

Midocean University

College of Management

Department of Project Management



The Impact of the Application of Total Quality Management on Saudi Construction Projects in Jeddah City

Prepared by

Ayman Afeef ID # 221002396 (Leader)

Rayan Alhajjaji ID # 221000585 (Member)

Qasem Aleissa ID # 221002208 (Member)

Supervisor

Dr. Walid Seddik

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Dedication

We dedicate our work to our families and friends. A special feeling of gratitude to our Loving parents. May Allah bless them all whose words of encouragement and push for tenacity support us to finish this work. To our dear wives who never left our sides for their support, encouragement, and constant assistance in bringing this work to light.

With love and respect

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List of abbreviations

TQM Total Quality Management

ISO International Organization for Standardization

QA Quality Assurance

QC Quality Control

QM Quality Management

QSM Quality Management System

QS Quality Systems

SA Saudi Arabia

FIDIC Federation International of Consulting Engineers

SPSS Statistical Package for Social Science

PMBOK Project Management Body of Knowledge

BS British Standards

CSFs Critical Success Factors

SPSS Statistical Package for Social Sciences

ICT Information and Communication Technologies

English abstract

The objective of this study was to examine the effects of Total Quality Management (TQM) implementation on the performance of Saudi construction projects in contracting companies, consultant engineering offices and real estate developers in Jeddah City. Enhanced performance can be achieved in various aspects, including time management, meeting client requirements, increasing profitability, reducing expenses, fulfilling safety standards, and maintaining effective project management and reliability. These improvements are essential within the fundamental constraints of projects, namely time, cost, and quality. The research employed a descriptive-analytical approach and utilized a questionnaire methodology to collect data. The study's sample consisted of 150 individuals. Using the Statistical Package for Social Science (SPSS) software, the data underwent analysis utilizing a range of statistical techniques, including linear and multiple regression, and several other approaches encompassed inside. The study demonstrated a favorable impact on the independent variable, specifically total quality. The present study examined the impact of management practices on the performance of construction projects, specifically focusing on the dimensions of cost, quality, and timeliness. The impact of project constraints, namely time, money, and quality, can be prioritized in a descending sequence as follows: time, cost, and quality. Additionally, the study demonstrated the aspects of the independent variable, Total Quality Management (TQM), and its beneficial impact on the dependent variable, performance in terms of prioritization. Construction projects can be arranged in a declining order based on the following criteria: personnel empowerment and continual improvement. The key areas of concentration in this context include customer-centricity, effective leadership, efficient operations management, and strategic supplier management. Investors in the construction sector in Saudi Arabia were interested in assessing the positive impact of Total Quality Management (TQM) on project efficiency, specifically by highlighting its favorable effects. The findings indicate that construction projects in Jeddah, Saudi Arabia, continue to face challenges associated with implementing Total Quality Management principles.

Keywords: Total Quality Management, Construction projects, Saudi Arabia, Jeddah

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Arabic abstract

الهدف من هذه الدراسة هو دراسة آثار تطبيق إدارة الجودة الشاملة (TQM) على أداء مشاريع البناء السعودية في شركات المقاولات والمكاتب الهندسية الاستشارية والمطورين العقاريين في المملكة العربية السعودية في مدينة جدة. لوحظ انه يمكن تحقيق الأداء الايجابي في جوانب مختلفة، بما في ذلك إدارة الوقت، وتلبية متطلبات العميل، وزيادة الربحية، وخفض النفقات، والوفاء بمعايير السلامة، والحفاظ على إدارة المشروع الفعالة والموثوقية. تعد هذه التحسينات ضرورية ضمن القيود الأساسية للمشاريع، وهي الوقت والتكلفة والجودة. تم استخدام البحث المنهج الوصفي التحليلي واستخدم منهجية الاستبيان لجمع البيانات. حيث تكونت عينة الدراسة من 150 فرد من العاملين في مجال الانشاءات في السعودية بمدينة جدة. وقد خضعت البيانات للتحليل باستخدام مجموعة من التقنيات الإحصائية، بما في ذلك الانحدار الخطي والمتعدد، بالإضافة إلى العديد من المناهج الأخرى المضمنة في الداخل. الحزمة الإحصائية للعلوم الاجتماعية (SSSP) هي أداة برمجية شائعة الاستخدام في البحث الأكاديمي في مجال العلوم الاجتماعية. وأظهرت الدراسة وجود تأثير إيجابي على المتغير المستقل، وتحديدًا الجودة الشاملة بمتغيراتها. حيث تناولت الدراسة الحالية تأثير الممارسات الإدارية على أداء مشاريع البناء، مع التركيز بشكل خاص على أبعاد التكلفة والجودة والتوقيت. يمكن ترتيب أولويات تأثير قيود المشروع أي الوقت والمال والجودة بتسلسل تنازلي على النحو التالي: الوقت والتكلفة والجودة. بالإضافة إلى ذلك تتناول الدراسة الحالية جوانب المتغير المستقل إدارة الجودة الشاملة وأثره المفيد على المتغير التابع الأداء في المشاريع. ومن حيث تحديد الأولويات يمكن ترتيب مشاريع البناء ترتيباً تنازلياً على أساس المعايير التالية: تمكين العاملين، والتحسين المستمر، وتشمل مجالات التركيز الرئيسية في هذا السياق التركيز على العملاء، والقيادة الفعالة، وإدارة العمليات بكفاءة، وإدارة التصميم الهندسية، وإدارة جودة تنفيذ الأعمال، والإدارة الإستراتيجية للموردين. كما اهتم المستثمرون في قطاع البناء في المملكة العربية السعودية بتقييم الأثر الإيجابي لإدارة الجودة الشاملة على كفاءة المشاريع، وتحديدًا من خلال تسليط الضوء على آثارها الإيجابية. وتشير النتائج إلى أن مشاريع البناء في المملكة العربية السعودية بمدينة جدة لا تزال تواجه التحديات المرتبطة بتنفيذ مبادئ إدارة الجودة الشاملة.

