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Institute of Graduate Studies
Civil Engineering

**IMPROVING THE PERFORMANCE OF IRAQI
CONTRACTING COMPANIES BY APPLYING
THE TOTAL QUALITY MANAGEMENT
SYSTEM**

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Master's Thesis

Supervisor

Assoc. Prof. Dr. Sepanta NAİMİ

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The thesis titled IMPROVING THE PERFORMANCE OF IRAQI CONTRACTING COMPANIES BY APPLYING THE TOTAL QUALITY MANAGEMENT SYSTEM prepared by ALI AL-JABERI and submitted on 17/04/2023 has been **accepted unanimously** for the degree of Master of Science in Civil Engineering

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Signature

DEDICATION

I want to express my gratitude to my parents, who have always been there for me and done the most for me. I couldn't have finished my task without their constant encouragement and positive reinforcement. It would be inexcusable of me not to explain to my closest friends and family how much I value their understanding and encouragement. Whether I was pleased or sad, they were there to cheer me up and tell me I could do anything. Lastly, I'd like to express my gratitude to everyone who helped keep me from feeling alone and isolated during my time here.



PREFACE

Before anything else, I'd like to give thanks to God for blessing me with the perseverance and fortitude to succeed in my endeavour. Thereafter, I'd want to express my deepest gratitude to my supervisor, for his unending guidance and support during the duration of the project, as well as for his patience, inspiration, and wealth of knowledge. Under his guidance, I've been able to become more independent as I've conducted research for my thesis. I hope the best for him in anything he does. I'd also like to express my gratitude to the other members of my thesis committee for their insightful criticism and assistance. Furthermore, I'd like to express my gratitude to everyone who has ever believed in me or supported me as I worked toward my goal of earning a college degree. One final thing I'd want to say is how grateful I am to my fellow master's students and to my co-workers for their moral and emotional support during my thesis writing and research process.

ABSTRACT

IMPROVING THE PERFORMANCE OF IRAQI CONTRACTING COMPANIES BY APPLYING THE TOTAL QUALITY MANAGEMENT SYSTEM

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Knowledge of the ideas of quality as well as the stages of its growth in order to achieve overall quality gained through the use of Arabic and foreign language sources in the course of the research Identifying the ISO standards, their relevance to comprehensive quality management and the methods by which contracting firms might receive them are discussed Positioned on the reality of the implementation of total quality management systems in contracting organizations, diagnosing weaknesses and strengths in the application through a questionnaire, and then interpreting the results, drawing judgments, and making solutions to prevent these problems In the current era, quality management has been one of the ideas and trends that has taken a comprehensive look at operations management and has had a significant impact on most businesses and services A total quality management approach is based on preventing errors until they occur, focusing on work and procedures together, making decisions based on facts, leveraging the expertise of the workforce, reducing complaints from customers, and rewarding employees who contribute to quality management and development efforts Individuals who did not adhere to all the specification's guidelines when creating things did not effectively employ the specification when creating things. so, there are issues with the way the specification is used during data analysis. And companies that did not match the standards at this phase do not receive the same outcomes as those that did. Some businesses at the planning stage exhibited a

shortcoming in their specification usage. Thus, they did not adhere to the specifications currently and do not appear to care about the specification's safety rules, as the majority of enterprises did not. This demonstrates that people are unconcerned with the specification's rules.

Keywords: TQM, Management, Planning, Performance, Iraqi Contracting Companies.



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ABBREVIATIONS

DMAIC	: Define-Measure-Analyze-Improve-Control
IPC	: Improving Performance of Iraqi Contracting Companies
IQ-TC	: Iraqi Contracting Companies
ISO	: International Organization For Standardization
JIT	: Just-In-Time Manufacturing
KPI	: Key Performance Indicators
PDCA	: Plan-Do-Check-Act Cycle
PDSA	: Plan-Do-Study-Act Cycle
QM	: Quality Management
ROI	: Return on Investment
SCM	: Supply Chain Management
Six Sigma	: A Set of Techniques And Tools For Process Improvement
SPC	: Statistical Process Control
TPMS	: Total Quality Management System
TQM	: Total Quality Management

1. CHAPTER ONE

1.1 INTRODUCTION

More mass manufacturing and more firms have emerged because of advancements in technology. In a competitive market, customers may more easily compare products based on both quality and price. There are three things' companies need to make sure of to make a profit in today 's economy: time, price, and quality. "The demand for the goods" is what most people think about when they talk about quality. However, there are other benefits for companies that can come from it, too. These include reduced waste and increased profits. From manufacture to sales to technical assistance after the sale, those that succeed today ensure that quality is a part of every step. As a result, they ensure that quality is ingrained in the company's corporate DNA. "Total Quality Management" refers to this method of thinking. What it is called that is depending on how well things work (TQM) [1].

Although TQM was first employed in the manufacturing business, the concept is now also being applied to the service industry. Each project in the construction business is unique, and there are many people engaged, as well as environmental and formal rules that affect the projects. They employ TQM for display, according to the literature review. We are going to investigate how TQM is implemented in the Iraqi construction business, what variables make it successful, and what issues it has. In addition, it will give firms advise on how to avoid these issues by highlighting the weaknesses in their implementation of TQM. Participants in this study completed a four-part questionnaire. Chapter one, "Introduction," begins with an explanation of the significance of this study and what it will accomplish. This will be one of chapters. It reviews the history with quality, TQM definition, concepts, gurus, quality techniques, and how to apply TQM in the construction business. Third chapter of thesis summarizes previous studies on TQM in construction and other industries. In the fourth chapter, "Material and Method," the study's sample size, collection methods, and data analysis are discussed. All this information may be found in the fifth chapter, "Results & Discussion," which includes findings from reliability/normality tests as well as demographic information about respondents [2]. There are a few things to keep in mind when reading through the conclusion and recommendations section of your thesis. Customers' happiness is a measure of quality in Iraq's building sector. When it comes to top management

dedication and leadership, there are certain issues with TQM. "Customer satisfaction" is the most significant benefit of TQM.

1.2 QUALITY'S EVOLUTION THROUGH HISTORY

Quality is an old idea. Historians know that the idea of quality originally appeared in Babylonia before 2150 B.C., referencing Hammurabi's order that states, "The builders who build a house that falls down and murders the people must be put to death." The historical rise of quality simply didn't happen immediately; rather, it progressed through four stages, as follows:

- a. Inspection
- b. Quality Control (QC)
- c. Quality Assurance (QA)
- d. Total Quality Management (TQM)

Summarized those stages and categorized them into two types, as indicated in Figure 1.1 [3]: reactive, that focuses on detecting and repairing problems, and proactively, which focuses on preventing challenges from the beginning [4].

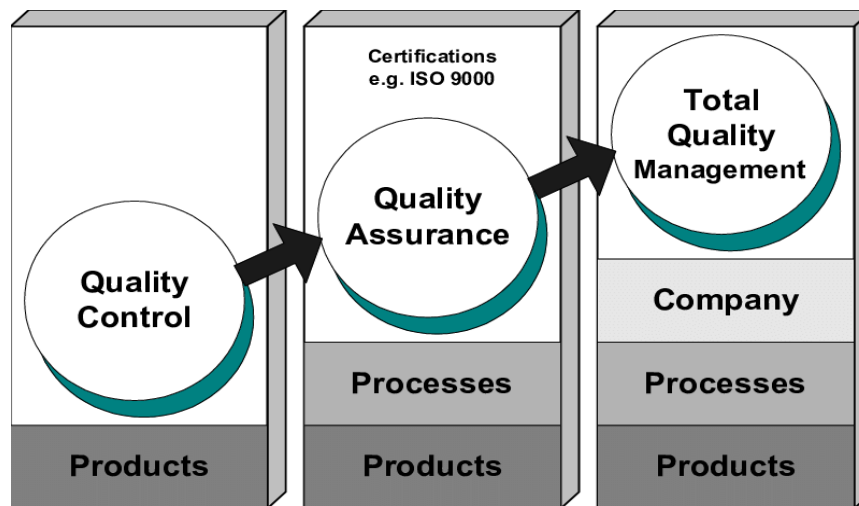


Figure 1.1: Progress of Quality Management [3].

