of the importance percentage.

This approach was developed and applied based on calculating the importance percentages of main factor and sub-factors. The model represents the CSFs of TQM implementation on construction projects in Palestine. To develop the model the following steps has been followed:

1. Calculation of the importance percentages of the main factors according to their impact on the TQM implementation, by summing the mathematical means of the main factors, which were obtained in Chapter 4, then equation 5.1, is used to calculate the importance percentage for each element as shown in Table 5.1.

$$I.P_{main} = \frac{X_{main}}{\sum_{1}^{13} X_{main}} \times 100\% \quad \ldots\ldots. (5.1)$$

Where:

$I.P_{main}$ = Importance percentage for main factors**,**

X_{main} =mathematical mean for main factors obtained from chapter four.

Table 5.1: The Importance Percentages of the Main Factors

No	Main Factors	X_{main} From Ch.4	$I.P_{main} = \frac{X_{main}}{\sum_{1}^{13} X_{main}} \times 100\%$
1	Top management commitment & leadership	3.96	$I.P_{main}(1)$= 7.59%
2	Human Resources Management	4.11	$I.P_{main}(2)$= 7.88%
3	External Customer Focus	3.58	$I.P_{main}(3)$= 6.86%
4	Process Management & Execution	4.31	$I.P_{main}(4)$= 8.26%
5	Supply management	4.09	$I.P_{main}(5)$= 7.84%
6	Information analysis and Evaluation	4.19	$I.P_{main}(6)$= 8.03%
7	Contract Documents	4.28	$I.P_{main}(7)$= 8.20%
8	Materials & Equipments	3.91	$I.P_{main}(8)$= 7.49%
9	Financial Issues	4.01	$I.P_{main}(9)$= 7.68%
10	Site Layout	3.90	$I.P_{main}(10)$= 7.47%
11	Systems	4.07	$I.P_{main}(11)$= 7.80%
12	Surrounding Environment	3.75	$I.P_{main}(12)$= 7.19%
13	Continuous Improvement	4.02	$I.P_{main}(13)$= 7.70%
TQM		$\sum_{1}^{13} X_{main}$ = 52.18	

2. Calculation of the importance percentage for s sub factors under main factors in reference to their impact on TQM implementation using equation 5.2.

$$\text{I.P}_{\text{main-sub}} = I.P_{main} \times \frac{X_{main-sub}}{\frac{no.(sub)}{\sum_{1} X_{main-sub}}} \times 100\% \quad \text{..... (5.2)}$$

Where: I.P $_{\text{main-sub}}$ = Importance percentage for sub factors under main factors,

X $_{\text{main-sub}}$ =mathematical mean for sub factors under main factors

For example to calculate the importance of sub factors under top management commitment & leadership main factor the following procedures can be follow: Summation of mathematical mean of sub factors in the main factor 'top management commitment & leadership'. Then the percentage for each factor in reference to top management commitment & leadership sub-factor is calculated as shown in the fourth column of Table 5.2. Then it is multiplied by the fifth column obtained from the fourth column of Table 5.1 as in order to calculate the percentage of each factor in reference to its impact on TQM implementation. The percentage of sub factors under top management commitment & leadership factor

$$\text{I.P}_{\text{1-sub}} = I.P_1 \times \frac{X_{1_{-sub}}}{\sum_{1}^{6} X_{1-sub}} \quad \text{.... (5.3)}$$

Table 5.2: Importance Percentages of sub factors of "Top Management Commitment & Leadership"

NO	Sub Factors for Top management commitment & leadership	$X_{1\text{-sub}}$ From Ch.4	$\frac{X_{1\_sub}}{\sum_{1}^{6} X_{1-sub}}$	$I.P_{main}(1)$ From Table 5.1	$I.P_{1\text{-sub}}$ Equation (5.3)
1	1. Management establishing clear definition of quality in the mission	3.65	15.37%	7.59%	1.1666
2	2. Attachment of importance to quality by top management in relation to cost and schedule	3.86	16.26%	7.59%	1.2341
3	3. Reviewing quality issues in the top management meetings.	3.70	15.59	7.59%	1.1832
4	4. Regularity and speed of the owner in decision making.	4.01	16.89	7.59%	1.2820
5	5. Procedures of selecting contractors and awarding the tender to the most accurate bidder	4.44	18.70	7.59%	1.4193
6	6.Development & implementation of plans on basis of company capabilities	4.08	17.19	7.59%	1.3047
		=23.7			

Table 5.3: Importance Percentages of sub factors of "Human Resource Management"

No	Sub Factors for Human Resource Management	$X_{2\text{-sub}}$	$\frac{X_{2_{-sub}}}{\sum_{1}^{8} X_{2-sub}}$	$I.P_{main(2)}$	$I.P_{2\text{-sub}}$
1	1. Income level and wages of employees and labors.	3.65	11.21%	7.88%	0.8833
2	2. Using Motivation System for employees and labors.	4.02	12.35%	7.88%	0.9732
3	3. Training courses for employees in quality improvement skills	4.00	12.29%	7.88%	0.9685
4	4. Skill and experience of supervision staff, and their authority in project site	4.24	13.03%	7.88%	1.0268
5	5. Skill and experience of contractor's staff, and labors with high experience.	4.31	13.24%	7.88%	1.0433
6	6. Skill and experience of designers.	4.20	12.90%	7.88%	1.0165
7	7. Cooperation & coordination b/w supervision & Contractor’s staff	4.30	13.21%	7.88%	1.0409
8	8.Absence of past disagreements between contract parties	3.83	11.77%	7.88%	0.9275
		32.55			

Table 5.4: Importance Percentages of sub factors of "The Owner"

No	Sub Factors for External Customer Focus (The Owner)	$X_{3\text{-sub}}$	$\frac{X_{3_{-sub}}}{\sum_{1}^{6} X_{3-sub}}$	$I.P_{main}(3)$	$I.P_{3\text{-sub}}$
1	1. Owner's requirements are used as the basis for quality.	3.26	15.14%	6.86%	1.0386
2	2. Owner organization nature	3.11	14.44%	6.86%	0.9906
3	3. Responding effectively to owner's enquiries & complaints.	3.54	16.44%	6.86%	1.1278
4	4. Preventive & corrective actions undertaken to delight customers	3.44	15.98%	6.86%	1.0962
5	5. Using the facilities and buildings properly by the owner.	3.96	18.39%	6.86%	1.2616
6	6. Price and budget specified by the owner.	4.22	19.60%	6.86%	1.3446
		21.53			

Table 5.5: Importance Percentages of sub factors of "Process Management and Execution"

No	Sub Factors for Process Management and Execution	$X_{4\text{-sub}}$	$\frac{X_{4_{-sub}}}{\sum_{1}^{6} X_{4-sub}}$	$I.P_{main}(4)$	$I.P_{4\text{-sub}}$
1	1. Testing, reviewing and inspection of incoming products or work for specification compliance.	4.37	16.92%	8.26%	1.3976
2	2. Preparing and using shop drawings.	4.28	16.57%	8.26%	1.3687
3	3. Using of a comprehensive and continuous supervision system.	4.28	16.57%	8.26%	1.3687
4	4. Clarity of work or process instruction giving to employees and site staff.	4.58	17.73%	8.26%	1.4645
5	5. Process flow chart and inspection for activities that directly affect quality.	4.06	15.72%	8.26%	1.2985
6	6. Clear procedure for accepting performed activities.	4.26	16.49%	8.26%	1.3621
		25.83			

Table 5.6: Importance Percentages of sub factors of "Supplier Management"

No	Sub Factors for Supplier Management	$X_{5\text{-sub}}$	$\frac{X_{5_{-sub}}}{\sum_{1}^{5} X_{5-sub}}$	$I.P_{main(5)}$	$I.P_{5\text{-sub}}$
1	1. Reliance on suppliers who are evaluated and selected based on their capability and commitment to product and service quality.	4.10	20.05%	7.84%	1.5719
2	2. Providing clear specifications to suppliers.	4.24	20.73%	7.84%	1.6252
3	3. Providing technical assistance of suppliers	3.89	19.02%	7.84%	1.4912
4	4. Suppliers having programs to ensure quality of their products	3.93	19.22%	7.84%	1.5068
5	5. Supply materials for the project in a timely manner.	4.29	20.98%	7.84%	1.6448
		20.45			

Table 5.7: Importance Percentages of sub factors of "Information Analysis and Evaluation"

No	Sub Factors for Information Analysis and Evaluation	$X_{6\text{-}sub}$	$\frac{X_{6_{-sub}}}{\sum_{1}^{5} X_{6-sub}}$	$I.P_{main(6)}$	$I.P_{6\text{-}sub}$
1	1.Review of drawings and specification before tendering	4.39	20.96%	8.03%	1.6831
2	2.Document procedures for review disposition of nonconforming	4.08	19.48%	8.03%	1.5642
3	3. Documentation of corrective and preventive actions.	4.05	19.34%	8.03%	1.5530
4	4. Documentation of project related documents.	4.20	20.06%	8.03%	1.6108
5	5. Continuity Audit to ensure high-quality work	4.22	20.15%	8.03%	1.6180
		20.94			

Table 5.8: Importance Percentages of sub factors of "Contract Documents"

No	Sub Factors for Contract Documents	$X_{7\text{-sub}}$	$\frac{X_{7_{-sub}}}{\sum_{1}^{6} X_{7-sub}}$	$I.P_{main(7)}$	$I.P_{7\text{-sub}}$
1	1. Absence of a conflict between the tender documents.	4.38	17.06%	8.20%	1.3989
2	2. Conditions of written contract are clear and fair, also responsibilities distribution is clear.	4.30	16.74%	8.20%	1.3727
3	3. Bill of quantity is very detailed and accurate.	4.32	16.82%	8.20%	1.3792
4	4. Completeness and consistency of design drawings.	4.40	17.13%	8.20%	1.4047
5	5. Using modern techniques in designing and conformance to codes.	4.17	16.24%	8.20%	1.3317
6	6. A competent authority or party to audit drawings of design.	4.11	16.00%	8.20%	1.3120
		25.68			

Table 5.9: Importance Percentages of sub factors of "Materials &Equipments"

No.	Sub Factors for Materials and Equipments	X_{8-sub}	$\frac{X_{8_{-sub}}}{\sum_{1}^{5} X_{8-sub}}$	$I.P_{main(8)}$	$I.P_{8-sub}$
1	1. Using storage and handling system for materials in project site.	3.68	18.84%	7.49%	1.4111
2	2. Palestinian Standards Institution role.	3.59	18.38%	7.49%	1.3767
3	3. Laboratories competence for samples testing and approval.	4.20	21.51%	7.49%	1.6111
4	4. Optimal use of materials to reduce wastage.	3.99	20.43%	7.49%	1.5302
5	5. Good utilization of equipment and regular maintenance.	4.07	20.84%	7.49%	1.5609
		19.53			

Table 5.10: Importance Percentages of sub factors of "Financial Issues"