الكلمات المفتاحية: إدارة الجودة الشاملة، المشاريع الإنشائية، المملكة العربية السعودية، جدة

1. Introduction

Enhancing work excellence and performance is crucial for companies and project managers to gain strategic advantages and stay competitive. Total Quality Management (TQM) is crucial for Saudi construction projects in Jeddah city to be completed successfully and to the satisfaction of all parties involved.

TQM has been recognized as a management concept that empowers systems and processes to meet increasing customer demands through a relentless pursuit of continuous improvement, emphasizing teamwork and the ethical application of management techniques (Abazid, Gökçekus & Çelik, 2019). TQM concepts were first employed in the manufacturing sector in Japan and have more recently been adopted in the United States. These concepts have increased productivity, decreased product costs, and increased product reliability (Stasiowski & Burstein, 1994).

Quality Management (QM) offers an effective means to accomplish this aim. The International Organization for Standardization (ISO) and TQM are only two examples of Quality Management Systems (QMS) that businesses are working hard to embrace and apply (Al-Musleh, 2010).

The construction industry in Saudi Arabia (SA) has grown significantly during the last ten years. It should be highlighted that building developments are regarded as one of the most fruitful investment stages globally. Construction projects today focus on traditional outcomes and quality, cost-effectiveness, cost reduction, time, and resource conservation (Abazid & Harb, 2018).

Engineering construction initiatives in Saudi Arabia have experienced production deficiencies and flimsy execution phases in the past and up until this day. The developments also suffer from a lack of planning, leading, observing, and evaluating. This is the outcome of insufficient quality standards and a marked lack of interest on the part of the higher department in applying the concepts of quality, which focus on generating quick profits.

The lack of responsibility on the part of the highest management of corporations and establishments in the construction industry to use the necessary efforts for manipulating the quality theories goes along

with their principles that the application of quality necessitates additional justified time and effort. The lack of effective coordination and communication among the key players in a construction project, such as the owner, designer, executor, and supervisor, led to a lack of standards and specifications, which hampered the project's implementation process. Additionally, the reliance on unqualified or inexperienced subcontractors violated the project's specifications and requirements (Wheaton & Schrott, 2018).

This research highlights several serious problems that have arisen from implementing TQM in the Saudi construction sector. Despite disparities in economic development, most countries share the same challenges of inadequate design, defective products, and shoddy construction (Metri, 2005). However, Bryde & Robinson (2005) state that the vast majority of contractors have fallen short of their stakeholders' expectations in terms of cost, quality, and timeliness.

While numerous studies have been published on the subject of TQM's use in other sectors, very few have zeroed in on the building industry. According to Metri (2005), this is because the construction sector is notoriously slow to adopt TQM-inspired reforms. Therefore, it has been identified as important to develop strategies to promote coordination between concept, design, and implementation by shifting from a culture of conflict to one of collaboration in order to boost productivity, reduce costs, and boost customer satisfaction.

As such, the purpose of this study is to assess how well the overall quality theories have been implemented in practice during the delivery of Saudi building projects. The construction industry is currently facing the significant challenge of implementing TQM. Thus, TQM emphasizes process improvement, teamwork, customer and supplier involvement, and training and education to achieve customer satisfaction, cost-effectiveness, defect-free projects, and a culture and environment conducive to innovation and technology advancement (Arditi & Gunaydin, 1997). In light of this, the present research was conducted to address the following fundamental question: What is the impact of applying TQM to construction projects in Saudi Arabia, Jeddah city?

2. Research problem

TQM is becoming more and more popular in Saudi Arabia's construction sector in Jeddah city. Yet, little is known about its practical effects on project outcomes. The effectiveness of TQM in raising project quality, lowering costs, and increasing customer satisfaction in the context of building projects in the Kingdom of Saudi Arabia, therefore, requires a thorough investigation. This research also examined the particular TQM techniques that are most successful in the Saudi construction sector and pinpointed any obstacles that might hinder efficient TQM application there. The findings of this study could ultimately help the Saudi Arabian construction industry create best practices for TQM adoption, which would help the region's construction project outcomes overall.

Nimra et al., (2022) have focused on TQM in Pakistan and its effects on various aspects of performance have been analyzed. These include firm supply performance, export performance, innovation performance, corporate green performance, organizational performance, business performance, and public sector university performance. However, there is a lack of data on the impact of TQM on the local construction sector. Existing studies have focused on certain topics, including structural collapse, ISO certifications, and information and communication technologies (ICT) based modelling.

Previous literature reviews have shown that few papers discuss quality management at a public level. It is challenging to examine quality because of lax regulation and a lack of implementation of quality measures in all regions and buildings (Vijayabanu, et al., 2021).

Syaj (2015) focused on examining how TQM adds value to construction projects in Saudi Arabia. They found that TQM can add value by improving quality, reducing costs, increasing productivity, and enhancing customer satisfaction.

This investigation seeks to answer the fundamental question of how TQM impacts construction projects in Saudi Arabia. This study's findings had implications for construction companies, engineering consultant offices, and project managers in Jeddah, Saudi Arabia, who are implementing TQM and attempting to increase the value of their projects.

The principal outcome of this study was developing a management model for introducing TQM in Saudi construction firms, consulting engineering offices, and project management positions in Jeddah city. This model served as a tool for measuring TQM and evaluating a company's quality management strengths and deficiencies. The application of this model resulted in the continuous enhancement of construction project performance, leading to higher quality outcomes, increased productivity, increased customer satisfaction, and other factors.