1.2.1 Inspection

Inspections are conducted to undertake a thorough examination of a process, a product, or a service in order to assess whether or not it complies with preset specifications. "A complete examination, testing, formal evaluation, and overall appraisal of an item or service in order to establish whether or not it meets predefined requirements," as defined in Figure 1.2 [3], is the definition of inspection [5].

This stage began in the 1910s, when the Ford Motor Company hired teams of inspectors to check on the quality of the T-model automobiles that were being manufactured at the time. To accomplish this, we needed to identify low-quality products and separate them from that of acceptable quality. We were able to accomplish this by conducting an extensive inspection.

The argument is that "examination with the goal of detecting faulty products and rejecting them is too late, ineffective, and costly" since it results in waste, which raises costs that are reflected in the price that the consumers are willing to pay.



Figure 1.2: Construction Inspection Quality Management [12].

1.2.2 Quality Control (QC)

At the dawn of the twentieth century, as production processes evolved, we entered this phase. Control is defined as "the process of allocating power and responsibility for such a strategic planning while preserving the method of monitoring accurate result." The following are the processes that make up this broad description, which may be used to describe anything from products to services [6].

- a. Establishing benchmarks.
- b. Evaluating conformance.
- c. Acting When It's Necessary
- d. Improvements are being planned.

Quality Control is defined by the International Organization for Standardization (ISO) as "operational methodologies and activities performed to achieve quality criteria." Quality control can be defined simply "the regulatory system through which we analyze true results, compare that to standards, and respond to any divergence between both the two." Invented by Shewhart, the control chart and the Dodge-acceptance principle Roming's sampling approach contributed to the development of this stage to a greater extent than the proposed system allows, Figure 1.3 below [7].



Figure 1.3: Quality Control [7].

1.2.3 Quality Assurance (QA)

"All the organized and coordinated operations carried out and validated as necessary within the quality system to provide entire assurance that a unit will fulfill criteria for quality," is how the ISO defines Quality Assurance (QA). Because Quality Control concentrates on finding faults after they've occurred, whereas Quality Assurance stresses preventing defects from occurring in the first place, many construction and engineering experts mistake the two terms. He stressed the significance of Quality Control as an integral aspect of any QA program [8].



Figure 1.4: Quality Assurance [7].

1.2.4 Total Quality Management (TQM)

Total Quality Management, the final phase in the quality growth, necessitates the understanding and application of quality management theories and guidelines in all aspects of corporate activities. Many American professionals have made major contributions to the development of TQM, Figure 1.5 below [7], which can be attributed to their work. The simplest approach to describe TQM is to look at its three components: "Total," "Quality," and "Management" all refer to the process of achieving quality products and services with the participation of everyone. An organization's human and material resources should be used in the most efficient manner possible to meet the organization's goals, according to BSI (British Standards Institution).

ISO defines TQM as a management style that emphasizes quality, and it's supported by the involvement of all its participants and aims for long-term performance providing effective

happiness and benefits to all members of the firm and society. TQM is described as "zero defects in an organization's products and services [9]." A company's product or service should not be affected by a company's inability to do things correctly the first time around, which is why it is so crucial to focus on quality in all parts of a company's operation. Customer demands and company goals are linked, TQM is "a corporate business management philosophy," according with British Quality Association. Use it in the workplace as well as the workplace. TQM, in Oakland's opinion, is a management method aimed at improving the overall efficiency, flexibility, and productivity of a corporation. It's just as relevant in the service sector as it is in the manufacturing sector. It involves the organization of entire corporations at all levels, in all departments, and in all activities.

Total Quality Management (TQM) is a management style that encompasses all levels of a company and emphasizes customer experience through all the concept of continual improvement. It's critical to define "client" and that there are no misconceptions. Internal and external customers are two types of customers that an organization might have, and both types are important to the success of the company. One is an external customer if they use the products or services provided by your company and another is an inside customer if they are both employees of your firm. When it comes to ensuring customer satisfaction, internal customers are crucial [10].

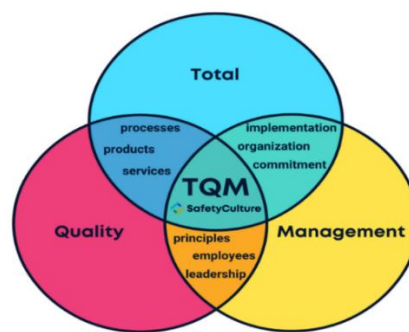


Figure 1.5: Total Quality Management [7].

1.3 RESEARCH PROBLEM

Compressive industry has a tremendous impact on Iraq's infrastructure and economy, and this is well acknowledged by the international community. Despite this, the industry is inefficient, the quality is mediocre, the budgets are fictitious, and the costs are out of control. That is the crux of the problem with this research: There isn't a solution to this problem [11]. The application of total quality management in engineering projects is out of reach for organizations that work on engineering projects because there is no clear explanation of how the requirements of total quality management may be applied in these organizations, nor is there a clear process or approach for how to apply them. The importance of Total Quality Management (TQM) in the management of engineering projects in Iraq can be determined from this point.

1.4 OBJECTIVES AND AIMS OF THE RESEARCH

Deployment of Total Quality Management (TQM) within a construction firm is being examined and investigated with the ultimate purpose of developing recommendations to assist the organization in implementing TQM [12]. Considering this objective, the following objectives have been identified:

- a. The effectiveness of TQM adoption should be evaluated considering the company's internal Critical Success Factors (CSFs).
- b. Secondly, it is necessary to examine the internal challenges that are impeding the organization's ability to implement Total Quality Management (TQM).
- c. Third, to determine the advantages of TQM implementation in the organization.
- d. To give advice to the firm to assist them in implementing TQM.

As a result of a lack of time and resources to include all stakeholders and investigate all related issues, the researcher focuses on and investigates only intra-organizational TQM issues, which are issues that occur within the company. Issues that occur outside the company are excluded from this study.

1.5 QUESTIONS TO DISCUSS

The research's main questions are:

- a. what are the company's internal critical success elements for implementing TQM?
- b. What are the company's internal reservations about implementing TQM?
- c. What are the expected business benefits of using TQM?

1.6 METHODOLOGY OF RESEARCH

This Thesis uses a case study to evaluate and discuss the intraorganizational crucial success elements, issues, and advantages of Quality management in a construction firm [13]. The research project was carried out using the following methods:

- a. conducting moderately questionnaires with management and employees to examine and investigate internal TQM implementation challenges.
- b. As part of the company's TQM implementation, performing a survey to determine employee knowledge and perceptions of quality, teamwork, and job satisfaction.
- c. gaining access to the firm's website and records

Following the inductive approach to data collection, the deductive scientific research methodology was implemented. According to the researcher's examination and interpretation of the data, this reality can be corrected and updated. A random sample of construction companies, consultancy firms, and employers was used to gather data for this study. To get the information, the researcher used a questionnaire, which he or she then gave out to the participants.

1.7 THESIS STRUCTURE

Chapter One: Introduction.

Chapter Two: Literature Reviews, and previous Studies.

Chapter Three: Methodology.

Chapter Four: Resulting and Discission

Chapter Five: Conclusion and Future Research.

2. LITERATURE REVIEW

This chapter offers a condensed overview of TQM in the construction industry, including topics such as its roots, concepts, gurus, quality methods and procedures, including practical implementations.

2.1 INTRODUCTION

Many commercial companies' slogans in recent years have included the word "Quality." It is employed to describe various things in various ways, which might lead to misunderstandings. The term 'Quality' is based on the Latin word 'quails,' which means 'of what kind?' and is used to define the specifications of a service or product in any industry. Quality is a subjective concept that signifies various things to various people, varies by country, and is influenced by level of living, personal gratification, traditions, class structure, and training [14].

Many researchers and groups are working to define quality in a variety of different ways since there is no universally accepted definition of the concept.