No	Sub Factors for Financial Issues	$X_{9\text{-}sub}$	$\frac{X_{9_{-sub}}}{\sum_{1}^{5} X_{9-sub}}$	$I.P_{main(9)}$	$I.P_{9\text{-}sub}$
1	1.Amount of contractor's cash flow	4.10	20.46%	7.68%	1.5713
2	2.Non delay of interim payments	4.21	21.01%	7.68%	1.6136
3	3.Achieving bank facilities to contractor	3.80	18.96%	7.68%	1.4561
4	4. Provision of the appropriate budget for project implementation before tendering.	4.24	21.16%	7.68%	1.6251
5	5. Advanced payment paid to contractor to facilitate his work.	3.69	18.41%	7.68%	1.4139
		20.04			

Table 5.11: Importance Percentages of sub factors of "Site Layout"

No	Sub Factors for Site Layout	X_{10-sub}	$\frac{X_{10_{-sub}}}{\sum_{1}^{5} X_{10-sub}}$	$I.P_{main(10)}$	$I.P_{10-sub}$
1	1. Site layout is large and suitable for labors & equipments movement	3.56	18.20%	7.47%	1.3595
2	2. Site layout is organized well by contractor.	3.96	20.25%	7.47%	1.5127
3	3. Site layout has storage areas for materials.	3.86	19.73%	7.47%	1.4738
4	4. Site is clean & getting rid of waste in an organized ways.	3.90	19.94%	7.47%	1.4895
5	5. Achieve the requirements of safety in the site layout	4.28	21.88%	7.47%	1.6344
		19.56			

Table 5.12: Importance Percentages of sub factors of "Systems Used"

No	Sub Factors for Systems Used	X_{11-sub}	$\frac{X_{11\_sub}}{\sum_{1}^{5} X_{11-sub}}$	$I.P_{main(11)}$	$I.P_{11-sub}$
1	1.Using computer software & application	3.98	19.55%	7.80%	1.5249
2	2.Implement & using time schedule	4.13	20.28%	7.80%	1.5818
3	3. Using cost control system.	3.96	19.45%	7.80%	1.5171
4	4. Implement a safety program.	4.41	21.66%	7.80%	1.6895
5	5. Using a complete applied resources management system.	3.88	19.06%	7.80%	1.4867
		20.36			

Table 5.13: Importance Percentages of sub factors of "surrounding environment"

No	Sub Factors for The Surrounding Environment	X_{12-sub}	$\frac{X_{12\_sub}}{\sum_{1}^{5} X_{12-sub}}$	$I.P_{main(12)}$	$I.P_{12-sub}$
1	1.The socio-economic environment	3.44	18.33%	7.19%	1.3179
2	2.Stability of Political environment	3.83	20.40%	7.19%	1.4668
3	3. Barriers and closure of the roads and its effects on cost of materials	3.97	21.15%	7.19%	1.5207
4	4.Israeli restrictions on imports	3.98	21.20%	7.19%	1.5243
5	5. Cooperation of nearby residents project in the work implementation	3.55	18.91%	7.19%	1.3524
		18.77			

Table 5.14: Importance Percentages of sub factors of "Continuous Improvement"

No	Sub Factors for Continuous Improvement	X_{13-sub}	$\frac{X_{13_{-sub}}}{\sum_{1}^{6} X_{13-sub}}$	$I.P_{main(13)}$	$I.P_{13-sub}$
1	1. Finding the root causes in the diagnosis of problems and defects.	4.07	17.05%	7.70%	1.3129
2	2. Identification of areas for quality improvement and implementing it.	4.09	17.13%	7.70%	1.3190
3	3. Teamwork	4.25	17.80%	7.70%	1.3706
4	4. Change the company's policy in relation to quality gradually.	3.79	15.88%	7.70%	1.2228
5	5. Identification of quality tools.	3.88	16.25%	7.70%	1.2513
6	6. Change the company's policy in relation to quality gradually.	3.79	15.88%	7.70%	1.2228
		23.87			

3. The sub-factors are organized in a descending order of priority and the sub factors' cumulative percentage is calculated to use the Pareto principle, which states that 20% of the factors achieve 80% of the importance percentage to find the critical success factors of TQM implementation. Table 5.15 shows the Cumulative percentages of sub-factors in descending arrangement.

Table 5.15: Cumulative Percentages of sub factors in Ascending Arrangement

No.	Sub Factors	I.P $_{\text{main-sub}}$	Sub factor percentage related to TQM	Cumulative sub factor percentage
1	4. Implement a safety program.	I.P 11-4	1.6895	1.6895
2	1.Review drawings & specification before tendering	I.P 6-1	1.6831	3.3726
3	5. Supply materials for projects in a timely manner	I.P 5-5	1.6448	5.0174
4	5. Achieve safety requirements in the site layout	I.P 10-5	1.6344	6.6518
5	2.Providing clear specifications to suppliers	I.P 5-2	1.6252	8.277
6	4.Provision of appropriate budget required for project implementation before tendering	I.P 9-4	1.6251	9.9021
7	5. Continuity audit to ensure high quality	I.P 6-5	1.618	11.5201
8	2. The non delay of interim payments.	I.P 9-2	1.6136	13.1337
9	3.Laboratories competence for samples testing & approval	I.P 8-3	1.6111	14.7448
10	4.Documentation of project related quality	I.P 6-4	1.6108	16.3556
11	2. Implementing & using time schedule	I.P 11-2	1.5818	17.9374
12	1.Reliance on suppliers who are selected based on their capability & commitment to product & service quality	I.P 5-1	1.5719	19.5093
13	1. The amount of contractor's cash flow.	I.P 9-1	1.5713	21.0806
14	2.Document procedures for reviewing disposition of nonconforming products	I.P 6-2	1.5642	22.6448
15	5.Good utilization of equipment & regular maintenance	I.P 8-5	1.5609	24.2057
16	3.Documentation of corrective & preventive actions	I.P 6-3	1.553	25.7587
17	4.Optimal use of materials to reduce wastage	I.P 8-4	1.5302	27.2889
18	1.Using computer software & application	I.P 11-1	1.5249	28.8138

19	4.Israeli restrictions on imports	I.P 12-4	1.5243	30.3381
20	3.Barriers & closure of the roads & its effects on cost of materials transfer.	I.P 12-3	1.5207	31.8588
21	3.Using cost control system.	I.P 11-3	1.5171	33.3759
22	2.Site layout is organized well	I.P 10-2	1.5127	34.8886
23	4.Suppliers having programs to ensure quality of their products / services.	I.P 5-4	1.5068	36.3954
24	3.Providing technical assistance of suppliers by the contractor companies	I.P 5-3	1.4912	37.8866
25	4.Site is clean and getting rid of projects waste in an organized ways	I.P 10-4	1.4895	39.3761
26	5.Using a complete applied resources management system	I.P 11-5	1.4867	40.8628
27	3.Site layout has storage areas for materials	I.P 10-3	1.4738	42.3366
28	2.Stability of political environment	I.P 12-2	1.4668	43.8034
29	4.Clarity of work or process instruction giving to employees and site staff.	I.P 4-4	1.4645	45.2679
30	3.Achieving bank facilities to the contractor	I.P 9-3	1.4561	46.724
31	5.Procedures of selecting contractors & awarding the tender to the most accurate bidder not to the lowest evaluated bidder	I.P 1-5	1.4193	48.1433
32	5.Advanced payment is paid to contractor to facilitate his work.	I.P 9-5	1.4139	49.5572
33	1.Using storage & handling system for materials in project site	I.P 8-1	1.4111	50.9683
34	4.Completeness & consistency of design drawings	I.P 7-4	1.4047	52.373
35	1.Absence of a conflict between the tender documents	I.P 7-1	1.3989	53.7719
36	1.Testing, reviewing & inspection of incoming products or work for specification compliance	I.P 4-1	1.3976	55.1695
37	3.Bill of quantity is very detailed & accurate	I.P 7-3	1.3792	56.5487
38	2. Palestinian Standards Institution role	I.P 8-2	1.3767	57.9254
39	2.Conditions of written contract are clear & fair also responsibilities distribution is	I.P 7-2	1.3727	59.2981

	clear			
40	3. Teamwork	I.P 13-3	1.3706	60.6687
41	2.Preparing & using shop drawings	I.P 4-2	1.3687	62.0374
42	3.Using of a comprehensive & continuous supervision system	I.P 4-3	1.3687	63.4061
43	6.Clear procedure for accepting performed activities	I.P 4-6	1.3621	64.7682
44	1.Site layout is large & suitable for movement of labors & equipments	I.P 10-1	1.3595	66.1277
45	5.Cooperation of nearby residents to projects in implementation of works	I.P 12-5	1.3524	67.4801
46	6.Price & budget specified by the owner	I.P 3-6	1.3446	68.8247
47	5.Using modern techniques in designing & conformance to codes	I.P 7-5	1.3317	70.1564
48	2.Identification of areas for quality improvement & implementing it	I.P 13-2	1.319	71.4754
49	1.The socio-economic environment	I.P 12-1	1.3179	72.7933
50	1.Finding the root causes in the diagnosis of problems & defects.	I.P 13-1	1.3129	74.1062
51	6.A competent authority or party to audit drawings of design	I.P 7-6	1.312	75.4182
52	6. Development & implementation of plans on the basis of company's capabilities & readiness	I.P 1-6	1.3047	76.7229
53	5.Process flow chart & inspection for activities that directly affect quality	I.P 4-5	1.2985	78.0214
54	4.Regularity & speed of the owner in decision making	I.P 1-4	1.282	79.3034
55	5.Using the facilities & buildings properly by the owner	I.P 3-5	1.2616	80.565
56	5. Identification of quality tools	I.P 13-5	1.2513	81.8163
57	2.Attachment of importance to quality by top management in relation to cost & schedule objectives	I.P 1-2	1.2341	83.0504
58	4.Change the company's policy in relation to quality gradually	I.P 13-4	1.2228	84.2732
59	6.Tracking COQ process	I.P 13-6	1.2228	85.496

60	3.Reviewing quality issues in the top management meetings	I.P 1-3	1.1832	86.6792
61	1.Management establishing clear definition of quality in the mission of the company	I.P 1-1	1.1666	87.8458
62	3.Responding effectively to owner's enquiries & complaints	I.P 3-3	1.1278	88.9736
63	4.Preventive & corrective actions undertaken to delight customers	I.P 3-4	1.0962	90.0698
64	5. Skill & experience of contractor's staff, and using labors with high experience	I.P 2-5	1.0433	91.1131
65	7.Cooperation & effective coordination between Supervision & Contractor's staff	I.P 2-7	1.0409	92.154
66	1.Owner's requirements are used as the basis for quality	I.P 3-1	1.0386	93.1926
67	4. Skill & experience of Supervision staff, and their authority in the project site	I.P 2-4	1.0268	94.2194
68	6. Skill and experience of designers	I.P 2-6	1.0165	95.2359
69	2.Owner organization nature	I.P 3-2	0.9906	96.2265
70	2.Using Motivation System for employees & labors	I.P 2-2	0.9732	97.1997
71	3.Training courses for employees in quality improvement skills & technical skills	I.P 2-3	0.9685	98.1682
72	8.Absence of past disagreements between contract parties	I.P 2-8	0.9275	99.0957
73	1.Income level & wages of employees & labors	I.P 2-1	0.8833	100

4. Figure 5.1 shows that 80% of the results were achieved by 55 sub factors, meaning that the 80/20 assumption is not applicable. However the critical success sub factors (CSsF) were assumed as the sub factors that meet 70% of the importance of the Pareto Chart which are 47 sub factors according to the Figure 5.2.