3. The importance and objectives of the research

Following a review of relevant prior research, the researchers aimed to accomplish the following with the current study:

- **Improve construction project outcomes:** This research helped identify the factors contributing to the successful implementation of TQM practices in the construction industry in Saudi Arabia, Jeddah city. The outcomes of this research could lead to improved project quality, reduced costs, and enhanced customer satisfaction, ultimately improving construction project outcomes.
- **Enhance the competitiveness of the construction industry by identifying the TQM practices that promote long-term adoption and competitiveness.** The outcomes of this research could help construction companies in Saudi Arabia, Jeddah city, to stay competitive in the global market.
- **Contribute to the development of best practices:** This research could contribute to the development of best practices for TQM implementation in the Saudi construction sector in Jeddah city, help to improve project outcomes and enhance the industry's reputation.
- **Support government initiatives:** This research could support government initiatives to improve the quality and efficiency of construction projects in Saudi Arabia, Jeddah city, by providing evidence-based insights into the impact of TQM practices on project outcomes.

3.1 Study questions

This research addressed the following questions:

Question 1: How does the application of TQM practices in construction projects in Saudi Arabia, Jeddah impact project quality, and what are the specific TQM practices that are most effective in improving quality?

Question 2: How does the application of TQM practices in construction projects in Saudi Arabia, Jeddah impact project costs, and what are the specific TQM practices that are most effective in reducing costs?

Question 3: How does the application of TQM practices in construction projects in Saudi Arabia, Jeddah impact customer satisfaction, and what are the specific TQM practices that are most effective in enhancing customer satisfaction?

Question 4: To what extent does the level of employee involvement in TQM practices in construction projects in Saudi Arabia, Jeddah affect project success, and what are the specific TQM practices that promote employee involvement?

Question 5: What factors (Top Management Commitment, Process Management, Continuous improvement, etc..) influence the adoption of TQM practices in construction projects in Saudi Arabia, Jeddah city, and how do these factors impact the successful implementation of TQM practices?

3.2 Objectives

The primary objective of this study was to shed light on the application of TQM concepts in the building sector, which could improve the quality, timeliness, and cost-effectiveness of project delivery. To accomplish this, we need to achieve the following goals:

Objective 1: To evaluate the effectiveness of TQM practices in improving project quality, reducing costs, and enhancing customer satisfaction in construction projects in Saudi Arabia, Jeddah.

Objective 2: To identify the specific TQM practices that are most effective in the Saudi construction industry and explore how these practices can be implemented to achieve the desired outcomes.

Objective 3: To identify the barriers to successful TQM implementation in the Saudi construction industry and develop strategies to overcome these barriers.

Objective 4: To explore the factors that influence the adoption of TQM practices in the Saudi construction industry and develop recommendations for promoting the adoption of these practices.

Objective 5: To assess the long-term impact of TQM practices on the competitiveness of construction companies in Saudi Arabia, Jeddah city.

4. Research hypotheses

The following hypotheses were tested to complete the objectives of the research successfully:

Hypothesis 1: The application of TQM in construction projects in Saudi Arabia, Jeddah, improved project quality.

Hypothesis 2: The implementation of TQM practices in construction projects in Saudi Arabia, Jeddah, resulted in reduced project costs.

Hypothesis 3: The adoption of TQM principles in construction projects in Saudi Arabia, Jeddah, led to increased customer satisfaction.

Hypothesis 4: The use of TQM in construction projects in Saudi Arabia, Jeddah, improved project completion time.

Hypothesis 5: The application of TQM practices in construction projects in Saudi Arabia, Jeddah, led to increased employee engagement and motivation.

5. Literature review

TQM is developed in a variety of other fields, including manufacturing, marketing, strategy, and engineering. TQM also helps in sub-functional domains like construction.

Various studies in the literature define TQM from multiple perspectives; for example, the Deming approach, 1986 emphasized the importance of top management responsibilities, while Juran's approach, 1993 emphasized QC circles and self-managing teams. In addition, Feigenbaum's approach emphasized setting quality standards, while Ishikawa's approach, 1985 studied cause-and-effect relationships using statistical approaches.

TQM has been largely regarded as a winning management philosophy that can be successfully implemented in the construction business (Elghamrawy & Shibayama, 2008). The TQM technique should be emphasized in the construction industry to increase quality and productivity while eliminating waste (Harrington et al., 1992). Significant economic gains can be obtained by applying and quantifying TQM procedures (McIntyre et al., 2000).

According to Ngowi (2000), TQM is an integrated strategy that takes into account cultural values and assumptions in a way that allows cultural values to be successfully hosted by organizational practices. Improvements in commitment, quality strategy planning, customer focus, project management, and quality data analysis are among the most important steps (Liao et al., 2018).

Additionally, Al-Tayeb (2008) researched TQM to identify critical success criteria and create a model for incorporating TQM into the planning, design, and construction of a variety of projects in the Gaza Strip. The questionnaire served as a means of gathering information. The research uncovered 8 primary components and 81 secondary factors. In this study, the Pareto principle was utilized to determine which aspects of TQM adoption on construction projects in the Gaza Strip needed more attention. According to the findings, 7 Critical Success Factors (CSFs) and 38 essential subfactors are required for TQM to be effectively implemented.

Based on AL-Sehali (2001) study, the overarching goal of the research was to create a framework for implementing TQM in the construction industry in Bahrain through the creation of a dynamic specifications model to enhance construction performance, improve the relationship between consultants, clients, builders, and suppliers, keep costs under control, and lessen the number of disputes, claims, and

variations that occur during construction. Landin (2000) examined how QM is used in Swedish construction and its effects. To cover the entire construction process, many companies were studied from different categories. The main methodologies were interviews, key factors, and ISO 9001 data sorting. QM was found to boost efficiency and competitiveness. Inspections started most QMs, likely because of customer needs.

Companies had trouble sourcing resources for these examinations, making them useless. Over time, ISO 9001 acceptance increased. Companies didn't use all components of ISO 9001 because they didn't value them equally. In conclusion, ISO 9001-based quality systems in construction were utilized to varied degrees and were gaining acceptance.