- a. The objective of Total Quality Management (TQM) is to ensure that all products and services are of the highest possible quality at all times.
- b. In TQM, all managers and workers use quantitative approaches to continually improve the organization's processes, products, and services in order to fulfill the demands and expectations of customers.
- c. Total Quality Management (TQM) is a management strategy for boosting an organization's overall performance in terms of its efficiency, effectiveness, adaptability, and competitiveness.
- d. TQM emphasizes the value of culture in developing, manufacturing, and enhancing products and services that meet or exceed consumer expectations.
- e. TQM refers to the collective efforts of a company and its processes to provide customers with goods and services that not only meet but also, ideally, surpass their expectations.

According to Arditi and Günaydin (1997), the term "quality" in the construction industry refers to "meeting the requirements of the manager, the designer, the constructor, and the regulatory organizations." Ferguson and Clayton (1998) provided further elaboration on the

quality notion presented before by defining the requirements of each stakeholder [15]. This line of reasoning can be found in Table 2.1.

Table 2.1: Definition of Quality in The Building Business Explained.

Needs	Description
Conforming to the needs of the proprietor.	➤ The project's ability to meet its functional objectives. ➤ Completed on time and under budget. ➤ Care and feeding.
Exactly what the creator had in mind	➤ Making available a detailed breakdown of what will be done. ➤ Allow enough money in the budget to hire and employ a competent team. ➤ Allocate funds to collect sufficient field data before beginning design. ➤ Allowing the owner and the architect sufficient time to reach a conclusion is a priority. ➤ Hire someone to do the work for you for a reasonable price and a good amount of time.
From the accordance with the builder's specifications.	➤ Delivery of Contract Documents, Including Plans and Specifications. detailed enough for the builder to put up a competitive offer or price proposal. ➤ Prompt permission and processing of modification orders by both the owner and the design professional. ➤ Staff in field design and inspections are able to interpret the requirements of the contract fairly and in a timely manner. ➤ Negotiate a timeframe for work to be completed that allows for a fair profit.
Tolerating the needs of government watchdogs.	➤ Observance of all relevant rules, statutes, and policies. ➤ Infrastructure defense includes utility protection. ➤ Keep the public healthy and safe. ➤ Issues related to the environment.

2.2 TRADITIONAL QUALITY DEVELOPMENT

It's not a new idea to talk about quality. The law of Hammurabi, the ruler of Babylonia, that states: "The builders who create a house which comes down and murders the residents must be put to death" (Yldrm, 2002), is cited by historians as evidence that the idea of quality first existed there around 2150 B.C [16].

The historical evolution of quality did not happen overnight; instead, it went through four stages of progress, which can be outlined as following:

- a. Inspection
- b. Quality Control (QC)

- c. Quality Assurance (QA)
- d. Total Quality Management (TQM)

Janakiraman and Gopal (2006) provided a summary of these phases and divided them into two types, as shown in Figure 2.1 [17]: reactive phases, which concentrate on problem detection and resolution, and proactive phases, which aim to prevent problems from occurring in the first place.



Figure 2.1: Adjustments in Quality Over Time [17].

2.2.1 Inspection

The inspection, according to Ruman (2010), is "a specialized examination, testing, formal evaluation exercise, and overall appraisal of such a process, product, and otherwise service to identify if it adheres to set requirements."

This phase first appeared in the 1910s, when teams of inspectors were engaged by the Ford Motor Company to evaluate the quality of their T-model automobiles. The inspection's goal was to find products of low quality and distinguish them from products of acceptable quality (Dahlgard et al., 1997) [18].

According to Deming (1986), "inspection with the objective of detecting poor product and tossing them out is really late, ineffective, and costly" because the inspection led to wastes that add expenses that are represented in the price the consumer is charged.

2.2.2 Quality Control (QC)

Complexity of production systems heralded the beginning of this period at the turn of the twentieth century. The definition of control given by Feigenbaum (1991) is "the practice of assigning authority and responsibility for a management task while maintaining the means to assure good results." The following procedures make up Misra (2008)'s general definition of value creation, which may be applied to anything from a product to a service [19].

- a. Setting guidelines.
- b. Evaluating conformity.
- c. Acting when it is required.
- d. Making improvements in advance.

The term "operational approaches and actions which are utilized to satisfy the objectives for quality" is how the International Organization for Standardization (ISO) defines "quality control." According to Juran, quality control is "the regulatory structure by which we measure overall performance, evaluate it with standards, and act on the discrepancy." (Oluwatoyin and Oluseun, 2008).

This phase was more effective than the inspection phase due to the use of Shewhart's control charts and Dodge's acceptance of Rom's sampling approach [20].

2.2.3 Quality Assurance (QA)

The International Organization for Standardization (ISO) describes quality assurance as "all the planned and systematic operations conducted within the quality system, and demonstrated as needed to provide adequate confidence that an entity will fulfill requirements for quality." As the third and final stage of the quality development process, quality assurance is the culmination of the quality development processs [21]. When we talk about quality assurance, what we really mean is something that Oakland (2004) defined as "the prevention of quality problems by planned and methodical activities surrounding processes (including documentation)" Since 2010 (Rumane), this is what we mean when we talk about quality assurance [22].

Quality Assurance puts more of an emphasis on preventing flaws from happening in the first place, whereas quality control is concerned with finding problems after they have already

been made (Jha, 2011). On the other hand, engineers and contractors will frequently use the terms interchangeably. He went on to say that quality control is just one component of an overall quality assurance plan, and he said this in the next sentence.

2.2.4 Total Quality Management (TQM)

Total Quality Management, the final step in the quality development, is characterized by an in-depth familiarity with and implementation of quality management ideas and principles across the board. Several prominent American thinkers, including Dr. Edward Deming, Dr. Joseph Juran, and Philip Crosby [23], are largely responsible for TQM's evolution (Dahlgaard et al., 1997).

Total Quality Management can be broken down into its constituent parts in order to provide a clear explanation of what it is and how it works (Erturul, 2006). These parts are "Total," which refers to the involvement of all employees, "Quality," which means providing what the customer wants, and "Management," which refers to the method used to achieve quality results [24].

Total Quality Management, as described by the British Standards Institution (BSI), is "a management philosophy and company practices that strive to harness the human and material resources of an organization in the most effective way to fulfill the objectives of the organization" (Hoyle, 2007).

It is also defined by ISO as "a management style of an organization oriented on quality [25], based on the engagement of all its members and aiming at long-term success through customer satisfaction and benefits to all members of the organization and society" (Pfeifer, 2002).

TQM is defined by Collard (1989) as "Zero faults in the products and services of a company. Doing things well the first time around doesn't increase the price of a company's goods or services, and yet ensuring high quality in all areas of business is essential.

TQM is "a corporate business management philosophy which understands that customer needs and business goals are interdependent," as defined by the British Quality Association [26]. It has commercial and industrial applications (Pike and Barnes, 1995).

"a method of management that enhances an organization's overall efficacy, adaptability, and competitiveness," as described by Oakland. It is equally relevant in the service sector as it is in manufacturing. All aspects of a company, from operations to personnel [27], need to be in order for this to be successful (Robson, 1989: from Pike and Barnes, 1995).

Total Quality Management may be summed up as an approach to management that emphasizes customer happiness through a policy of constant innovation and inclusion at all levels of the company.

The term "customer" needs to be defined to prevent confusion. A customer is somebody who buys or sells a company's goods or services and can be both an outsider and an insider. Customers that are not employees of your organization but nonetheless utilize your goods and services are considered external customers, whereas employees are considered internal customers [28]. Taking care of internal consumers is crucial to ensuring the happiness of external ones (Charantimath, 2003).

2.3 BASICS OF QUALITY MANAGEMENT

When the various TQM gurus' theories are compared with one another, it becomes abundantly evident that each of them had their own distinctive perspective on quality management. But despite their differences, these approaches share several similarities that might be seen as TQM's core principles. These principles are as follows, according to ISO (Pyzdek & Keller, 2012): "customer focus," "people involvement," "leadership," "continuous improvement," "fact-based approach to decision making [29]," "process approach," "system approach to management," and "mutually beneficial supplier partnerships."