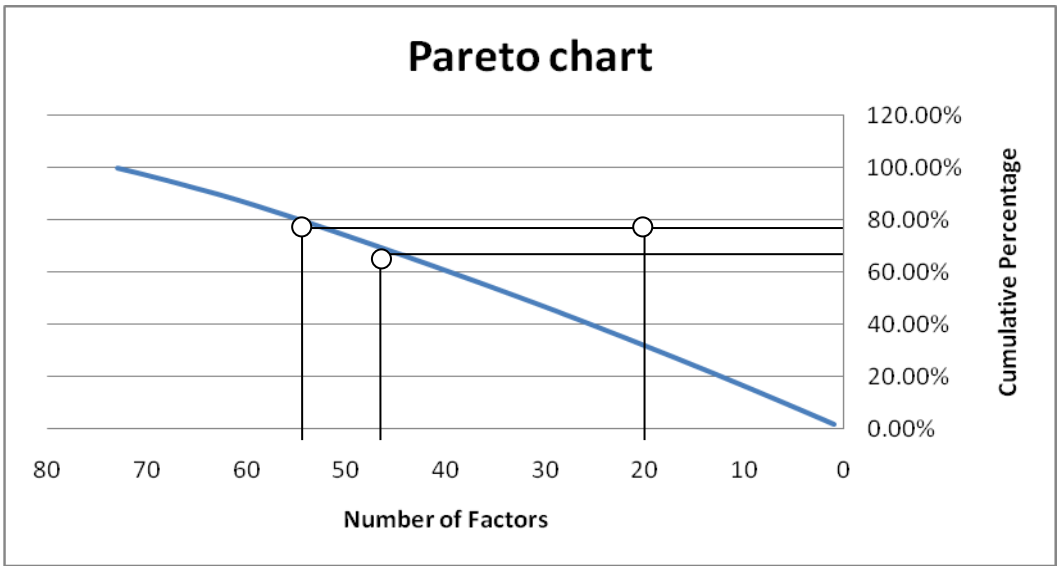

Figure 5.2: Pareto Chart for TQM Sub Factors Number

5. After finding CSsF that effect in the TQM implementation, they are rearranged based on their main group as shown in Table 5.16. The sum of these parameters represents about 70%, to change it to 100% representation the sub factors were multiplied by 100% and divided by the overall total of the percentages as shown in the fourth column of Table 5.16.

Table 5.16: Modify Critical Success Sub Factors (MCSsF) of TQM Implementation

Main Factor	Sub Factors	CSsFi1 %	$\frac{CSsFi1}{\sum CSsFi1} \times 100$ %
1 T .M.C & leadership 2.02 31%	5. Procedures of selecting contractors and awarding the tender to the most accurate bidder not to the lowest evaluated bidder.	I.P 1-5= 1.4193	2.0231
3 Owner 1.9166	6. Price and budget specified by the owner. (Owner's emphasis on price)	I.P 3-6= 1.3446	1.9166
4 Process Management & Execution 9.9229 %	4. Clarity of work or process instruction giving to employees, artisans and site staff.	I.P 4-4= 1.4645	2.0875
	1. Testing, reviewing and inspection of incoming products or work for specification compliance.	I.P 4-1= 1.3976	1.9921
	2. Preparing and using shop drawings.	I.P 4-2= 1.3687	1.9509
	3. Using of a comprehensive and continuous supervision system.	I.P 4-3= 1.3687	1.9509
	6.Clear procedure for accepting performed activities	I.P 4-6= 1.3621	1.9415
5 Supplier management 11.1749	5. Supply materials for the project in a timely manner.	I.P 5-5= 1.6448	2.3445
	2. Providing clear specifications to suppliers.	I.P 5-2= 1.6252	2.3165
	1. Reliance on suppliers who are evaluated and selected based on their capability and commitment to product and service quality.	I.P 5-1= 1.5719	2.2406
	4. Suppliers having programs to ensure quality of their products / services.	I.P 5-4= 1.5068	2.1478
	3. Providing Technical Assistance of suppliers by the contractor companies.	I.P 5-3= 1.4912	2.1255
6 Information analysis and Evaluation	1. Review of drawings and specification before tendering process	I.P 6-1= 1.6831	2.3991
	5. Continuity Audit to ensure high-quality work	I.P 6-5= 1.618	2.3063
	4. Documentation of project related documents.	1.6108	2.2960
	2. Document procedures for reviewing disposition of nonconforming products.	I.P 6-2= 1.5642	2.2296

	3. Documentation of corrective and preventive actions.	I.P 6-3= 1.553	2.2136
7 Contract Documents (Contract & Drawings) 9.8169	4. Completeness and consistency of design drawings.	I.P 7-4= 1.4047	2.0022
	1. Absence of a conflict between the tender documents.	I.P 7-1= 1.3989	1.9940
	3. Bill of quantity is very detailed and accurate.	I.P 7-3= 1.3792	1.9659
	2. Conditions of written contract are clear and fair, also responsibilities distribution is clear.	I.P 7-2= 1.3727	1.9566
	5. Using modern techniques in designing and conformance to codes.	I.P 7-5= 1.3317	1.8982
8 Materials & Equipments 10.6761	3. Laboratories competence for samples testing and approval.	I.P 8-3= 1.6111	2.2964
	5. Good utilization of equipment and regular maintenance.	I.P 8-5= 1.5609	2.2249
	4. Optimal use of materials to reduce wastage.	I.P 8-4= 1.5302	2.1811
	1. Using storage and handling system for materials in project site.	I.P 8-1= 1.4111	2.0114
	2. Palestinian Standards Institution role.	I.P 8-2= 1.3767	1.9623
9 Financial Issues 10.947	4. Provision of the appropriate budget required for project implementation before tender launching.	I.P 9-4= 1.6251	2.3164
	2. The non delay of interim payments.	I.P 9-2= 1.6136	2.3000
	1. The amount of contractor's cash flow.	I.P 9-1= 1.5713	2.2397
	3. Achieving bank facilities to the contractor.	I.P 9-3= 1.4561	2.0755
	5. Advanced payment is paid to contractor to facilitate his work.	I.P 9-5= 1.4139	2.0154
10 Site Layout 10.6475	5. Achieve the requirements of safety in the site layout	I.P 10-5= 1.6344	2.3297
	2. Site layout is organized well by contractor.	I.P 10-2= 1.5127	2.1562
	4. Site is clean and getting rid of projects waste in an organized ways.	I.P 10-4= 1.4895	2.1231
	3. Site layout has storage areas for materials.	I.P 10-3= 1.4738	2.1007
	1.Site layout is large and suitable for movement of labors and equipments.	I.P 10-1= 1.3595	1.9378
11 Systems Used	4. Implement a safety program.	I.P 11-4= 1.6895	2.4082
	2. Implement and using Time Schedule.	I.P 11-2= 1.5818	2.2547

	1. Using computer software and applications.	I.P 11-1= 1.5249	2.1736
	3. Using cost control system.	I.P 11-3= 1.5171	2.1625
	5.Using a complete applied resources management system.	I.P 11-5= 1.4867	2.1191
12 Surrounding Environment 8.3588	4.Israeli restrictions on imports	I.P 12-4= 1.5243	2.1727
	3. Barriers and closure of the roads and its effects on cost of materials transfer.	I.P 12-3= 1.5207	2.1676
	2.Stability of Political environment	I.P 12-2= 1.4668	2.0908
	5. Cooperation of some nearby residents to some projects in the implementation of some works.	I.P 12-5= 1.3524	1.9277
13 Continuous Improvement 1.9536	3. Teamwork	I.P 13-3= 1.3706	1.9536
TQM Summation		**70.1564%**	**100%**

From the results it is clear that the critical main factors affect TQM implementation are: Top management commitment & leadership, External Customer Focus, Process Management & Execution, Supplier management, Information analysis and Evaluation, Contract Documents (Contract & Drawings), Materials & Equipments, Financial Issues, Site Layout, Systems Used, Surrounding Environment and Continuous Improvement. Figure 5.2 shows the importance percentage of each main CSFs of TQM implementation.

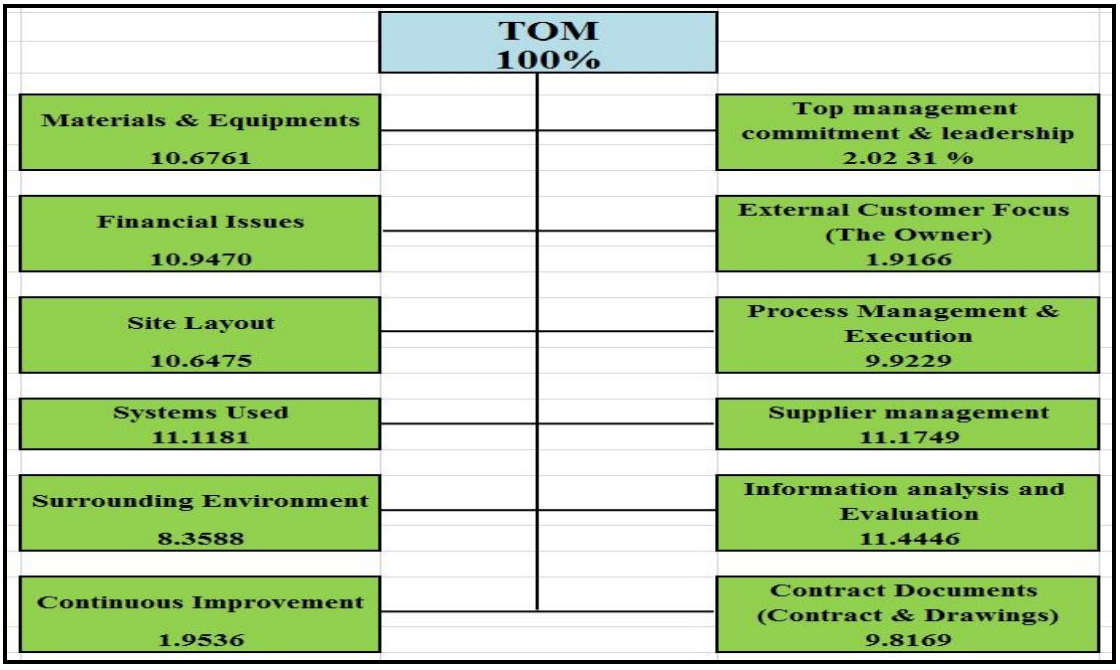

Figure 5.3: Critical Success Factors (CSFs) of TQM Implementation

5.4.1 Model Application

In order to create a practical, easy to use model that measures TQM implementation an Excel form was developed. The model was developed base on the modified importance percentage for the CSsF. The CSFs are answered by the user, who suggests a value that quantifies the extent to which the organization has achieved on this factor X, the model then calculate the organization's achievement of the TQM by multiplying the modified importance percentage by X.

5.4.2 Using the Model

The results clearly indicate that there are twelve CSFs with 47 CSsF were needed for the successful implementation of TQM in construction organizations in Palestine. From the results a model has been developed. This model describes the primary QM methods, which may be used to

assess an organization’s present strengths and weaknesses with regard to its use of QM methods.