Many firms' QM implementations fail due to implementation challenges (Yusoff et al., 2006). Poor management and staff attitudes, limited resources, training, and surroundings hinder implementation (Willar, 2012).

Yusoff et al., (2006) listed QM's challenges as high cost, especially initial cost, resistance to change, loss of productivity due to learning the new system, management interference, limited ability of personnel, remote job sites that are hard to control, and communication issues within the workforce.

Abdul-Rahman and Tan (2005) identified several barriers to implementing TQM on construction sites: too much paperwork, a transient workforce, field employees viewing TQM as irrelevant, difficulty measuring results, low bids, and subcontractors and suppliers not interested in TQM.

TQM implementation requires identifying key elements. Saraph et al., (1989) identified eight TQM CSFs in their QM instrument. Their study influenced further studies, which developed distinct frameworks based on diverse views (Zhang, 2000).

Although these frameworks have distinct TQM techniques, they all emphasize leadership, strategic planning, customer and market focus, human resources focus, process management, continuous improvement, and supplier management (Dale, 2003).

An exhaustive analysis of TQM literature from quality leaders, quality award models, and QM studies in the construction industry yielded the following 26 important factors: Management / Leadership, Quality Department Role, Training, Employee Relations, Information & Analysis, Supplier Quality Management, Product/Service Design, Process Management, Customer Management, Teamwork, Continuous Improvement, Planning, Employee Involvement, Benchmarking/ Deliverables, Vision and Plan Statement, Evaluation, Communication, Statistical Process Control, Learning, Recognition and Reward, Contract Documents, Materials & Equipment, Financial Issuance.

The study reorganized all the factors so that those that dealt with the same difficulties were grouped together. The final list of CSFs for implementing TQM on construction projects was as follows: Top management commitment and leadership, Human resource management, External Customer Focus, Supplier quality management, Process management, Information Analysis and Evaluation, Continuous Improvement, Contract Documents, Materials & Equipment, Financial Issues, Site Layout, Systems Used, and Surrounding Environment. These factors are essential for the successful implementation of TQM on construction projects.

6. Research methodology

The methodology adopted for the study on the introduction of TQM in construction companies in Saudi Arabia, Jeddah, involved a three-phase approach. This study used a cross-sectional approach to examine how TQM influenced construction projects in Saudi Arabia, Jeddah.

The target sample comprised Saudi construction professionals in Jeddah city (Contractors, Consultants, Engineers, and Project Managers). Purposive sampling was used to choose people working in the same construction field. The sample size was selected based on practicality and suitability factors, and a total of at least 120 participants were included in the study.

Participants were recruited by using a combination of convenience and snowball sampling methods. Professional networks, social groups for engineering, and construction sector contacts were used to find the participants. They were then invited to refer to other potential individuals who satisfy the crite-

ria for inclusion. Efforts were made to ensure gathering information on project types, sizes, and geographic locations in Saudi Arabia, Jeddah.

The questionnaire addressed several aspects of TQM and its impact on construction projects, such as quality improvement, project performance, client satisfaction, cost control, and employee engagement. On a Likert scale, participants were asked to score their agreement or disagreement, and they were also given a chance to contribute additional comments and observations.

The study was conducted in accordance with ethical standards. Participants were informed about the research objectives, their voluntary involvement, and the confidentiality of their responses. All participants were asked to provide their informed consent before beginning the questionnaire. Personal identifying information was kept confidential, and data was anonymized and aggregated for analysis.

- The first phase was the preliminary phase, which presented different sources of information. This phase involved a comprehensive literature review of previous studies on TQM in construction projects in Saudi Arabia, Jeddah and other countries to identify best practices and key factors affecting project performance.
- The second phase involved the development of a questionnaire. The questionnaire was designed to gather information on the current use of TQM practices in construction projects in Saudi Arabia, Jeddah. The questionnaire included questions on various aspects of TQM, such as quality management, continuous improvement, customer focus, leadership, and employee involvement.
- The third phase involved data collection and statistical analysis. The data collected through the questionnaire was analyzed using the Statistical Package for Social Sciences (SPSS) to identify the relationship between adopting TQM practices and project outcomes such as quality, costs, customer satisfaction, completion time, and employee engagement.

The main outcome of this study was to develop a model for the introduction of TQM in construction companies in Saudi Arabia. The methodology adopted for the study was designed to gather comprehensive information on the current state of TQM practices in construction projects in Saudi Arabia, Jeddah

city identify areas for improvement, and develop a model or a set of guidelines for introducing and implementing TQM practices. Overall, the methodology involved a combination of literature review, questionnaire development, data collection, and statistical analysis.

The questionnaire was gathering information on TQM practices in construction projects. The study used the results to identify areas for improvement and develop guidelines for introducing TQM practices.

7. Research limits

This study evaluated the impact of the application of TQM on construction projects in Saudi Arabia in Jeddah city by analyzing several influencing factors, such as communication and Top Management Commitment & Leadership, Training and Process Management & Execution .. etc.. by targeting a group of at least 120 individuals working in the construction sector and contracting companies, consultant engineering offices, and project management offices including (Project Managers, Quality Managers, Engineers, Inspectors) in Saudi Arabia, Jeddah city through an electronic questionnaire that was distributed between July and August of 2023.

8. The general perception of the research structure

This research investigated how TQM influenced construction projects in Saudi Arabia, Jeddah city, by stating the key components of TQM. It also evaluated the key factors that impacted the implementation of the TQM within construction projects in Saudi Arabia, Jeddah. The questionnaire assessed each factor from Project Office Perspective and their experiences in the project, which made the research conclude the problems and their solutions from the same perspective.