Dahlgaard et al., 1997 The "TQM Pyramid" is a model that Kanji and Asher devised to describe the TQM concepts that they came up with. Figure 2.1 illustrates the TQM principles in the form of a pyramid [30], with Leadership (the commitment of management) acting as the base of the pyramid and the other TQM principles (customer focus, attention on facts, continuous improvements, and everybody's participation) serving as its layers.

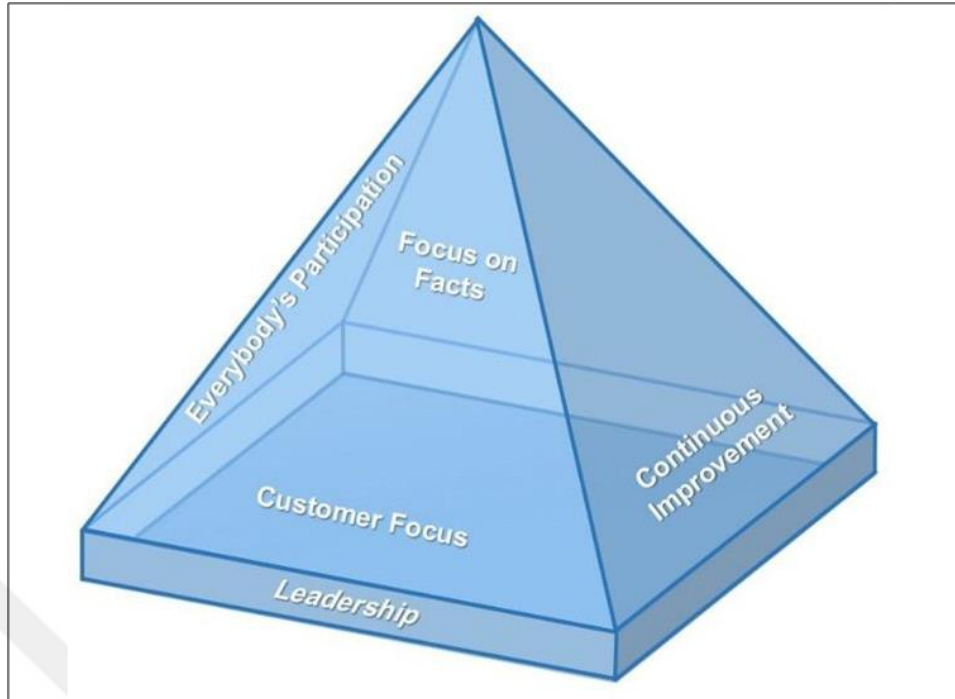


Figure 2.2: The Pyramid of TQM [30].

2.3.1 Quality

The term "quality" is often used to describe the degree to which a service or good meets or exceeds the needs of its target audience (Bagad, 2008). The price and the product's intended function inform these expectations. Products and services are considered high-quality when they perform above and beyond customer expectations. As a result, the term is essentially abstract and dependent on one's point of view [31].

One clearer definition of quality is provided by ISO 9000:2000. To what extent do a product's "inherent characteristics fulfill requirements?" is how quality is defined. To better grasp the idea, the term can be dissected into its component parts. A quality can be described as bad, good, or superb, in accordance with this definition of the term "degree." In a similar vein, the word "inherent" means "already present within," especially as a permanent quality [32]. Qualitative or quantitative measures might be categorized as "characteristics." A product or service's "requirement" is its established necessity or expectation.

In addition, Lakhe and Mohanty (1994) state that conducting market research is crucial to establishing quality since it establishes product or service requirements and identifies consumer demands. On the other hand, one may argue that in order for quality to be

universally effective, it needs to include all of an organization's functions, all of its departments, and all of its processes. Therefore, to accomplish all the goals associated with comprehensive quality management, it is essential to foster teamwork among all the personnel and throughout all the processes [33].

2.3.2 Qualitative Factors

The nine characteristics of quality identified by Garvin (1987) are then used to define what must be included in the creation of new products and the enhancement of current ones [34], Table 2.2 show these factors.

Table 2.2: Qualitative Factors.

Qualitative	Definition and Usage
Aesthetics	Perceptual details, such the surface coating.
Conformance	Performance that is up to par with established norms or criteria.
Durability	Repairs count toward the useful life of an object.
Features	Additional features and supplementary product qualities, such as a remote control, are examples.
Performance	Features that are essential to the product, such how brilliant the screen is.
Reliability	Average time until failure, and how reliably the unit performs over time.
Reputation	Results achieved in the past and other non-tangible factors, such as a position as number one.
Service	Solving customer issues and making repairs simple.

2.3.3 Aesthetics

This criterion considers the visual product's appeal from an aesthetic standpoint as well as its impact on the reputation of the organization.

According to Garvin (1987), Everything, like how something "looks," "feels," "sounds," "tastes," and "smells," is "obviously a matter of personal evaluation and a sign of individual preference." This is true whether we're talking about how something "looks," "feels,"

"sounds," "tastes," or "smells." "Most of the time [35], a production should be rejected if it has flaws or problems that make it look bad, even if they don't affect other parts of its quality," writes Pereira. "Most of the time, a production should be rejected if it has flaws or problems that make it look bad" (2008: 1). [Needs a citation] "Mistakes or problems that take away from the beauty of a production".

2.3.4 Conformance

The extent to which a product's process or product features match established norms is another indicator of quality, as stated by Garvin (1987). Concerning this criterion, the question "Does the product or service match to the specifications?" is crucial [36]. A product or service is believed to be in accordance with established norms if it is designed to achieve the desired results within the specified parameters (Pereira, 2008).

2.3.5 Durability

According to Garvin (1987), the economic and technological aspects of durability are of equal importance. When assessing the longevity of a product, its durability can be evaluated according to the number of times it can be utilized before it begins to deteriorate. Before making a purchase, consumers often think about the total cost of ownership [37], which includes the cost of maintenance and replacement parts, in addition to the amount of time and money that will be involved (Garvin, 1987). This criterion provides an answer to the question of how long a product or service will continue to function or remain viable as a result of its application. As a consequence of this, it has a great deal in common with the concept of a warranty [38]. In addition, the procurement agreements with the suppliers almost always include the specifications for the product's longevity (Pereira, 2008).

2.3.6 Features

This criterion is more closely related to the features of the service or product, which are the traits that are vital to the service or product achieving its function or goal. According to Garvin's (1987) definition, features are the "bells and whistles" of products and services; they are the supplemental elements that enhance the use of the product or service [39]. Therefore, it is still extremely important for providers who are attempting to create the product to specify the product's performance qualities and explain the applications for which

it is intended (Pereira, 2008). In addition [40], the availability of a large number of features is frequently perceived by customers to be of greater importance than the availability of features that are regarded as being of a higher quality (Lakhe & Mohanty, 1994).

2.3.7 Performance

This factor addresses whether the advertised benefits are actually delivered by the product or service. According to Pereira (2008), when deliverables are not specified in the requirements in a manner that is both explicit and exhaustive [41], performance has a tendency to become a source of friction between the service provider and the client. According to Garvin, as this aspect of quality is comprised of measurable elements, products can often be evaluated objectively based on particular criteria of performance (1987).

2.3.8 Reliability

It has been known for quite some time that the reliability and effectiveness of a company's goods and services are a significant factor in determining both the company's reputation and the value of its brand among customers [42]. The question of whether or not the product will successfully carry out the purpose for which it was designed is the major concern here." (Pereira, 2008) "According to what Garvin has to say about the matter, this criterion takes into account the possibility that a product would become defective or break within a specified amount of time (1987) [43]. Time to failure, mean time without failures, and failure rate per unit of time are three of the most common reliability metrics. Time to failure is another common reliability statistic. In addition, as the costs of downtime and maintenance continue to climb, customers have a growing desire for reliability.