The model has a main interface, which contains the twelve critical factors as shown in Appendix E. By pressing any of these buttons a new page will appear, the user completes column (X) by a percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied then the user presses in TQM in the same page to return to the main interface. This is repeated for all the main factors. The final result that represents the percentage of applying TQM by the organization is then displayed.

Chapter Six

Conclusions and Recommendations

6.1 Introduction

From all previous chapters, it can be concluded that the local construction sector is facing many problems and obstacles, which limit quality performance. In addition, twelve critical success factors were conducted to improve the quality in construction organizations.

Thus, through this chapter; study conclusions will be reviewed, and the recommendations will be presented to help in enhancing the Palestinian construction sector performance. Also, some further studies will be proposed for completing and strengthening this work.

6.2 Conclusions

The comprehensive literature review of the TQM concept in chapter two covered the main principles, tools, techniques and models of the TQM philosophy, also discussed the construction industry in Palestine and critical problems are facing. It was established the common factors considered critical for the success of TQM. However, cost, quality, and duration of projects are the three parameters that considered the enduring problems of construction companies in Palestine. Chapter three discussed the methodology used in the study. Chapter four discussed analysis of both the interviews and questionnaires. In chapters five the problems solutions and model development were discussed. And chapter six discussed conclusions and recommendations for this study.

The findings of this study revealed the important of TQM implementation. TQM appears to be a concept which is difficult to summarize in a short definition. TQM is a continuous process of incremental improvements. It gives the organization a competitive edge. Any organization, which ignores TQM, is doing itself a disservice.

Based on the findings, several points can be concluded:

1. According to majority of respondents, their perception of quality is by the continuous improvement, then inspection and corrective actions, then elimination of defects. This means that the concept of quality is a well-understood terminology by the employees within the company.
2. Most companies do not have quality documents, and the existing of quality policies, manuals or documents in respondent's companies is not sufficient and they do not follow any laid down policy. This indicates the lack of commitment of top management towards the implementation of QM in construction projects.
3. Leadership and participation of top management of construction companies in quality management in Palestine need to be strengthened.
4. The high cost and complicated procedures of getting ISO certificate limited the number of companies who have this certificate.
5. Majority of companies check for design conformance to standard before commencement of project and during construction. This means that this companies need more efforts to improve the quality.

6. There is no awareness about TQM in construction industry in Palestine. Top managers and engineers do not have enough knowledge of the implementation of TQM and how it can be introduced in practice.
7. Training is an integral part of TQM program. The majority of employees in Palestinian construction companies lack adequate training, lack of courses and lack of workshops on quality improvement which points to the need for more participation in training and workshops sessions.
8. A large part of the existing construction projects in Palestine are given to contractor whose price is the lowest. According to interviewers "Financial situation is the basis of quality, there is no one working for the quality at the expense of losing his money".
9. It is clear that the implementation of QM is greatly perceived as a mean to fulfill contractual obligations instead of continuous improvement.
10. Donor institutions are the most commitment parties to achieve quality, then engineering offices.
11. There is lack of commitment by the contracting companies and governmental institutions to achieve quality, so they should work hard and hard in this field in order to improve quality systems in their companies.
12. Quality situation in private construction sector is better than it in public construction sector according to select the appropriate contractor.
13. The understanding of quality and implementing the quality systems is not sufficient. Also the current situation needs more attention and

studies in this subject to clarify the quality concept to all parties of the construction industry.

14. The results of the study clearly indicate that Process management and execution is the most critical factor for the successful implementation of TQM in the Palestinian organizations followed by contract documents, information analysis and evaluation, human resources management, supply management, systems used, continuous improvement, financial issues, top management commitment & leadership, materials & equipments, site layout, surrounding environment, then external customer focus which is the owner. It is clear that almost all factors have high level of importance, which means almost all sub factors are very important to implementing TQM in construction sector in Palestine.
15. The results of the study clearly indicate number of critical sub factors was needed for the successful implementation of TQM in construction organizations in Palestine such as: implement a safety program, review of drawings and specification before tendering, supply materials for the project in a timely manner, providing clear specifications to suppliers, and appropriate budget required for project implementation before tendering. Clarity of work instruction, awarding the tender to the most accurate bidder are also among the factors effecting quality.
16. Most of the company manager are highly educated, who have a Bachelor or postgraduate certificates, so they have positive influence in

improving quality in their organization if they aware with quality issues.

17. The contract parties lack of awareness of some main construction terminologies. So the importance of a raising awareness for the important terminologies must be done by training courses and publications.
18. A model has been developed. This model describes the primary QM methods, which may be used to assess an organization's present strengths and weaknesses with regard to its use of QM methods.
19. TQM is not a common practice; it may be more precise to say that the construction parties are familiar with the quality issues (QA/QC) but the concept of TQM, which is taken as a "totality" concept does not exist. It needs to be designed, implemented and more importantly, the manager needs to make the employee aware of the benefits it can bring to the working ethics, make life easy for everyone, rather than becoming a barrier.
20. The degree of consistency in terms of perceptions of quality between the different types of organizations was studded, and there is not a significant difference in perception between contracting and consulting companies with regard to main factors affecting quality. Thus, the contracting and consulting companies do not perceive main factors affecting quality differently.

6.3 Recommendations.

Based on the results and conclusions, the following points can be recommended to all parties in order to implement TQM on construction sector in Palestine:

1. It is important that each contracting or consulting firm to select or design its own definition of quality. This definition should be clear and understood by everyone in the company. Once speaking the same language, quality can be measured and managed effectively. The quality elements to be understood clearly are:
   - ✓Definition of quality is how to reach the continuous improvement.
   - ✓Quality is a target for everyone in the company.
   - ✓It is a team work and a continuous improvement process.
   - ✓Quality is the responsibility of everyone and not of top management only.
2. It is important that the contracting or consulting firms develop a QMS to meet the requirements of the international quality standards. This QMS should contain three levels of documentation, which are hierarchical in nature:
   - ✓Quality Manual: provides a concise summary of the QMS policy.
   - ✓Procedures Manual: describes the system functions.
   - ✓Work instructions: contains specifications and detailed methods.
3. Achieving the quality improvement needs the cooperation of all the parties involved in the construction industry. Owners, designers,

supervision staff, and contractors should exert concerted efforts in order to establish and disseminate quality awareness.

4. Investigate the cost of each TQM success factor and using the results in this study to develop an optimization model to identify the factor that effect in TQM implementation with least cost.
5. It is recommended that with regards to documentations surrounding quality solutions and quality problems, focus should be on documentation coupled with the learning, since only recording quality problems and simply documenting these is not enough to put a preventive action plan in place. Failure to implement the appropriate training leaves the company constantly working in corrective action mode rather than moving towards the preventive one which is dictated by TQM philosophy. The issues were discussed and action plans were devised to ensure that these incidents don't happen again, working in preventive action mode rather than needing to initiate a corrective action plan at each non-conformity identified.
6. The lessons learnt during the implementation of TQM need to be fully documented and evaluated systematically.
7. Drawings, specifications, bill of quantities and design documents received from the designer affect the quality of the construction project. Drawings, specifications and bill of quantities are the only documents given to the contractor that show the design concept, size and scope of the job. Therefore, it is critical that these documents be clear, concise

and uniform. Local standards should be developed to ensure minimum quality requirements and procedure to measure them.

8. It is recommended for the construction firms to develop its own overall QMS to ensure that most quality elements be achieved.
9. It is recommended that owners or consultants who seek high quality should not award contracts to the lowest bidder whose price is lower than the project fair estimate, as many projects were delayed and suffer from quality problems.
10. Contribution of Owners in the design process and making the right decisions in the proper time will improve the quality of construction projects.
11. It is highly recommended to raise the level of awareness in quality field at the technical institutions, the society of engineers, and the authorities' offices, to improve the level of quality in every phase of the construction process of the project until handover to client, to full satisfaction.
12. Spreading the awareness of TQM is essential, especially in the earlier stages because every person in the company must learn the concept before it can be applied. They have to know what will happen next and to do this; they have to be a part of the TQM system
13. A team of highly motivated and talented professionals should be selected to work as supervising.
14. Observations shall be appropriately recorded at all levels and recommendations should be made for future improvements.

15. It is recommended to use the developed model. Project managers can use this model to assess the quality level of a construction project. Assessments of likely project outcomes can be ascertained during construction and any necessary correction actions can be initiated.
16. Achieving the level where employees supervise themselves leads to achieving the maximum quality possible in their work. It is viewed that in future the willingness of people to achieve quality should be taken as a steppingstone but in addition educating and training aspects must be implemented to achieve quality outputs.
17. Quality should extend to after completion phase. It is suggested TQM should include the time period after the products is delivered and used by the clients. Therefore, the focus should be on warranty maintenance, which is currently not present in TQM literature.
18. Government is recommended to construct new warehouse in settlement of west bank to store the required construction materials. This proposal is a partially solution of borders closures matters.
19. It is recommended to keep the site layout cleaned and organized well. This will facilitate the construction process and improve the output quality.
20. Create master specifications for the construction industry in Palestine. This master specification should categorize the projects into small, medium and large projects, or normal, complex and specialized projects, taking into account the methods of construction used in the

construction industry in Palestine, the level of workmanship, the availability of raw materials and the construction in a hot climate.

6.4 Future suggested study.

This study advocates the importance of implementing the TQM among Palestinian construction companies. In light of the findings, there is an urgent need to propose key areas of study for the advancement of the construction industry in Palestine. The most important study topics proposed are the following:

1. A comparative study on the implementation of TQM among construction companies in: Palestine, development countries, Japan and USA.
2. A study to determine rework cost per sector in the construction industry. Such information would be valuable in informing stakeholders of the actual cost of quality problems, and will assist in motivating and focusing quality improvements in the industry. Such improvement will have benefits for the industry itself, but also the economy as a whole.
3. A study to focus on development of an effective training programme for construction companies in Palestine.
4. A study on the benefits of introducing the concept of self-monitoring among employees of construction companies in Palestine.
5. A study on the communication barrier among construction companies in Palestine (problems and solutions).

6. A study on the development of strategic planning in terms of recruitment methods for Palestinian construction companies in light of the concept of TQM.

6.5 Limitaions of the study

This study is restricted by the following items:

1. In terms of geographical coverage, this study covered the main cities in West Bank only. Jerusalem and Gaza strip were not included in this study due to access difficulties to these locations.
2. Most of projects in West Bank are awarded in a competitive bid. Owners usually hire consultants. As those consultants represent the viewpoint of owners, this study took into consideration the opinions of two categories, contractors and consultants.
3. Only two categories involved in this study:
   A. Contractors registered in the Palestinian Contractors Union and classified under the first, second and third degrees at the year 2014.
   B. Consultants who are registered in the Engineering Association and have a valid registration of 1st class consultants at the year 2014.

   Others who were not registered were ignored.

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APPENDICES

Appendix A

Questionnaire

(English Form)

Challenges in the Implementation of Quality Management in the Construction Sector in Palestine.