9. Data Analysis and Discussion

A total of 150 samples were collected for the present study to determine the essential elements of Total Quality Management (TQM) implementation in construction projects in Saudi Arabia, Jeddah City. Jeddah area respondents constituted 93% of the total, while other province respondents made up 7% of individuals who participated in the study. Within the sample population, it was found that 43% of the respondents were affiliated with the specified category. In the age range of 26-35 years, 20% of individuals fell under this demographic. approximately 19.5% of individuals fell into the age group of 51-65 years. Approximately 17.5% of individuals fell into the age range of greater than 65 years. The participants in the study were chosen from a certain population. Construction sites typically employ a range of experts, including individuals holding designations such as project managers and contractors. The individual possesses expertise in engineering and consulting. Within the sample population, 35.4% of individuals in the surveyed population hold the occupation of project manager, while 23% were employed as engineers. Additionally, 36% of respondents were engaged in another occupation. Among the individuals involved in the project, the majority, precisely 93%, were contractors, 5% were consultants, and the remaining 2% held supervising positions. Moreover, it is worth noting that 41% of the participants possessed a professional background ranging from 5 to 10 years of experience. Approximately 39% of individuals possessed job experience ranging from 15 to 20 years. In addition, A majority of the participants, precisely 51%, reported having previous experience in the private construction sector. A significant proportion of individuals, precisely 49%, have been employed in the field of public construction. The samples were obtained from individuals fulfilling the role of project managers. The individuals involved in high-level projects include contractors, engineers, and consultants. The net-worth projects vary in value from 500 million Saudi Riyals to 1 billion Saudi Riyals. Saudi Arabia, Jeddah is the country under consideration.

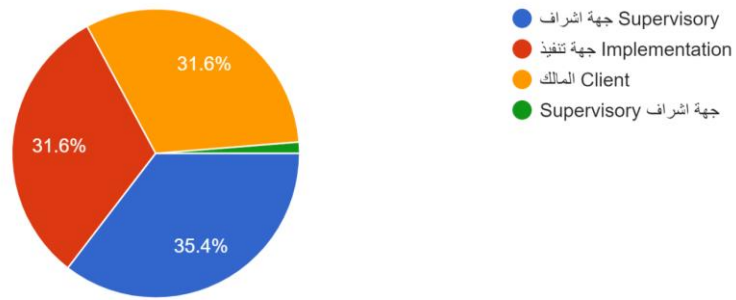


Figure 1.0: Distribution of Organizations Based on Type

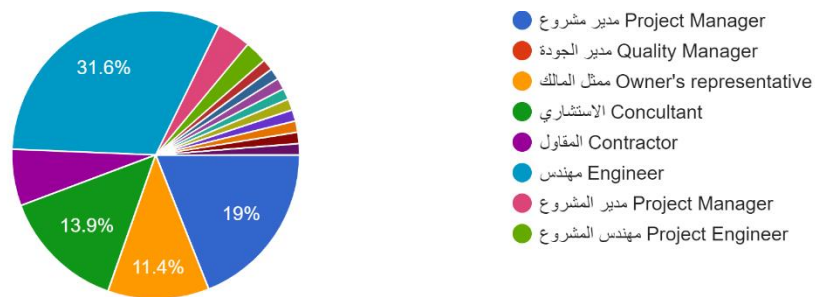


Figure 2.0: Distribution of Job Positions

9.1 Data Measurement

This study employed a descriptive, analytical approach to achieve its objectives. A total of 200 questionnaires were distributed to engineering firms, construction companies and real estate developers in Jeddah city, and 160 responses were retrieved, and 6% were not related to Jeddah city, so the number that was analyzed became 150 questionnaires, which were suitable for statistical analysis, with a rate of (75%) of the number of distributed questionnaires. The data collected from the questionnaires was analyzed using the Statistical Package for the Social Sciences (SPSS) software and the Relative Importance Index (RII) and mean values method.

The questionnaire was designed to allow respondents to express their opinions using a Likert scale, which was considered the most appropriate method for analyzing the data. The ordinal scales, or Likert scales, were structured as shown in Table 1.0

Statement	Completely Agree	Mostly Agree	Slightly Agree	Mostly Disagree	Completely Disagree
Scale	5	4	3	2	1

Table 1.0 Likert scale

9.2 Questionnaire Model

In this study, the questionnaire was designed to streamline the data collection process and enhance the reliability and validity of the information obtained from the participants. The questionnaire was divided into several sections, each addressing specific topics. The first section focused on the characteristics of the respondents, including their organizational affiliation, academic qualifications, experience, and job title. The second section consisted of questions to assess the respondents' perceptions of upper management's failure to adhere to the principles of total quality management.

9.3 Validity of Questionnaire

The term validity refers to the degree to which an instrument accurately measures what it is intended to measure. Validity encompasses several different aspects and evaluation methods. Additionally, statistical validity was used to assess the validity of the instrument, including internal and construct validity.

9.4 Internal Validity

The validity of the internal consistency of the paragraphs of the questionnaire was confirmed by two arbitrators. The stability of the questionnaire was also confirmed by measuring the Cronbach alpha coefficient to ensure that it is statistically significant. The results are as follows in Table 2.0:

#	Value	Alpha value
1	Senior management commitment	0.840
2	Empowering employees	0.827
3	Clint Satisfaction	0.832
4	Operations Management	0.779
5	Construction project design	0.788
6	Continuous improvement	0.801
7	Cost management	0.753
8	Education and training	0.739
9	Quality management	0.734
10	Quality of construction project. Implementation	0.803

Table 2.0 The internal consistency coefficient values for the items of the independent and dependent variable

It is clear from the above table that the values of the Cronbach alpha internal consistency coefficient for all items of the study tool ranged between 0.840 and 0.741, where the stability coefficient is considered weak if the coefficient values are less than 0.60. Bougie, 2010 assumed that the minimum stability coefficient is 0.70. The stability is very good whenever the coefficient values are 0.8 or more. Therefore, these dimensions indicate the stability of the study tool and the consistency between its paragraphs, its reliability, and the possibility of relying on it to conduct the statistical analysis.