2.3.9 Reputation

People's perceptions of an item are summed up by its reputation. Garvin (1987) states that "reputation is the basic substance of perceived quality [44]." This phrase encapsulates the essential nature of the connection between a company's reputation and how individuals evaluate the quality of a product. The argument holds water because consumers are likely to draw parallels between the quality of a product that is selling well now and the quality of products that have sold well in the past, or between the quality of items in a new product line and the quality of products that the company has already established. Alternatively, it is

persuasive because there is a similarity between the quality of a new product line and the quality of the company's established products. As a result, the essential assumption behind this discussion is that an individual's own point of view is the most accurate depiction of the world around them [45]. Therefore, "A product of excellent quality may gain a perception of being poor-quality simply because of poor service by installations or field professionals," which represents a regrettable statement. The quality of the product, rather than the quality of the service it receives, is frequently blamed for a failure [46], even though the failure could have been caused by improper installation or maintenance of the product (Pereira, 2008).

2.3.10 Service

The consumer's ability to repair and maintain the product is the focus of this criterion. Consumers are concerned about more than just how quickly services are restored, service schedules are kept on time, how customers interact with service personnel [47], and how frequently service sessions or repairs fail to solve ongoing issues, according to Garvin (1987). Consumers are worried about these things [48].

2.4 QUALITY SYSTEMS

Bennett (n.d.) defines a quality system as "a set of policies and procedures used by an organization to control and improve the quality of its products and services [49]." The author makes note of the many different forms of management structures. Additional examples of management systems are those concerned with finances, safety, and the environment.

The International Organization for Standardization (ISO) defines a quality system as the "management system used to command and govern an organization with regard to quality," however Bennett (n.d.) argues that this definition, like many others offered by the ISO [50], is too vague.

According to Bennett, "quality systems" refer to the procedures used "to plan, design, develop, make, and/or deliver your services or products." The author continues by stating that a service-based firm's service delivery system defines it [51]. She goes on to argue that a corporation can be viewed as the support system for the purchase, upkeep, distribution, as well as installation of commodities produced by outside parties [52].

The International Organization for Standardization 9001 divides the various components of a quality management system into four classes (Bennett, n.d.). According to Bennett [53], these groups can be broken down into the following:

- a. Management responsibilities, such as setting and reviewing goals.
- b. People, instruments, and other supplies are all examples of resources.
- c. Realization or the processes involved in the production and delivery of a service or product.
- d. The all-important feedback loop consists of • Monitoring, Measuring, and Checking.

According to Bennett (n.d.), quality management encompasses not just the procedures necessary to physically produce the product or service but also the following:

- a. Organizational management entails planning, establishing objectives, and analyzing progress and outcomes.
- b. It entails ensuring that all available plant, equipment, IT, tools, etc. are in working order and that all available human resources are competent and able to do their duties.
- c. If we want to know what happened and why, we need to double-check and analyze the results.
- d. Systematically finding and fixing points of failure or even other problems is part of this.
- e. Moreover, development is a key component.

According to Bennett (n.d.), a quality system's constituent parts cooperate to accomplish two goals:

- a. To create products and services of uniformly high quality that fulfil all relevant needs.
- b. So that we may achieve higher levels of contentment among our clientele.

2.5 CONTINUOUS QUALITY IMPROVEMENT

Wiggins and Mathias (2013) describe the process of Continuous Quality Improvement (CQI) as the method through which a program "systematically and purposefully improves services and promotes positive outcomes [54]." According to the authors of the study, CQI refers to an activity that is ongoing, data-driven, and proactive. Therefore, in a CQI environment, data

is gathered and used to make improvements even while things are already heading in the correct direction, Figure 2.3 [55]. This is in contrast to the traditional approach, which focuses solely on addressing problems only after they have occurred and necessitate attention (Wiggins & Mathias, 2013).

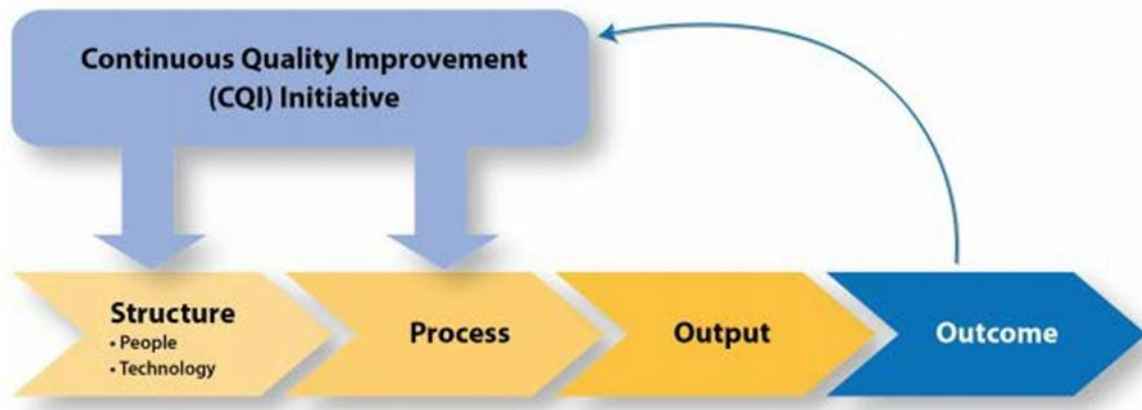


Figure 2.3: Model for CQI Framework Development [55].

According to the authors, utilizing a systematic planning method to review the existing practice procedures and enhance systems and processes in order to reach the intended outcome and vision for the desired future state is the most important step in any CQI endeavor. This is the key to achieving success in any CQI endeavor [56].

CQI is a never-ending loop that consists of planning, carrying out, inspecting, and making improvements. Continuous Quality Improvement goes beyond merely complying with external norms and standards because it is reliant on the team working on that particular program taking internal ownership of the process [57]. This means that CQI is more than just a formality (Wiggin and Mathias, 2013). As a result, the individuals who are a part of the company are the ones who are in control of the change's lever, which creates an atmosphere that is enthusiastic about professional development (Wiggins & Mathias, 2013).

The authors argue that a supportive infrastructure, which includes resources, supportive policies and practices, and so on, is necessary for the process to achieve a degree of continuous learning that is capable of responding to the need for research and innovation [58]. This is necessary in order for the process to be able to achieve the desired degree of continuous learning.

CQI's structure, process, and results are broken down into three categories in this model. All of a company's resources—human, physical, technological, and financial—are part of its structure. Activities, workflows, and all the tasks performed to obtain an end result are all part of the process. The term "output" is shorthand for the state of affairs just before the modification was made, and it is often associated with business or efficiency objectives [59]. In this sense, "outcome" refers to the final product of the entire process. As a last point, the repetitive and cyclical character of the CQI initiative is represented by the Feedback Loop between the output/outcome and the CQI initiative.

According to Lambert, Carr, and Hubbard (2006), the CQI process is a group effort that results in functional improvements. They argue that these transformations are achieved through a series of phases that prioritize adapting processes, giving workers more say in their work, prioritizing the needs of consumers [60], and fostering a culture of dedication to the company over the long haul (Lambert, Carr and Hubbard, 2006).

According to the National Learning Consortium (2013), the first step in transforming the present into the future by using CQI is to establish a clear vision of the transformed environment and to identify the necessary required modifications to achieve that vision. The next step is to solicit ideas from invested team members who are familiar with CQI's requirements [61]. In a nutshell, changing the way people, organizations, and institutions use technology is essential to the success of the entire procedure. In order to get from where we are now to where we want to be in the future, we can use CQI, as shown in the accompanying diagram [62], Figure 2.4.

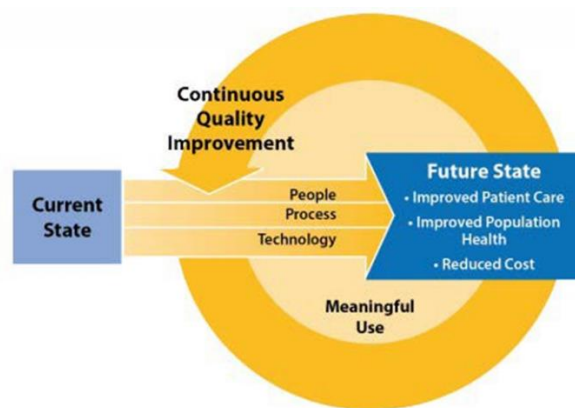


Figure 2.4: Transitioning from The Present to The Future Using CQI [62].