Many construction companies in many countries have been using TQM successfully for a number of years now and reaping rich rewards in improved client, consultant, and supplier relations, reduced "cost of quality", on time and within budget project completions, it is a dynamic process which promote never ending improvement in the effectiveness and efficiency of all elements of a business to result in an organization doing the right thing, first time and all the time in order to ensure complete customer satisfaction.

This questionnaire considered as a part of the supplementary study to achieve master degree in the Engineering Management/An Najah National University–Nablus.

Please take a look at the following questionnaire and try to answer correctly and accurately, as many questions as possible. All the information gathered here will be kept strictly confidential and will be used only for study and analysis purposes without mentioning the person or company names. If you require clarification and any further information, please do not hesitate to contact me.You can have electronic questionnaire from the below link: https://docs.google.com/forms/d/1rf99IqsrKFN8joq-KTtGxox94tj6eJtNm_dZJt4oFp4/viewform

Maysoon Hesham Syaj Email: maysoon_hesham@hotmail.com

Thanks for your assistant and cooperation

Section One
General information about the person who is filling the questionnaire

1. **Type of Organization:**

☐ Consulting Office ☐ Contracting Company

2. **Respondent Position:**

☐ Company Manager ☐ Project Manager
☐ Site Engineer ☐ Supervision Engineer

3. **Respondent Scientific Qualification:**

☐ Higher Studies ☐ Bachelor ☐ High School
☐ Diploma ☐ Less than High School

4. **Respondent Years of Experiance:**

☐ Less than 5 years ☐ 5-10 years
☐ 11- 20 years ☐ 21 years and above

5. **The Dollar Value of Construction Project Performed During the Last Three Years (Millions Dollar)**

☐ Less than 1 ☐ From 1 to less than 5
☐ From 5 to less than 10 ☐ More than 10

6. **Type of Projects in the Company**

☐ Building ☐ Infrastructure ☐ Building &Infrastructure

7. **Company Location in the West Bank:……..**
8. **Year of Establishment for the Company:……**

Section Two

Evaluate the current level of the implementation of quality management in the construction sector in Palestine

1. **What is your perception of quality?**

☐ Inspection and Corrective Actions
☐ Continuous Improvement
☐ Increase Productivity
☐ Customer Satisfaction
☐ Elimination of Defects
☐ A Tool to Increase Profits
☐ A Competitive Advantage
☐

2. **Does your Company have Quality Policies, Manuals or Documents?**

☐ Yes ☐ No ☐ Partially Existing

3. **Has your Company got the ISO Certificate?**

☐ Yes ☐ No

4. **When your Company Check for Design Drawings Conformance to Standards?**

☐ Do not Check it Out
☐ Commencement of Project
☐ After Every Design Before
☐ During Construction

5. **How do your Company Train the Employee for Quality?**

☐ No Training is Given
☐ Workshops on Quality Improvement
☐ On-Site
☐ Short Courses

6. **How is the Process of Selection the Contractor?**

☐ Based on the Minimum Price
☐ Based on Technical Evaluation
☐ Based on Technical and Financial Evaluation
☐

7. **Is the Supervisor's Control Comprehensive and Ensure the Rightness of the Work?**

☐ Yes ☐ No ☐ Sometims

8. **Does the Contractor's Engineer Exist at the Site Permanently?**

☐ Yes ☐ No ☐ Don't Know

9. **Does the Contractor's Engineer do his role in achieving quality at the Site?**

☐ Yes ☐ No ☐ Don't Know

10. **Are materials stored in places suitable for its safety?**

☐ Yes ☐ No ☐ Don't Know

11. **In your view, What are the most party commitment to achieve quality in construction projects?**

☐ Governmental institutions ☐ Donor institutions
☐ Engineering offices ☐ Contracting Companies

Section Three
PROBLEMS AND OBSTACLES AFFECTING QUALITY MANAGEMENT IMPLEMENTATION

1. In your view, what are the problems affecting Quality Management (QM) implementation in your company. Not limited to one answer

☐ 1. The difficulty in changing behaviors and attitudes related to quality.
☐ 2. Lack of top-management commitment/understanding of quality issues.
☐ 3. Absence of a clear strategy for quality management in the company.
☐ 4. Lack of employees' and workers' commitment/understanding, and resistance to quality programs.
☐ 5. Lack of communication between project's parties (contractor and consultant).
☐ 6. Firms' emphasis on short-term objectives/gains.
☐ 7. Lack of education and training to drive the improvement process**.**
☐ 8. Loss of part of the productivity of workers as a result of the effort in training.
☐ 9. Too much documents are required which lead to difficulty on documentation ability.
☐ 10. Lack of expertise/resources in Quality Management System.
☐ 11. A lack of codes and specifications.
☐ 12. Insufficient attention to achieve quality by workers in projects.
☐ 13. Instability of the volume of work and the instability of the national economy.
☐ 14. Absence of rewards and appreciation of the achievement of employees and workers.
☐ 15. Awarded the tender on the basis of lower prices and not efficiency.
☐ 16. Lack of feedback from previous projects and take advantage of them.
☐ 17. Absence of advance planning for the project.

☐ 18.Not use computer software to manage projects effectively.

☐ 19.Lake of owner's awareness

☐ 20.Other issues……..

Section Four

Critical Success Factors Affecting the Quality Improvement

Below are a number of Critical Success Factors for Quality Improvement which can have an impact on quality management in Palestine. Please indicate how significant each one can influence quality management *(Please mark just one box)*

1=not significant; 2=slightly significant 3=moderately significant; 4=very significant; 5=exceedingly significant.

Critical Success Factors	1	2	3	4	5
1) FACTORS RELATED TO TOP MANAGEMENT COMMITMENT AND LEADERSHIP					
1. Management establishing clear definition of quality in the mission of the company.					
2. Attachment of importance to quality by top management in relation to cost and schedule objectives.					
3. Reviewing quality issues in the top management meetings.					
4. Regularity and speed of the owner in decision making.					
5. Procedures of selecting contractors and awarding the tender to the most accurate bidder not to the lowest evaluated bidder.					
6. Development and implementation of plans on the basis of the company's capabilities and readiness.					
2) FACTORS RELATED TO HUMAN RESOURCE MANAGEMENT					
1. Income level and wages of employees and labors.					
2. Using Motivation System for employees and labors.					
3. Training courses for employees in quality improvement skills and technical skills.					
4. Skill and experience of Supervision staff, and their authority in the project site.					
5. Skill and experience of contractor's staff, and using labors with high experience.					
6. Skill and experience of designers.					
7. Cooperation and effective coordination between Supervision and Contractor’s staff.					

8. Absence of past disagreements between contract parties					
3) FACTORS RELATED TO EXTERNAL CUSTOMER FOCUS (THE OWNER)					
1. Owner's requirements are used as the basis for quality.					
2. Owner organization nature (Public or Private)					
3. Responding effectively to owner's enquiries and complaints.					
4. Preventive and corrective actions undertaken to delight customers.					
5. Using the facilities and buildings properly by the owner.					
6. Price and budget specified by the owner. (Owner’s emphasis on price)					
4) FACTORS RELATED TO PROCESS MANAGEMENT AND EXECUTION					
1. Testing, reviewing and inspection of incoming products or work for specification compliance.					
2. Preparing and using shop drawings.					
3. Using of a comprehensive and continuous supervision system.					
4. Clarity of work or process instruction giving to employees, artisans and site staff.					
5. Process flow chart and inspection for activities that directly affect quality.					
6. Clear procedure for accepting performed activities.					
5) FACTORS RELATED TO SUPPLIER MANAGEMENT					
1. Reliance on suppliers who are evaluated and selected based on their capability and commitment to product and service quality.					
2. Providing clear specifications to suppliers.					
3. Providing Technical Assistance of suppliers by the contractor companies.					
4. Suppliers having programs to ensure quality of their products / services.					

5. Supply materials for the project in a timely manner.					
6) FACTORS RELATED TO INFORMATION ANALYSIS AND EVALUATION					
1. Review of drawings and specification before tendering process.					
2. Document procedures for reviewing disposition of nonconforming products.					
3. Documentation of corrective and preventive actions.					
4. Documentation of project related documents.					
5. Continuity Audit to ensure high-quality work					
7) FACTORS RELATED TO CONTRACT DOCUMENTS (CONTRACT & DRAWINGS)					
1. Absence of a conflict between the tender documents. (Completeness and consistency of tender document.)					
2. Conditions of written contract are clear and fair, also responsibilities distribution is clear.					
3. Bill of quantity is very detailed and accurate.					
4. Completeness and consistency of design drawings.					
5. Using modern techniques in designing and conformance to codes.					
6. A competent authority or party to audit drawings of design.					
8) FACTORS RELATED TO MATERIALS AND EQUIPMENTS					
1. Using storage and handling system for materials in project site.					
2. Palestinian Standards Institution role.					
3. Laboratories competence for samples testing and approval.					
4. Optimal use of materials to reduce wastage.					
5. Good utilization of equipment and regular maintenance.					
9) FACTORS RELATED TO FINANCIAL ISSUES					
1. The amount of contractor’s cash flow.					
2. The non delay of interim payments.					
3. Achieving bank facilities to the contractor.					

4. Provision of the appropriate budget required for project implementation before tender launching.					
5. Advanced payment is paid to contractor to facilitate his work.					
10) FACTORS RELATED TO SITE LAYOUT					
1.Site layout is large and suitable for movement of labors and equipments.					
2.Site layout is organized well by contractor.					
3.Site layout has storage areas for materials.					
4.Site is clean and getting rid of projects waste in an organized ways.					
5.Achieve the requirements of safety in the site layout.					
11) FACTORS RELATED TO SYSTEMS USED					
1. Using computer software and applications.					
2. Implement and using Time Schedule.					
3. Using cost control system.					
4. Implement a safety program.					
5. Using a complete applied resources management system.					
12) FACTORS RELATED TO THE SURROUNDING ENVIROMENT					
1. The socio-economic environment.					
2. Stability of Political environment.					
3. Barriers and closure of the roads and its effects on cost of materials transfer.					
4. Israeli restrictions on imports.					
5. Cooperation of some nearby residents to some projects in the implementation of some works.					
13) FACTORS RELATED TO CONTINUOUS IMPROVEMENT					
1. Finding the root causes in the diagnosis of problems and defects.					
2. Identification of areas for quality improvement and implementing it.					
3. Teamwork					
4. Change the company's policy in relation to quality gradually.					
5. Identification of quality tools.					

6. Tracking Cost of quality process (rework, waste, rejects) for continuous improvement.					

B. What are your suggestions to improve the level of quality in construction projects in Palestine?

……

……

……

Appendix B

(Arabic Format)

استبيان حول

تحديات تنفيذ إدارة الجودة في قطاع الإنشاءات في فلسطين

السادة الكرام- تحية طيبة وبعد

إن استخدام إدارة الجودة أظهرت نجاحا في الدول التي تتبناها، حيث أظهرت العديد من الدراسات الآثار الايجابية من وراء ذلك, مثل تسليم المشروع في الوقت المناسب وضمن الميزانية المحددة له، وتقليل تكاليف العمل من خلال التحسينات والقيام بفعاليات المشاريع بصورة صحيحة.