The researchers showcased the findings of the questionnaire analysis in Table 3.0 in accordance with the questionnaire.

Q. No	Items	No	Mean	Normative deviation	T-value	Degree of freedom	Sig.	Degree of acceptance
1	Senior management commitment	150	2.8759	.6881	22.494	120	.000	Natural
2	Empowering employees	150	2.9937	.4256	37.875	120	.000	Natural
3	Clint Satisfaction	150	3.4559	.4846	6.594	120	.000	agree
4	Operations Management	150	3.0065	.5431	.063	120	.950	Nature
5	Construction project design	150	3.0201	.7710	.140	120	.889	Nature
6	Continuous improvement	150	2.8889	.5665	-1.056	120	.300	Nature
7	Cost management	150	3.5000	.3908	6.889	120	.000	Agree
8	Education & training	150	2.443	.6724	-4.419	120	.000	Disagree
9	Quality management	150	2.9598	.5953	-.364	120	.719	Nature
10	Quality of construction project Implementation	150	3.0246	.4371	.303	120	.764	Nature

Table 3.0 Data analysis of TQM elements

The questionnaire findings revealed that top management commitment and leadership positively affect employee satisfaction, with a p-value of less than 0.05. However, the mean response for the questionnaire survey was 2.8, indicating that top management lacks knowledge of the concept of Total Quality Management (TQM). This is because most construction firms are privately owned, and the top management is the owner of the company, who may not have much experience or learning opportunities.

The findings also showed that supplier quality management positively affects client satisfaction, with a p-value of less than 0.05. However, the long-term cooperative relationship with suppliers is not based on product quality, but rather on low price. This results in poor product quality as suppliers that can produce high-quality products often require immediate payment, which many firms cannot afford.

The questionnaire also revealed that project design has a positive effect on the quality of project implementation, with a p-value of less than 0.05. The mean response for the questionnaire survey was 3.5, indicating that companies pay attention to producing quality designs by reviewing project designs before construction and making preliminary project designs. Coordination and participation among various departments in project development is an important component for producing quality projects.

Finally, the total mean for employee participation was 3.5, equal to the assumed mean of 3. However, the questionnaire survey data provided no significant statistical support for the hypothesis that participation and teamwork have a positive effect on employee satisfaction. This may be due to the fact that employee participation in their respective firms was "forceful" and not based on free will, decisions were made individually by top management only, and most employee recommendations and views were ignored. The questionnaire findings revealed that the total mean for the scale 5 for construction project design participation was equal to the assumed mean of 3, indicating that construction project design positively affects employee satisfaction ($p < 0.05$). In the construction industry in Saudi Arabia, it is necessary to implement a policy of recognition and reward, which may include public recognition, salary increases, promotions, bonuses, and non-monetary rewards. However, the survey response shows that reward and recognition are absent due to a focus on individual performance, related evaluation, and reward practices.

The total mean for the scale 6 empowerment & involvement was 2.8, less than the assumed mean of 3. The questionnaire findings revealed that empowerment & involvement positively affect employee satisfaction ($p < 0.05$). However, decisions are often made individually by top management only, and most

employee recommendations and views are ignored. In most companies, the owner of the company is also its director.

The questionnaire findings also revealed that change design has a negative effect on employee satisfaction ($p < 0.05$), with a mean response of 3.5. This indicates that changes in design can negatively impact employee productivity and interaction with work. Some problems in Saudi's construction industry related to changes in design include project delays and decreased quality. It is necessary to implement a special program for employees to deal with design changes.

Quality Management was found to positively affect employee satisfaction ($p < 0.05$), with employees having the capacity to perform their jobs better with proper training and education. However, in Saudi construction firms in Jeddah city, the mean response for the questionnaire survey was 2.4, indicating a lack of education and training in these firms. This may be due to factors such as reliance on local materials, low profits, and unwillingness to spend money on training. Finally, Quality Management was found to have a positive effect on Quality Management ($p < 0.05$), with a mean response of 2.9, indicating some interest by companies in focusing on clients. This interest is shown through the provision of warranties on project implementation. To improve client focus, it is necessary to collect extensive complaints and conduct client satisfaction surveys.

10. Conclusion

Most Saudi construction in Jeddah city enterprises lack TQM, according to data. This study found that TQM improves construction workgroup satisfaction, project quality, client satisfaction, and project implementation. TQM reduces time, and cost, and improves project quality and construction project performance. These results can help contractors see how TQM improves project performance. The study concluded that top management commitment and leadership, empowerment & involvement, participation, recognition & reward, education & training, and change of design improve employee happiness. Top management commitment, staff participation, and cooperation do not improve construction project performance. Supplier quality management improves customer satisfaction, while project design and client attention enhance the quality of implementation. Data analysis also showed that senior management does not learn most TQM concepts, salaries are cheap, incentives and training are scarce, and im-

ported materials are inadequate. This data helps the authors discover TQM processes to improve construction project performance. This research also shows that project teamwork satisfaction improves client satisfaction and construction project execution but not performance. Client satisfaction does not affect construction project implementation, but quality does. Finally, this study found valid and trustworthy methods to measure total quality management and project performance, which other researchers can use to assess its effects on building projects. Total Quality Management involves managing and improving construction projects to meet time, clients, profits, costs, safety regulations, and management and reliability within cost, time, and quality constraints. The preponderance of respondent judgments showed that top management's lack of commitment reduces TQM implementation in building projects. This descriptive-analytical study used SPSS, RI, and mean values to examine the importance and impact of TQM in construction. Data was collected from engineering firms and companies via questionnaires. The results showed how important TQM is for Saudi construction projects in Jeddah city.