2.6 SIX SIGMA

Because of globalization and the ease with which customers may acquire information, traditional business strategies are becoming increasingly ineffective. Given the current business climate, when every edge counts, the adoption of Six Sigma as a quality management strategy is not surprising [67].

To design and then produce almost faultless products and services, G.E. (n.d.) describes Six Sigma as a highly disciplined approach. A statistical term, Sigma quantifies the degree to which a given process deviates from perfection (G.E., n.d.). Six Sigma's basic tenet is that businesses may achieve defect-free performance by measuring current levels of quality and systematically eliminating the causes of those levels (G.E., n.d.) [68].

In the words of Raisinghani et al. (2005), "defect reduction is the immediate effect of Six Sigma," and this will ultimately lead to an increase in yield. Higher yields, as discussed further by Raisinghani et al. (2005), typically lead to greater customer satisfaction, which in turn leads to higher net profitability for the business. The authors further argue that Six Sigma is the gold standard for reducing expenses while simultaneously boosting a company's bottom line [69].

According to Cutcher-Gershenfeld (2004), the purpose of a company implementing Six Sigma is to lower production and development costs, as well as decrease cycle time and inventory levels. When a company's output reaches the Six Sigma standard, it reduces faults, boosts profits, and delights consumers. An industry can be motivated to adopt a data-driven, systematic approach to defect reduction and a higher degree of product quality by adopting the Six Sigma methodology.

National Learning Consortium (2013) identified the following five concepts upon which Six Sigma, a methodology for statistically modeling processes, is based on:

- a. Step one is to define the process and outcome that needs to be improved, along with its salient features and qualities. This will allow you to map the necessary inputs into the process that will produce the desired outputs and outcomes. The scope of the CQI project is here largely defined (National Learning Consortium, 2013).

- b. Step two is the measure of The CQI program needs to keep tabs on progress through data gathering "after the process and outcome to be improved are established" (National Learning Consortium, 2013, pp 10). Methods like surveys as well as structured observations can be used to record these indicators of performance.
- c. Analyze: After the measures have been developed and put into place, information may be gathered and examined to determine how they compare to standard practice. Finding the origins of problems found in routine analyses of data is fundamental to any continuous quality improvement (CQI) initiative. In an standard world, "starting point information would be picked prior to locating new activities in place and at regular intervals," as stated by the National Learning Consortium (2013, p. 9).
- d. Improve: The analysis results call for modification. The CQI project, for instance, must fundamentally analyze the complete implementation process and discover loopholes to magnify improvements if quality metrics do not show improvement after a given modification has been implemented (National Learning Consortium) (2013).
- e. The last step of the CQI process is control, which entails constant monitoring and continual enhancement (National Learning Consortium) (2013).

2.7 ZERO DEFECTS

For Suganthi and Samuel (2004), the cornerstone of the zero defects idea is the elimination of all waste from a specific undertaking [70]. All ineffective resources, including equipment, personnel, procedures, etc., qualify as waste in this context. As a result, it is generally agreed that the removal of everything in the production process that does not directly contribute to the project's success is warranted. When prices are reduced, as they are when the company eliminates waste, quality is improved.

Crosby's concept of "zero flaws" is based on four basic tenets. (Chary, 2009):

- a. Conformity to requirements is the assurance state that constitutes quality.
- b. Preventative measures are at the heart of the management system.
- c. The measuring system is the value of quality, and the performance requirement is "zero flaws," which means that it must be excellent.

For the zero flaws principle, "the entire is the sum of its component parts" is the fundamental idea. This serves as more evidence that flaws introduced at any point in the manufacturing

process can have far-reaching consequences for the final product [71]. Thus, according to the zero-defect concept, a corporation can benefit from functioning more smoothly and saving money by getting things done the first time (Suganthi and Samuel, 2004).

It has been argued that achieving zero defects is not attainable in practice, although advocates have countered that this should not be inferred from literary phrases when discussing quality management (Chary, 2009). Instead, "it refers to a situation in which waste has been eliminated and flaws have been reduced. Maintaining 100% defect-free projects is what this term refers to (Chandana, n.d.). It's about getting as close to perfect as possible so you can make meaningful improvements to quality. And while perfection may be unachievable, striving for it will lead to better outcomes [72].

2.8 TOTAL QUALITY MANAGEMENT

Total quality management is typically understood to be the result of a synchronization of many processes that define the behavioral dynamics of a company. To achieve this, we define a business as a sociotechnical system "where all actions are focused towards serving the expectations of its clients with efficiency and effectiveness." According to (Lakhe & Mohanty, 1994) [73].

TQM, or Total Quality Management, is a management philosophy with its roots in Japanese business culture. Its central tenet is the pursuit of perfection in all aspects of a company's operations in order to better meet the needs of customers and the expectations of communities while also achieving the organization's stated goals (Bagad, 2008). The basic idea is to make the most of everyone's talents and keep pushing for progress in all areas of the business (ISO, 2012). It's a method used by businesses to gain an edge in the marketplace (ISO, 2012). Competitive advantage is the result of a strategy that provides enhanced value for a firm, relative to its rivals, and sustainable is present if the increased value continues when competitors stop trying to copy the advantage (Xiang, 2007, p. 13). Therefore, Total Quality Management is a key enabler in gaining a market advantage [74].

2.9 TOTAL QUALITY MANAGEMENT

"Total quality management" is a relatively recent concept with which the emphasis is moved from the quality of goods to the quality of any and all issues within about an organization. To put it another way, it involves everything that a company does, elevates quality to the status of a strategic goal, and necessitates a concerted, cross-functional effort from all personnel. According to research (Polat, Damci, & Tatar, 2011; pp. 1116),

According to Chowdhury (2005), TQM first appeared as a management idea in Japan in the 1950s and gained traction in the West in the 1980s. Focusing on efficient manufacturing of quality that satisfies market expectations is central to the idea. Additionally, productivity rises as production costs fall because of quality enhancements made possible by more efficient administration of "design," "engineering," and "testing," as well as enhancements to existing, working processes. While quality is ultimately determined by what a consumer is prepared to pay for, it is important to note that the concept of excellence is a combination of human effort and technological advancement (Chowdhury, 2005).

According to Asim, Zaman, and Zarif (2013), page 27, "TQM actively promotes the excellent coordination and productive structure that is required within the business, its staff members, its suppliers, and its consumers" (emphasis added) [75]. This serves as a helpful reminder that customer satisfaction takes precedence above staff knowledge in an organization that is driven by Total Quality Management (TQM).

Regarding the topic of quality, Asim, Zaman, and Zarif (2013) state that "an organization's capacity to decode, unify, and eventually codify quality related behaviors is the distinguishing and most ultimately benefits of its tendency towards quality." Because of this, quality assurance is not just something that occurs once and then goes; rather, it is a continuous activity that helps streamline day-to-day operations and contributes to the institutionalization of excellence-related behaviors throughout a complete business. According to Motwani (2012), successful implementation of quality improvement initiatives such as TQM frequently necessitates alterations to an organization's culture, processes, values, and strategic priorities. As a result, Total Quality Management (TQM) can be seen as an ideology that promotes a methodical and comprehensive approach to the management

of quality inside an organization and the cultivation of a culture that emphasizes ongoing improvement [76].

2.10 TQM EVOLUTION

Brun (2011) examined the development of the TQM idea and came to the conclusion that the historical development of TQM fundamentally happened in four stages, as shown in Figure 2.5 [35]:

- a. Quality Inspection (QI).
- b. Quality Control (QC).
- c. Quality Assurance (QA).
- d. Total Quality Management (TQM).