يهدف هذا الاستبيان إلى تقييم مستوى تطبيق إدارة الجودة في قطاع الإنشاءات في فلسطين، وأبرز التحديات في تنفيذها وتحديد العوامل المؤثرة في تحسينها. يعتبر هذا الاستبيان جزءاً من البحث التكميلي لنيل درجة الماجستير في تخصص الإدارة الهندسية /جامعة النجاح الوطنية – نابلس.

إن هذا الاستبيان موجه إلى جهتين هم: الجهة المشرفة ممثلة بالمكاتب هندسية والجهة المنفذة ومن يمثلها من مديري مشاريع وشركات مقاولات.

أرجو من حضرتكم تعبئة هذا الاستبيان بالحقائق المناسبة والدقيقة قدر الإمكان، حيث أن جميع المعلومات الواردة في هذا الاستبيان ستستخدم فقط لأغراض هذا البحث وسيتم نشر النتائج على شكل نتائج إحصائية لمجموع شركات عينة البحث. بإمكانكم الحصول على نسخة الكترونية عن طريق الرابط التالي:

https://docs.google.com/forms/d/1rf99IqsrKFN8joq-KTtGxox94tj6eJtNm_dZJt4oFp4/viewform

إن المعلومات التي ستساهمون بها ستساعد في إثراء البحث العلمي وتطوير قطاع الإنشاءات في فلسطين.

شاكرين لكم حسن تعاونكم,,,

الباحثة: م.ميسون هشام سياج بريد الكتروني: **maysoon_hesham@hotmail.com**

القسم الأول :معلومات أولية

1. جهة العمل

☐ جهة إشراف(مكتب هندسي) ☐ جهة منفّذة (مقاولات)

2. الموقع الوظيفي

☐ مدير شركة ☐ مدير مشروع ☐ مهندس إشراف ☐ مهندس موقع

3. المؤهل العلمي

☐ دراسات عليا ☐ بكالوريوس ☐ ثانوية عامة ☐ دبلوم

4. عدد سنوات الخبرة

☐ أقل من خمس سنوات ☐ 5-10سنوات ☐ 11-20 سنة ☐ أكثر من 21سنة

5. قيمة المشاريع التي نفذت خلال السنوات الثلاث الماضية: (مليون دولار) مشاريع نفذت أو اشرف عليها

☐ أقل من (1) ☐ من1 إلى أقل من 5 ☐ من 5 إلى أقل من10 ☐ أكثر من (10)

6. مجالات عمل الشركة (أرجو كتابة التصنيف الحاصلة عليه الشركة)

☐أبنية ☐ بنية تحتية ☐ الاثنان معا

7. مقر الشركة

(المدينة):.....

8. سنة تأسيس

الشركة:.....

القسم الثاني:

تقييم مستوى تطبيق إدارة الجودة في قطاع الإنشاءات

الرجاء اختيار إجابة واحدة فقط

1. ما هو تصوركم عن مفهوم الجودة؟

☐التفتيش والتصحيح ☐تقليل أخطاء العمل ☐ التحسين المستمر ☐ أداة لزيادة أرباح الشركة

☐ زيادة الإنتاجية ☐ميزة تنافسية بين الشركات ☐تحقيق رضا المالك ☐ أخرى.....

2. هل يوجد لدى شركتكم دليل رسمي للجودة - سياسات أو معايير أو خطط - (Quality manual)؟

☐نعم ☐ لا ☐موجود بشكل جزئي

3. هل شركتكم حاصلة على شهادة الجودة ISO؟

☐نعم ☐ لا

4. متى تتحققون من أن مخططات التصميم مطابقة للمعايير التصميمية ومتكاملة؟

☐لا يتم التحقق من ذلك ☐بعد كل تصميم ☐قبل البدء بتنفيذ المشروع ☐اثناء تنفيذ المشروع

5. كيف تقومون بتدريب الموظفين والعاملين بما يتعلق بالجودة؟

☐لا يوجد تدريب ☐في الموقع ☐ورش عمل ☐ دورات قصيرة

6. على أي أساس تتم عملية ترسية العطاء واختيار المقاول؟

☐على أساس أقل الأسعار ☐على أساس الكفاءة ☐ على أساس أنسب الأسعار والكفاءة

7. هل الرقابة التي يقوم بها المشرف في أثناء التنفيذ شاملة لكل أنشطة المشروع و تضمن دقة التنفيذ وصحته؟

☐ نعم ☐لا ☐ أحيانا

8. **هل يتواجد مهندس المقاول بشكل دائم في الموقع؟**

☐نعم ☐ لا ☐ أحيانا

9. هل يقوم مهندس المقاول بدوره لتحقيق أهداف الجودة؟

☐نعم ☐ لا ☐ أحيانا

10.هل يتم تخزين مواد المشروع في أماكن تضمن سلامتها؟

☐نعم ☐ لا ☐ أحيانا

11.من وجهة نظرك، ما هي الجهة الاكثر التزاما بتحقيق الجودة في المشاريع الانشائية؟

☐المؤسسات الحكومية ☐ المؤسسات المانحة ☐ المكاتب الهندسية ☐

شركات المقاولات

القسم الثالث

مشاكل تؤثر على تنفيذ إدارة الجودة في المشاريع الإنشائية.

أ. من وجهة نظركم، ما هي المشاكل التي تؤثر على تنفيذ إدارة الجودة في مشاريعكم الإنشائية؟

يمكن اختيار أكثر من إجابة

- ☐ 1. صعوبة تغيير السلوكيات فيما يتعلق بالجودة.
- ☐ 2. عدم وجود التزام من الإدارة العليا بما يتعلق بالجودة.
- ☐ 3. عدم وجود إستراتيجية واضحة لإدارة الجودة في الشركة.
- ☐ 4. عدم وجود التزام من العاملين في الشركة بأمور الجودة ومقاومتهم لمثل هذه البرامج.
- ☐ 5. غياب التواصل والتنسيق بين أطراف المشروع.
- ☐ 6. تركيز الشركات على الأهداف والمكاسب قصيرة المدى.
- ☐ 7. نقص التدريبات (training)المتعلقة بعمليات التحسين في المشاريع.
- ☐ 8. خسارة جزء من إنتاجية العاملين نتيجة الجهد المبذول في تدريبهم
- ☐ 9. كثرة الوثائق المطلوبة للمشروع مما يؤدي إلى صعوبة القدرة على التوثيق.
- ☐ 10. نقص الخبرة في نظام إدارة الجودة.
- ☐ 11. نقص المواصفات وعدم وضوحها.
- ☐ 12. عدم أو قلة اهتمام العاملين في المشروع بتحقيق الجودة.
- ☐ 13. عدم استقرار حجم العمل وعدم استقرار الاقتصاد الوطني.
- ☐ 14. غياب المكافآت والتقدير للموظفين والعمال.
- ☐ 15. ترسية العطاء على أساس أقل الأسعار وليس الكفاءة.
- ☐ 16. عدم وجود تغذية راجعة من المشاريع السابقة والاستفادة منها.
- ☐ 17. غياب التخطيط المسبق للمشروع.
- ☐ 18. عدم استخدام الحوسبة وبرامج الكمبيوتر لإدارة المشاريع بشكل فعال.
- ☐ 19. قلة وعي المالك بأهمية تنفيذ الجودة في المشروع وفرض آرائه غير المدروسة.
- ☐ 20. مشاكل

أخرى.....

القسم الرابع

عوامل النجاح الحاسمة في تطبيق إدارة الجودة في المشاريع الإنشائية في فلسطين

أرجو تحديد درجة الأهمية للعوامل التالية المؤثرة في تحسين الجودة في المشاريع الإنشائية

العوامل المؤثرة في تحسين الجودة	درجة الأهمية				
	لا أهمية لذلك	مهم بدرجة قليلة	مهم بدرجة متوسطة	مهم بدرجة كبيرة	مهم بدرجة كبيرة جدا
أولا: عوامل تتعلق بالإدارة العليا والتزامها					
1. وضع تعريف واضح للجودة في رسالة الشركة					
2. قيام الإدارة العليا بربط الجودة بالتكلفة والجدول الزمني					
3. مراجعة الأمور المتعلقة بالجودة في اجتماعات الإدارة العليا					
4. انتظام وسرعة الجهة المالكة في اتخاذ القرارات اللازمة.					
5. أن تكون سياسات ترسية العطاء على الكفاءة وأدق الأسعار					
6. وضع وتنفيذ خطط على أساس قدرات الشركة وجاهزيتها					
ثانيا:عوامل تتعلق بإدارة الموارد البشرية (طاقم العمل والعمال)					
1. مستوى دخل وأجور طاقم العمل من موظفين وعمال					
2. استخدام نظام الحوافز للعاملين					
3. دورات تدريبية لطاقم العمل في مهارات يحتاجها المشروع					
4. مهارة وخبرة طاقم الإشراف، وسلطته على المقاول					
5. مهارة وخبرة طاقم المقاول واستخدام عمال ذوي خبرة					
6. مهارة وخبرة طاقم التصميم					
7. التعاون والتنسيق الفعال بين جميع المشاركين في المشروع					
8. عدم وجود خلافات سابقة بين جهة الإشراف وجهة التنفيذ					
ثالثا: عوامل تتعلق بالمالك					
1. اعتبار احتياجات المالك هي أساس عملية الجودة					
2. طبيعة الجهة المالكة: مؤسسة عامة أو خاصة					
3. الاستجابة بفاعلية لاستفسارات وشكاوي المالك					

4.اتخاذ إجراءات وقائية وتصحيحية تناسب المالك وترضيه					
5.استخدام وتشغيل المالك للمنشآت بشكل صحيح					
6.الميزانية والسعر المحدد من قبل المالك					
رابعا: عوامل تتعلق بإدارة سير العمل وطريقة التنفيذ					
1.اختبار وفحص مطابقة مواد وأعمال المشروع للمواصفات					
2.إعداد واستخدام رسومات تنفيذية					
3.استخدام نظام إشراف شامل ومستمر					
4.وضوح العمل وطريقة العمل للعمال ولطاقم عمل المشروع					
5.تفتيش الأنشطة والفعاليات التي تؤثر مباشرة على الجودة					
6.وجود خطوات واضحة لاستلام الأعمال					
خامسا: عوامل تتعلق بإدارة الموردين					
1.يتم اختيار الموردين على أساس كفاءتهم والتزامهم بالجودة					
2.توفير مواصفات واضحة للموردين					
3.توفير المساعدة الفنية من الموردين					
4.أن يمتلك الموردين برنامج لضمان جودة المواد					
5.تأمين مواد المشروع في الوقت المناسب					
سادسا: عوامل تتعلق بتحليل المعلومات وتقييمها					
1.مراجعة وتدقيق المخططات والمواصفات قبل طرح العطاء					
2.عمل إجراءات موثقة لكيفية التصرف بالمواد غير المطابقة للمواصفات					
3.توثيق الإجراءات التصحيحية والوقائية					
4.توثيق جميع الأوراق المتعلقة بالمشروع					
5.استمرارية التدقيق لضمان تقديم أعمال ذات جودة عالية					
سابعا: عوامل تتعلق بوثائق العطاء(العقود ومخططات التصميم)					
1.عدم وجود تعارض بين وثائق العطاء					
2.وضوح شروط العقد وعدالتها مع توزيع للمسؤوليات					
3.دقة جدول الكميات واحتوائه على جميع التفاصيل					
4.شمولية وترابط ووضوح مخططات التصميم					
5.استخدام التقنيات الحديثة في التصميم وتوافقه مع الكود					
6.وجود جهة مختصة تقوم بتدقيق مخططات التصميم					
ثامنا: عوامل تتعلق بالمواد والمعدات					