11. Recommendations

In light of the findings and interpretations of the study, several suggestions can be made concerning the application of TQM in the building and construction industry in Saudi Arabia, Jeddah city. Companies that perform contracting or consulting work should develop quality management systems (QMS) that are compliant with the criteria of international quality standards. To be successful in achieving quality improvement, cooperation from all parties involved in the construction industry is required. These parties include owners, designers, supervision staff, and contractors, all of whom should collaborate to build and spread quality awareness.

It is also vital to research the cost of each TQM success factor and utilize the results of this study to construct an optimization model in order to determine the element that has the largest effect on TQM implementation while at the same time having the lowest cost. The lessons that were learned throughout the process of implementing TQM ought to be completely documented and reviewed in a methodical manner. Drawings, specifications, bills of quantities, and other design papers received from the designer

all impact the building projects' quality. These documents should be clear, concise, and standard. Developing regional standards to establish minimum quality criteria and procedures for measuring them needs to be done.

Contracts should not be awarded to the lowest bidder if their price is lower than the project's fair estimate. This is due to the fact that many projects have been delayed and suffered from quality difficulties. Owners and consultants who seek good quality should not award contracts to the lowest bidder. It is important to select, in order to serve as supervisors, a group of experts who are both highly motivated and talented. After a product has been delivered to customers and utilized by those customers, there should be an emphasis on warranty maintenance to ensure continued high quality. This is not something that can be found in any TQM materials.

In conclusion, it is strongly suggested that master specifications be developed for the construction sector in Saudi Arabia, Jeddah. These specifications ought to divide projects into small, medium, and large projects as well as normal, complex, and specialized projects, taking into consideration the construction techniques utilized in the Saudi Arabian construction industry, the level of craftsmanship, the workmanship, the availability of raw materials, and the fact that construction takes place in a hot climate.

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Appendix Questionnaire in English and Arabic languages

(أثر تطبيق إدارة الجودة الشاملة على مشاريع البناء السعودية في مدينة جدة)

السادة الكرام تحية طيبة وبعد

يهدف هذا الاستبيان إلى تقييم أثر تطبيق إدارة الجودة الشاملة في مشاريع البناء السعودية في مدينة جدة وتحديد العوامل المؤثرة في تحسينها.

يعتبر هذا الاستبيان جزءاً من بحث التخرج لنيل درجة الماجستير في تخصص إدارة المشاريع - جامعة ميد أوشن. إن هذا الاستبيان موجه إلى المكاتب الاستشارية الهندسية وشركات المقاولات والمطورين العقاريين والمهندسين ومدراء المشاريع العاملين في قطاع الإنشاءات والتشييد في المملكة العربية السعودية في مدينة جدة.

نرجو منكم تعبئة هذا الاستبيان بالحقائق المناسبة والدقيقة قدر الإمكان، حيث إن جميع المعلومات الواردة في هذا الاستبيان ستستخدم فقط لأغراض هذا البحث وسيتم نشر النتائج على شكل نتائج إحصائية.

شاكرين لكم دعمكم الكريم،

القائمين على البحث

المهندس أيمن عفيف، المهندس ريان الحجاجي، الأستاذ قاسم العيسى

إشراف

الدكتور وليد صديق

(The Impact of the Application of Total Quality Management on Saudi Construction Projects in Jeddah City)

Greetings,

The goal behind the questionnaire is to evaluate the impact of the application of Total Quality Management on construction projects in Saudi Arabia in Jeddah city and identifying the factors affecting its improvement. This questionnaire is part of the supplementary research for obtaining a master's degree in the field of project management Midocean University. This questionnaire is addressed for engineering offices, contractor companies, engineers, project managers and real estate developers in the construction sector in Saudi Arabia, Jeddah City.

We would like you to fill out this questionnaire with appropriate and accurate facts as much as possible, as all the information contained in this questionnaire will be used only for the purposes of this research and the results will be published in the form of statistical results.

Your kind support is highly appreciated.

The researchers

Eng. Ayman Afeef, Eng. Rayan Alhajjaji, Mr. Qasem Aleissa

Supervisor

Dr. Walid Seddik

2.1 Employer جهة العمل

- ☐ Supervisory جهة إشراف
- ☐ Implementation جهة تنفيذ
- ☐ Client المالك

2.2 Job Title المسعى الوظيفي

- ☐ Project Manager مدير مشروع
- ☐ Quality Manager مدير الجودة
- ☐ Owner's representative ممثل المالك
- ☐ Consultant الاستشاري
- ☐ Contractor المقاول
- ☐ Engineer مهندس
- ☐ Other: _____

2.3 Qualifications المؤهل العلمي

- ☐ PH. D دكتوراة
- ☐ Master ماجستير
- ☐ Bachelor بكالوريوس
- ☐ Diploma دبلوم
- ☐ High School ثانوية عامة
- ☐ Other: _____

2.4 Specialization التخصص

- ☐ Civil Engineering هندسة مدنية
- ☐ Architectural Engineering هندسة معمارية
- ☐ Mechanical Engineering هندسة ميكانيكية
- ☐ Electrical Engineering هندسة كهربائية
- ☐ Safety Engineering هندسة السلامة
- ☐ Other: _____

2.5 Age and year العمر

- ☐ From 26 to 35
- ☐ From 36 to 50
- ☐ From 51 to 65
- ☐ Above 65 age years

2.6 Total Years of Experience إجمالي سنوات الخبرة

- ☐ أقل من 5 سنوات - Less than 5 years
- ☐ 5-10 سنوات - 5-10 years
- ☐ 11-15 سنة - 11-15 years
- ☐ أعلى من 15 سنة - Above 15 years