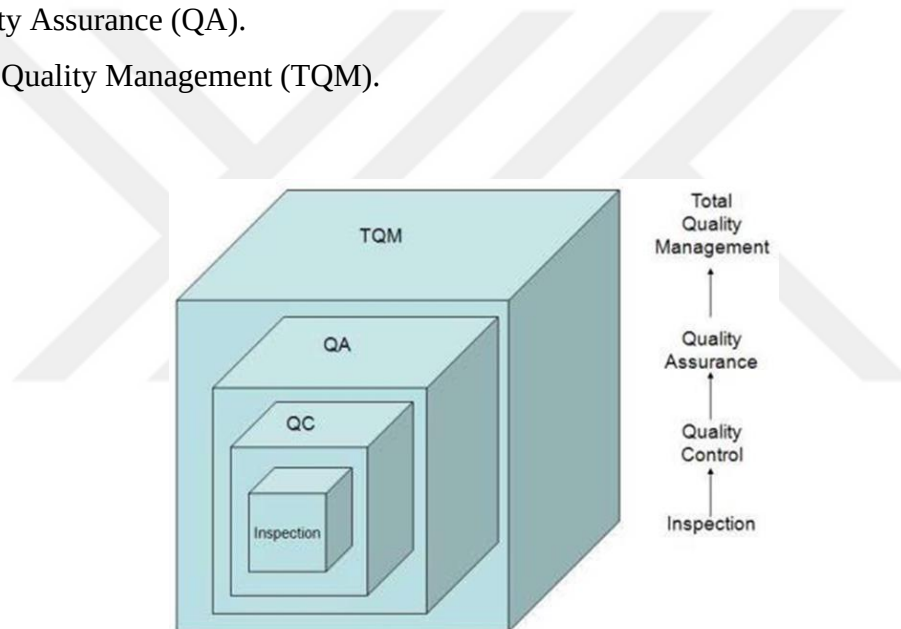


Figure 2.5: Levels of TQM [35].

2.10.1 Quality Inspection

Separating defective from acceptable products remains the primary focus of quality assurance. In the manufacturing process, only high-quality goods move on to the next stage; those that don't are either scrapped, reworked, or sold as second best (Bagad, 2008). In terms of quality control, as stated by Loughlin (2008, p. 4), "the inspection process is an after-the-fact measurement method that can only lead to non-conforming items being sent back to be re-worked or lead to lower graded goods that are manufactured in a rating system."

2.10.2 Quality Assurance

The second stage of TQM development saw quality regulated via supervised skills, written specification, measurement, and standardization (Bruns, 2011, p. 13). As a result, inspections, rather than workers, are relied upon to evaluate and verify the quality of final goods as manufacturing systems become more complicated. Statistical quality control through inspection, the creation of control charts, the implementation of inspection sampling techniques, and so on are all part of the process. Quality control was originally conceived as a means of differentiating between "firstly the variation arising from random causes and secondly the variance originating from assignable or specific reasons" (Brun, 2011, p. 13). Control charts for documenting lesser indications of non-conformity and process monitoring systems have advanced. That's why, as Loughlin (2008) argues, quality control is still, at its core, the simple act of finding errors and repairing them after they've already happened. In a quality control system, "A few of the ways that everything is monitored include detailed performance and product specifications, paperwork and procedure controls, product testing during the raw material and mid-production stages with reports being filed, and general feedback on the processes involved to staff and suppliers" (Loughlin, 2008, pp 4).

2.10.3 Quality Assurance

Quality Assurance, the third and final step of TQM development, incorporates all the preceding stages so that sufficient assurance can be provided that the final product or service will ultimately satisfy the needs of the client (Mandal, 2009). Since simply finding the errors was not enough to eradicate the root of the problem, quality assurance moved to the forefront to fulfill the requirement for ongoing continual improvement in quality, as stated by Loughlin (2008). To go from the quality control to the quality assurance era of Total Quality Management, "other activities are also established, such as comprehensive quality manuals, usage of cost of quality, creation of process control, and auditing of quality systems" (Brun, 2011, pp 13). As a result, quality assurance is comprised of quality inspection and quality control at its core, with an emphasis on spotting and stopping low-quality work wherever possible. In addition, the maturation of quality systems has resulted in the simplification of quality assurance thanks to cutting-edge quality planning and thorough quality manuals (Loughlin, 2008).

2.10.4 Total Quality Management

To achieve TQM, businesses must master and apply all quality management principles and concepts from the first three levels to their daily operations (Loughlin, 2008). A key tenet of TQM is that "the concepts of quality management must be used at every level, every stage, and in every department of the business," as stated by Brun (2011, p. 13).

This tends to restate the idea that TQM is enriched by the application of sophisticated quality management techniques, and that the process must extend outside the internal organization in order to build close collaboration with the suppliers. "The introduction of TQM can be considered as fortuitous in the pursuit of higher output and happier clients. The term "Total Quality Management" (TQM) refers to "a way of thinking about goals, organizations, processes, and people to ensure that the right things get done the first time; and an approach to enhancing the competitiveness, effectiveness, and adaptability of the complete business" (Abu-Jaber, 2007). This is an excerpt from Barak, Ali, and Onyeizu's (2011).

One could say that the realization of TQM as a substantial shift in an organization that necessitates an extensive restructuring of culture, process, strategic objectives, and organizational principles and beliefs is contingent on the discovery of and comprehension of superior processes. This is because TQM requires a massive transformation in all aspects of an organization, including culture, process, strategic objectives, and organizational principles and convictions.

Each stage in TQM's development is Table 2.3 below, along with a summary of its key features.

Table 2.3: Features of The Various TQM Stages.

INSPECTION	1. Salvage 2. Sorting, grading, and re-blending Corrective actions 3. Identify sources of non-conformance
QUALITY ASSURANCE	1. Quality system development. 2. Advanced quality planning. 3. Comprehensive quality manuals Use of quality costs 4. Involvement of non-production operation Failure mode and effect analysis
QUALITY CONTROL	1. Develop quality manuals. 2. Process performance data Self inspection 3. Product testing 4. Basic quality planning Use of basic statistics Paperwork control
TOTAL QUALITY MANAGEMENT	1. Policy deployment 2. Involves suppliers and customers Involve all operations. 3. Process management Performance measurement Teamwork 4. Employee involvement

2.11 TQM'S COMPONENT SECTIONS

2.11.1 Leadership

This fundamental tenet of TQM states, in essence, that senior management must appreciate the significance of quality and therefore must encourage the idea that quality is everyone's duty in the workplace (ISO, 2012). But the foundation must always be that the buck stops with upper management, which should take pleasure in its quality record. Under this model, quality excellence is central to the company's overall strategy and drives its execution (Mandal, 2009).

The following are, in essence, some of the intrinsic attributes of successful leaders, as outlined by Mandal (2009):

- a. Ability to pay close focus to all clients, both internal and external.
- b. The skill to give subordinates responsibility without micromanaging them, and the awareness to ensure they have access to the resources, training, and working conditions they need to be productive.
- c. shift one's attention from merely preserving existing quality to actively seeking ways to enhance it.
- d. have the ability to put an emphasis on prevention and to promote cooperation rather than competition.
- e. ability and talents for teaching and mentoring rather than managing and leading.
- f. capability of gaining insight from setbacks and making full use of subsequent opportunities for enhancement.
- g. passion for bettering one's ability to communicate and one's dedication to excellence.
- h. Possessing the organizational skills to set up structures that encourage high-quality work.

2.11.2 Customer Focus

Customers are what keep businesses afloat, so it's crucial that they know what they want and anticipate what they'll need in the future. (ISO, 2012, pages 3)

Every effort to enhance quality must always have the customer in mind. Since customers' wants, needs, and expectations are always evolving, customer happiness is now largely determined by the full scope of their interactions with a company (ISO, 2012). That's why it's crucial for businesses to review their quality assurance methods frequently and adapt to their consumers' ever-shifting demands [77].

Mandal (2009) argues that companies need to routinely poll their clientele for opinions in order to gauge how they're doing in terms of customer satisfaction, pricing, and on-time delivery, and to gauge how they stack up against the competition. Understanding what your customers desire and where you might improve requires collecting input from them. Consumers' opinions can be gathered through a variety of channels, including warranty cards and questionnaires, telephone and postal surveys, focus groups, customer complaint boxes, and a customer satisfaction index (Mukherjee, 2006).