1.استخدام نظام تخزين وشحن للمواد في الموقع					
2.دور مؤسسة المواصفات والمقاييس الفلسطينية					
3.كفاءة مختبرات فحص العينات واعتمادها					
4.الاستخدام الأمثل للمواد بحيث نقلل الفاقد					
5.الاستخدام الجيد للمعدات وعمل صيانة دورية لها					
تاسعا: عوامل تتعلق بالأمور المالية					
1.كمية التدفق المالي عند المقاول					
2.انتظام وسرعة صرف الدفعات المرحلية المستحقة للمقاول					
3.حصول المقاول على التسهيلات البنكية					
4.رصد الميزانية الملائمة لتنفيذ المشروع قبل طرح العطاء					
5.حصول المقاول على الدفعة المقدمة لتسهيل أموره					
عاشرا: عوامل تتعلق بالموقع العام للمشروع					
1.الموقع العام واسع ويتميز بسهولة الحركة للعمال والمعدات					
2.الموقع العام منظم بشكل جيد من قبل المقاول بعد الاستلام					
3.يتميز الموقع العام بوجود أماكن لتخزين المواد					
4.نظافة الموقع العام وإزالة نفايات المشروع بطرق منظمة					
5.تحقيق متطلبات السلامة العامة في الموقع العام					
الحادي عشر: عوامل تتعلق بالأنظمة المستخدمة					
1. استخدام برامج وتطبيقات الكمبيوتر					
2. تطبيق واستخدام الجداول الزمنية					
3. استخدام نظام ضبط التكلفة					
4. تطبيق برنامج الوقاية والسلامة					
5. استخدام نظام شامل لإدارة الموارد					
الثاني عشر:عوامل تتعلق في البيئة المحيطة					
1. البيئة الاجتماعية والاقتصادية					
2. ثبات الوضع السياسي					
3. الحواجز وإغلاق الطرق وتأثيرها على تكلفة نقل المواد					
4. القيود الإسرائيلية على الاستيراد					
5. تعاون السكان المجاورين للمشروع في تنفيذ الأعمال					
الثالث عشر: عوامل تتعلق بالتحسين المستمر					
1. البحث عن الأسباب الجذرية في تشخيص المشاكل والعيوب					
2. تحديد معايير تحسين الجودة وتطبيقها ومراقبتها					

3. العمل ضمن فريق					
4. أن يكون تغيير سياسة الشركة بما يتعلق بالجودة تدريجيا					
5. تحديد أدوات الجودة المستخدمة					
6. تتبع تكلفة الجودة مثل: تكلفة اعادة العمل،الهدر،المواد والاعمال المرفوضة (rework, waste, rejects)					

ب. ما هي اقتراحاتكم من أجل تحسين مستوى الجودة في المشاريع الانشائية في فلسطين؟

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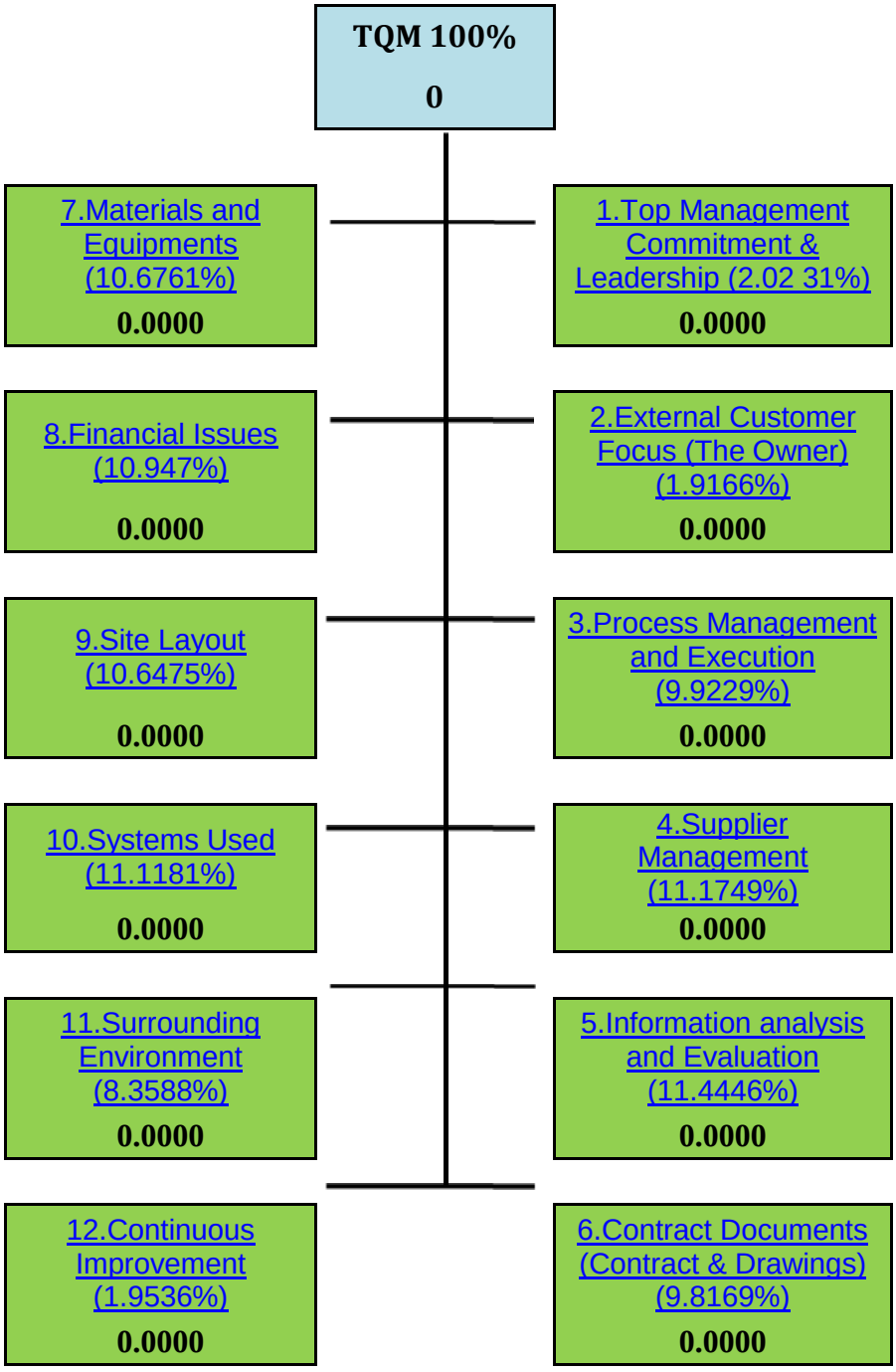
Appendix C

List of Arbitrators in the Pilot Study

No.	Name	Position and Organization
1.	Samer Sami	Statistical Specialist
2.	Dr. Ramiz Assaf	An-Najah National University
3.	Dr. Yahya Saleh	An-Najah National University
4.	Mohammad Al Amleh	Project manager in "AlTameer construction modern co".
5.	Dr. Khalid Al Qawasmeh	Director of "KR&S engineering & consultancy" office in Hebron
6.	Abdel Ghaffar Doufish	Director of "Doufish for general contracting" company in Hebron
7.	Zafer Siaj	Director of "New Vision" office in Hebron and Member of the board offices and engineering firms authority in Engineering Association
8.	George Sabat	Director of "Future Architecture & Consulting Engineers" office in Bethlehem
9.	Qasem Awad	Head of Management and Marketing Department at Al-Quds University
10.	Tareq Zaro	Member of the board offices and engineering firms' authority in Engineering Association

Appendix D


TQM 100%
0
7.Materials and Equipments (10.6761%)
0.0000
1.Top Management Commitment & Leadership (2.02 31%)
0.0000
8.Financial Issues (10.947%)
0.0000
2.External Customer Focus (The Owner) (1.9166%)
0.0000
9.Site Layout (10.6475%)
0.0000
3.Process Management and Execution (9.9229%)
0.0000
10.Systems Used (11.1181%)
0.0000
4.Supplier Management (11.1749%)
0.0000
11.Surrounding Environment (8.3588%)
0.0000
5.Information analysis and Evaluation (11.4446%)
0.0000
12.Continuous Improvement (1.9536%)
0.0000
6.Contract Documents (Contract & Drawings) (9.8169%)
0.0000

TQM

1. Top management commitment & leadership			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	5. Procedures of selecting contractors and awarding the tender to the most accurate bidder not to the lowest evaluated bidder.	0.02023		0

MCCSsF=Modify Critical Success Sub Factors

X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied

TQM

2. External Customer Focus (The Owner)			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	6. Price and budget specified by the owner. (Owner's emphasis on price)	0.0192		0

MCCSsF=Modify Critical Success Sub Factors

X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied

TQM

3. Process Management and Execution			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	4. Clarity of work or process instruction giving to employees, artisans and site staff.	0.02088		0
2	1. Testing, reviewing and inspection of incoming products or work for specification compliance.	0.01992		0
3	2. Preparing and using shop drawings.	0.01951		0
4	3. Using of a comprehensive and continuous supervision system.	0.01951		0
5	6. Clear procedure for accepting performed activities.	0.01942		0

MCCSsF=Modify Critical Success Sub Factors

X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied

TQM

4. Supplier Management			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	5. Supply materials for the project in a timely manner.	0.02345		0
2	2. Providing clear specifications to suppliers.	0.02317		0
3	1. Reliance on suppliers who are evaluated and selected based on their capability and commitment to product and service quality.	0.02241		0
4	4. Suppliers having programs to ensure quality of their products / services.	0.02148		0
5	3. Providing Technical Assistance of suppliers by the contractor companies.	0.02126		0

MCCSsF=Modify Critical Success Sub Factors

X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied

TQM

5. Information analysis and Evaluation			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	1. Review of drawings and specification before tendering process	0.02399		0
2	5. Continuity Audit to ensure high-quality work	0.02306		0
3	4. Documentation of project related documents.	0.02296		0
4	2. Document procedures for reviewing disposition of nonconforming products.	0.0223		0
5	3. Documentation of corrective and preventive actions.	0.02214		0

MCCSsF=Modify Critical Success Sub Factors

X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied

TQM

6. Contract Documents (Contract & Drawings)			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	1. Review of drawings and specification before tendering process	0.02002		0
2	5. Continuity Audit to ensure high-quality work	0.01994		0
3	4. Documentation of project related documents.	0.01966		0
4	2. Document procedures for reviewing disposition of nonconforming products.	0.01957		0
5	3. Documentation of corrective and preventive actions.	0.01898		0

MCCSsF=Modify Critical Success Sub Factors

X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied

TQM

7.Materials and Equipments			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	3. Laboratories competence for samples testing and approval.	0.02296		0
2	5. Good utilization of equipment and regular maintenance.	0.02225		0
3	4. Optimal use of materials to reduce wastage.	0.02181		0
4	1. Using storage and handling system for materials in project site.	0.02011		0
5	2. Palestinian Standards Institution role.	0.01962		0