2.7 Type of project نوع المشروع

- ☐ Buildings مباني
- ☐ Infrastructure بنية تحتية
- ☐ Other: _____

2.8 Firm Size حجم الشركة

- ☐ صغيرة (6-49) - Small (6-49)
- ☐ متوسطة (50-249) - Medium (50-249)
- ☐ كبيرة (أكثر من 250) - Large (Above 250)

2.9 Project Location موقع المشروع

- ☐ مدينة جدة Jeddah City
- ☐ Other: _____

2.10 Project Value قيمه المشروع

- ☐ أقل من 100 مليون رس Less than 1M SR
- ☐ ما بين 100-500 مليون رس 100to500M SR

○ أكثر من 500 مليون رس More than 500M SR

3.0: Evaluation of the level of implementation of total quality management in Saudi construction

تقييم مستوى تطبيق إدارة الجودة الشاملة قطاع الإنشاءات في السعودية في مدينة جدة sector

Item No	Description	1	2	3	4	5
		Strongly Disagree	Disagree	Natural	Agree	Strongly agree
3.1	The company has a clear vision to implement total quality management لدى الشركة رؤية واضحة لتطبيق إدارة الجودة الشاملة					
3.2	The company has a quality guide (policies, standards or plans) يوجد لدى الشركة دليل للجودة (سياسات او معايير أو خطط)					
3.3	Senior management verifies the commitment of all stakeholders in the project to implement total quality management policies تتحقق الإدارة العليا من التزام جميع المعنيين في المشروع من تطبيق سياسات إدارة الجودة الشاملة					

3.4	The company is keen to increase the participation of its employees in decision-making. تحرص الشركة على زيادة مشاركة العاملين لديها في اتخاذ القرارات					
3.5	The company applies clear and specific operations management procedures to accomplish the required work تطبق الشركة إجراءات إدارة العمليات بشكل واضح ومحدد لإنجاز الأعمال المطلوبة					

Section 4.0 Factors affecting the improvement of project quality العوامل المؤثرة في تحسين جودة المشروع

Item No	Description	1	2	3	4	5
		Strongly Disagree	disagree	natural	agree	strongly agree
4.1	Comprehensiveness, coherence and clarity of project design schemes شمولية وترابط ووضوح مخططات تصميم المشروع					
4.2	The presence of a competent body that audits the design plans. وجود جهة مختصة تقوم بتدقيق مخططات التصميم					
4.3	The contract documents are clear and contain all the required details. وضوح مستندات العقد واحتوائها على جميع التفاصيل المطلوبة					

4.4	The use of modern technologies in design and its compatibility with the Saudi Building Code استخدام التقنيات الحديثة في التصميم وتوافقه مع كود البناء السعودي					
4.5	Improve project quality by the lessons learned from the past project's successes and failures. تحسين جودة المشروع من خلال الدروس المستفادة من نجاح وفشل المشاريع السابقة.					

Section 5.0 Factors affecting project cost reduction العوامل المؤثرة على تخفيض تكلفة المشروع

Item No	Description	1	2	3	4	5
		Strongly Disagree	disagree	natural	agree	strongly agree
5.1	Application of value engineering with an eye on performance and quality improvements تطبيق الهندسة القيمة مع مراعاة تحسين الأداء والجودة					

5.2	Give the design stage enough time to reduce design risks, the most important of which is the unjustified extra cost. إعطاء مرحلة التصميم الوقت الكافي لها للحد من مخاطر التصميم وأهمها التكلفة الزائدة الغير مبررة					
5.3	Reducing the demand for change orders in project documents, which increases the value of the project. الحد من طلبات التغيير في وثائق المشروع مما يزيد من قيمة المشروع					
5.4	Comprehensiveness and accuracy of project bills of quantities and their inclusion of all details شمولية ودقة جداول كميات المشروع واحتوائها على جميع التفاصيل					
5.5	Awarding the specialized works in the project with a direct contract with the specialized authority to implement them. ترسية الأعمال المتخصصة في المشروع بعقد مباشر مع الجهة المتخصصة لتنفيذها					

Section 6.0 Factors affecting customer satisfaction العوامل المؤثرة على رضا العميل

Item No	Description	1	2	3	4	5
		Strongly Disagree	disagree	natural	agree	strongly agree
6.1	The implementing agency's commitment to the project schedule التزام الجهة المنفذة بالجدول الزمني للمشروع					
6.2	Deliver the project according to the specified budget تسليم المشروع وفق الميزانية المحددة					
6.3	Deliver the project according to the required quality تسليم المشروع وفق الجودة المطلوبة					
6.4	Take effective communication actions to consider the owner's needs اتخاذ إجراءات التواصل الفعال لاعتبار احتياجات المالك					

6.5	Optimal use of resources to achieve the benefit of the project استغلال الموارد بالشكل الأمثل لتحقيق المنفعة من المشروع					
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Section 7.0: If there are other important elements in implementing of total quality management on Saudi projects, please mention them.

إذا كانت هناك عناصر أخرى مهمة في تنفيذ إدارة الجودة الشاملة على المشاريع السعودية في مدينة جدة، فيرجى ذكرها

Optional questions are not mandatory - أسئلة اختيارية غير إلزامية.

7.1 What are the factors affecting improving the quality level in Saudi construction projects?

ما هي العوامل التي تؤثر على تحسين مستوى الجودة في المشاريع الإنشائية السعودية

7.2 What are the factors affecting the cost reduction of Saudi construction projects?

ما هي العوامل التي تؤثر على خفض تكلفة المشاريع الإنشائية السعودية

أثر تطبيق إدارة الجودة الشاملة على مشاريع البناء السعودية في مدينة جدة

إعداد الطلاب

القائد/ أيمن عفيف (الرقم الجامعي 221002396)

العضو/ ريان الحجاجي (الرقم الجامعي 221000585)

العضو/ قاسم عيسى (الرقم الجامعي 221002208)

إشراف

د. وليد صديق

العام الدراسي

2023