MCCSsF=Modify Critical Success Sub Factors

X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied

TQM

8.Financial Issues			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	4. Provision of the appropriate budget required for project implementation before tender launching.	0.02316		0
2	2. The non delay of interim payments.	0.023		0
3	1. The amount of contractor's cash flow.	0.0224		0
4	3. Achieving bank facilities to the contractor.	0.02076		0
5	5. Advanced payment is paid to contractor to facilitate his work.	0.02015		0

MCCSsF=Modify Critical Success Sub Factors

X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied

TQM

9.Site Layout			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	5. Achieve the requirements of safety in the site layout	0.0233		0
2	2. Site layout is organized well by contractor.	0.02156		0
3	4. Site is clean and getting rid of projects waste in an organized ways.	0.02123		0
4	3. Site layout has storage areas for materials.	0.02101		0
5	1.Site layout is large and suitable for movement of labors and equipments.	0.01938		0

MCCSsF=Modify Critical Success Sub Factors

X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied

TQM

10.Systems Used			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	4. Implement a safety program.	0.02408		0
2	2. Implement and using Time Schedule.	0.02255		0
3	1. Using computer software and applications.	0.02174		0
4	3. Using cost control system.	0.02163		0
5	5. Using a complete applied resources management system.	0.02119		0

MCCSsF=Modify Critical Success Sub Factors

X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied

TQM

11.Surrounding Environment			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	4.Israeli restrictions on imports	0.02173		0
2	3. Barriers and closure of the roads and its effects on cost of materials transfer.	0.02168		0
3	2.Stability of Political environment	0.02091		0
4	5. Cooperation of some nearby residents to some projects in the implementation of some works.	0.01928		0

MCCSsF=Modify Critical Success Sub Factors

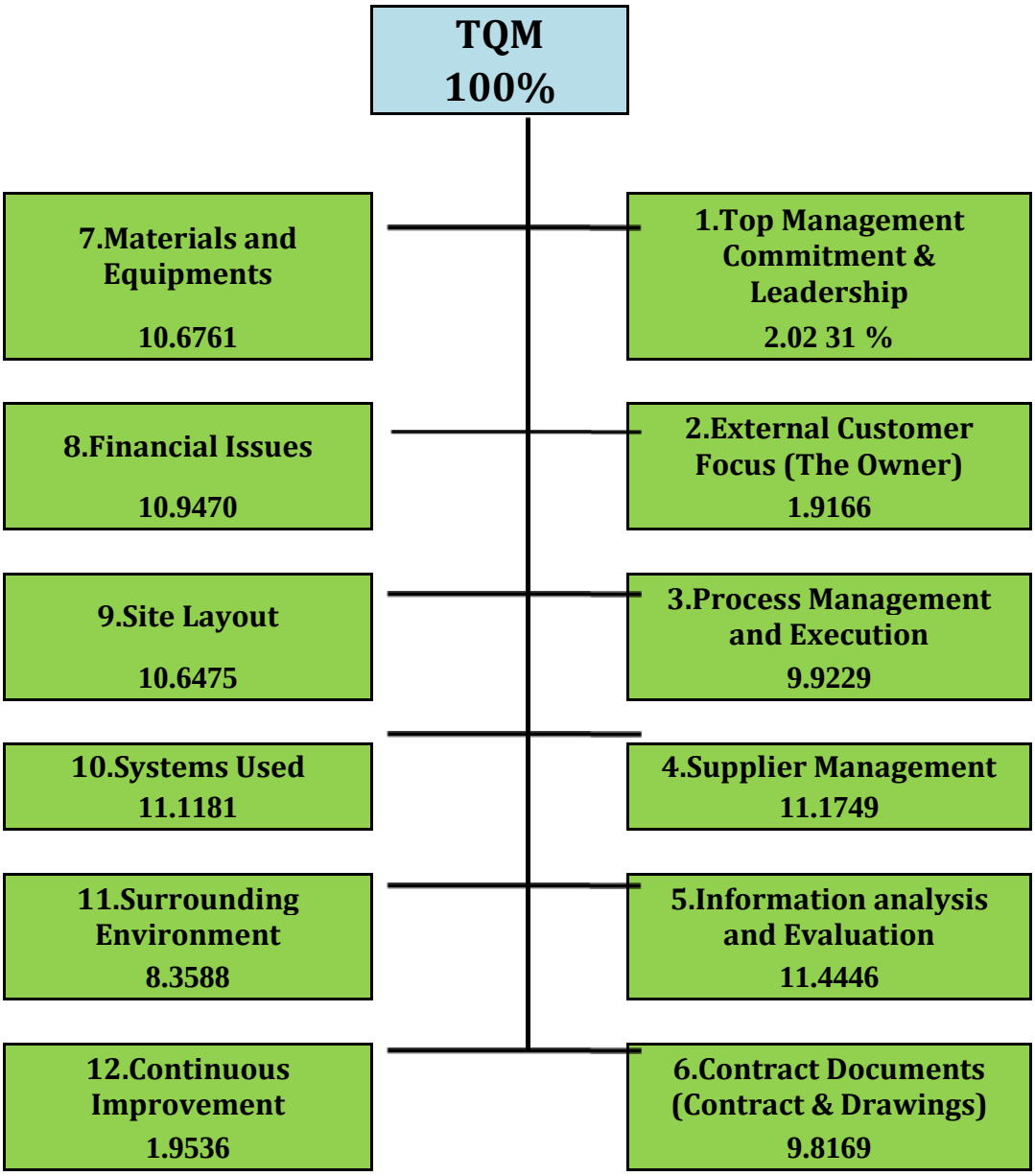
X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied

TQM

12.Continuous Improvement			=	0
No.	**Critical Sub Factor**	**MCCSsF**	**(X)**	**Answer**
1	3. Teamwork	0.0195		0

MCCSsF=Modify Critical Success Sub Factors

X=A percentage ranging from 0 to 100 based on the extent that the sub factors has been actually applied


TQM
100%
7.Materials and Equipments
10.6761
1.Top Management Commitment & Leadership
2.02 31 %
8.Financial Issues
10.9470
2.External Customer Focus (The Owner)
1.9166
9.Site Layout
10.6475
3.Process Management and Execution
9.9229
10.Systems Used
11.1181
4.Supplier Management
11.1749
11.Surrounding Environment
8.3588
5.Information analysis and Evaluation
11.4446
12.Continuous Improvement
1.9536
6.Contract Documents (Contract & Drawings)
9.8169

جامعة النجاح الوطنية
كلية الدراسات العليا

التحديات التي تواجه تطبيق ادارة الجودة في قطاع الانشاءات في فلسطين

إعداد
ميسون هشام سياج

إشراف
د. رياض عبد الكريم عوض

قدمت هذه الأطروحة استكمالا لمتطلبات درجة الماجستير في الإدارة الهندسية بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس, فلسطين
2015

التحديات التي تواجه تطبيق ادارة الجودة في قطاع الانشاءات في فلسطين

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الملخص

تعتبر صناعة التشييد واحدة من أهم الصناعات المؤثرة في تطوير البنية التحتية و الاقتصاد الفلسطيني. ولكن هذه الصناعة تفتقر الى الكفاءة، فالجودة ردئية و الميزانيات غير حقيقية والاسعار مفرط فيها. ان الادارة الجيدة تؤدي الى زيادة الكفاءة فتعمل على تقليل الفشل في جودة العمل و توفير كم هائل من المال في هذا القطاع. ان تحسين الجودة اصبح تحديا كبيرا يواجه قطاع الانشاءات ويمكن ان ينطوي على تقليل تكلفة حل مشاكل اعادة العمل وتقليل تكلفة الصيانة والتصليح وتحسين قيمة دورة حياة المشاريع الانشائية. يمكن اعتبار ادارة الجودة الشاملة واحدة من افضل الحلول للتغلب على مشاكل هذا القطاع و واحدة من اهم العناصر لنجاح هذا القطاع.

يهدف هذا البحث إلى توفير المعلومات الضرورية اللازمة لتحسين إدارة الجودة لقطاع الإنشاءات في فلسطين. من اهم اهداف هذا البحث هو التعرف على الوضع الحالي للجودة وتسليط الضوء على المشاكل والعقبات الرئيسية التي تواجه شركات البناء في تنفيذ إدارة الجودة الشاملة وتحديد عوامل النجاح اللازمة لتنفيذها في قطاع الانشاءات في فلسطين، ثم تطوير نموذج يساعد شركات الانشاءات في تحديد مواطن القوة والضعف بالنسبة لكيفية استخدام أساليب إدارة الجودة.

تم تطوير استبيان كأداة لجمع البيانات. مجتمع الدراسة يتكون من أفراد من شركات الانشاءات في المدن الرئيسية في فلسطين. وقد تم اختيار عينة عشوائيا مكونة من 174 شخص من شركات الانشاءات للحصول على آرائهم حول المشاكل وأهم العوامل التي تؤثر على الجودة.

يتضح من إجابات المستجيبين أن فهم الجودة وتطبيق نظم الجودة ليست كافية كما ان الوضع الحالي للجودة في قطاع الانشاءات في فلسطين بحاجة الى مزيد من الاهتمام والدراسات.علاوة على ذلك فان مشاركة الإدارة العليا في هذه الشركات بحاجة إلى تعزيز وتقوية.

كما أن نتائج الدراسة تشير إلى أن ترسية المناقصة على أساس أقل الأسعار، ونقص الخبرة في نظام إدارة الجودة، ونقص التعليم والتدريب، أيضا قلة وعي المالك بأهمية الجودة، وتركيز الشركات على تحقيق مكاسب قصيرة المدى من أهم مشاكل في ادارة الجودة في هذا القطاع في فلسطين. أيضا إن أهم العوامل التي تحسن جودة قطاع الانشاءات هي: تنفيذ برنامج السلامة، ومراجعة المخططات والمواصفات قبل عملية طرح العطاء، وجلب مواد المشروع في الوقت المناسب، وتوفير مواصفات واضحة للموردين، وتوفير الميزانية المناسبة واللازمة لتنفيذ المشروع قبل طرح العطاء. كما ان وضوح تعليمات العمل، وإحالة العطاء على اساس دقة الاسعار وانسبها بدلا من اقل الاسعار هي أيضا من بين العوامل المؤثرة على الجودة.

نتائج الدراسة تشير بوضوح الى ان هناك 12 عاملا حاسما للنجاح تتضمن 47 عنصر من العناصر الفرعيه الحاسمه لتطبيق ادارة الجوده الشامله على شركات الانشاءات الفلسطينية بشكل ناجح.

من التوصيات التي توصلت اليها الباحثة: الحاجة الى رفع الوعي بأهمية نظام ادارة الجودة بعمل ورش عمل و دورات تدريبية في هذا المجال. و ضرورة تبني نظام للجودة في شركات المقاولات والمكاتب الهندسية وذلك باستخدام النموذج المطور كأداة لقياس الجودة وتحديد نقاط الضعف التي تؤدي إلى انخفاض درجة الجودة وتحسينه.