2.11.3 Involvement of Employees

Because "people are the most important asset any given business possesses, and that quality emanates from people" (ISO, 2012), TQM places a premium on employee participation in all facets of quality assurance and improvement. Employees can be engaged through the use of members of the project team, quality control circles (QCC), on-the-job training and education, motivational activities like incentive schemes, and the creation of a work culture that values dedication and quality. The employees have a significant role in creating an environment of constant enhancement [78].

Some of the main advantages of employee participation are listed by ISO:

- a. "Enthusiastic, devoted, and actively involved staff members.
- b. Adopting novel approaches to achieve established goals.
- c. Individuals taking responsibility for their actions.
- d. Individuals that are ready to take part in and make contributions to the process of continuous improvement.

2.11.4 Process Approach

"Analysis of processes ought to be an inherent element of the organization," writes Loughlin (2008, p. 6), "there should be an emphasis on processes instead of the functions, and be element of the Kaizen movement for continuous improvement."

Quality just at source is still a major idea in TQM, as Mukherjee (2006) points out. As a result, process management is still vital for managers and workers to zero in on the finer points of work in order to boost quality. As ISO (2012, p. 5) argues, "a desired result is delivered more efficiently when activities as well as associated resources are handled as a process." As an added bonus, ISO (2012) lists many advantages of TQM's process methodology. In the first place, efficient utilization of resources decreases prices and shortens cycle times. Two, it produces higher-quality, more reliable, and more predictable outcomes. And third, the possibilities for improvement are better defined and ranked.

What's more, it's not uncommon for the following to result from employing a process-oriented strategy:

- a. The process of methodically outlining the steps that must be taken to achieve a goal.
- b. The delegation of authority and the assignment of responsibilities for the administration of critical processes.
- c. Capability analysis and performance monitoring of essential processes.
- d. Locating the points of contact between various organizational processes is essential.
- e. Putting one's attention where it will do the best, such as on the tools, techniques, and supplies that will boost the most important operations of the business.
- f. Assessing the potential dangers, outcomes, and results of actions on clients, vendors, and other stakeholders.

2.11.5 Continuous Improvement

Under this tenet of Total Quality Management, all activities, whether they are directly related to manufacturing or the running of a company, are treated as processes (ISO, 2012). As a result, it follows that better process management directly leads to happier customers. There are five strategies to seek improvement, as outlined by Mukherjee (2006).

- a. Lessen the amount of resources available.
- b. Fix the mistakes.
- c. Assume the needs of your downstream customers.
- d. Increase safety measures.
- e. Facilitate the performer's sense of accomplishment by improving the process.

ISO (2012) argues that the overall goal of an organization should always be to improve its own performance. As a result, the business will be better able to capitalize on opportunities as well as maintain a competitive edge through enhanced skills.

Additionally, the results of adopting the idea of continuous improvement are often.

- a. "Taking a methodical, company-wide approach to enhancing performance over time.
- b. People are being educated on the processes and resources of continuous improvement.
- c. Making the ongoing enhancement of the company's products, procedures, and infrastructure a priority for all employees.
- d. Setting objectives and KPIs to drive and monitor continuous progress.
- e. improvements being recognized and appreciated.

2.11.6 Quality of Suppliers

The cost of acquired materials accounts for over 40% of total manufacturing expenses (ISO, 2012). Since a sizable proportion of quality-related issues stem mostly from suppliers, supplier quality management is still an important consideration. Therefore, a strong relationship with the suppliers is essential for enhancing quality.

McCubbrey (n.d.) recommends using quality assurance measures at each stage of the supply chain. “supply chain management that emphasizes knowledge sharing, certification of suppliers, and supplier participation in product development.”

In addition, ISO (2012, pp. 10) argues that effective supplier relationship management provides the adopting organization with the following advantages:

- a. A heightened capacity to mutually benefit each party.
- b. Cooperation characterized by nimbleness and rapidity in responding to shifting demands from the market or from customers.
- c. Reduction of expenditures and maximization of availability of means.

Therefore, it is important to strike a balance between short-term and long-term goals while forming supplier relationships that will benefit both parties involved. The company can build cooperative development as well as improvement activities with its suppliers if it is able to communicate its intentions and critical information to them clearly and openly. In short, supplier management serves to motivate and urge suppliers to do better and to properly acknowledge and appreciate those that do so.

2.11.7 Performance Measures

Total quality management necessitates, at its core, fact-based management of quality rather than relying on subjective judgment (ISO, 2012). This seems to emphasize once again the importance of comparing actual results to those that were hoped for in order to achieve good management. The use of baselines to evaluate progress toward improvement is, thus, central to the TQM approach.

Mukherjee (2006) lists numerous performance indicators that might be applied appropriately:

- a. Models for Quality Awards, such as the Malcolm Baldrige National Quality Award (MBNQA), the European Foundation for Quality Management Quality Award (EFQM).
- b. Benchmarking.
- c. Techniques from the field of statistics, such as control charts.
- d. Quality management systems certifications, such as ISO 9001:2000 and ISO 14001:2004, are examples.

2.12 OAKLAND'S TQM MODEL

Culture, dedication, and communication are the backbone of Total Quality Management (TQM), as stated by Oakland (2014). (Planning, Performance, Process and People). When compared to the "hard management necessities" represented by the "4 Ps," the "soft outcomes" achieved by focusing on the "3 Cs" have earned this designation. The model is shown in the following Figure 2.6 [40].

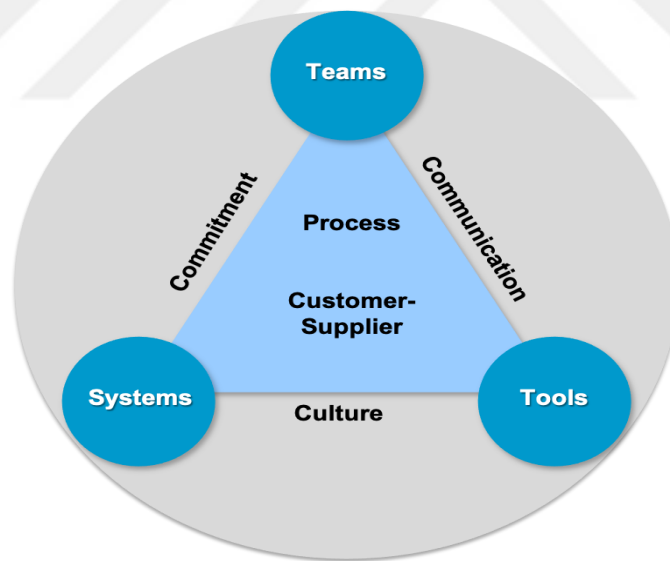


Figure 2.6: Oakland's TQM Model [40].

This demonstrates the potential for enhanced Performance via refined approaches to both Planning and the supervision of Personnel and the processes by which they are employed. These four pillars, or "hard management necessities," constitute the foundation of the new,

simplified TQM model and are essential to delivering high-quality products and services to customers [79].

Commitment to quality and meeting customer requirements, communication of the quality message, and acknowledgment of the need to transform the culture of most organizations to achieve overall quality should all surround the new model's central idea. These are the "soft requirements" that must surround the "hard requirements" of strategy, personnel, and operational procedures [80].

Planning includes coming up with and implementing plans of action, assembling the necessary teams and means, and building with quality in mind.

- a. Measurement of performance includes creating a "balanced scorecard" for the company, as well as self-evaluation, audits, reviews, and comparisons with similar businesses.
- b. Quality management systems; routine enhancement; process analysis and redesign; general process comprehension and administration.
- c. The focus is on the people, namely on human resource management, cultural shift, teamwork, communication, innovation, and education.
- d. Culture is a broad term that includes many facets of an organization's atmosphere, such as how decisions are made, how employees are rewarded, how well they work together, how safe their jobs are, how fairly they are compensated, and how much pride they have in their work. TQM's foundation rests squarely on the importance of culture.
- e. Part of what makes Oakland's model so compelling is its emphasis on the importance of commitment from senior management and the entire company in making TQM a reality.
- f. Effective communication, directed at the right people, is still crucial to the success of the TQM program.

2.13 EVIDENCE FROM PRACTICE AND EXPERIENCE ABOUT THE IMPORTANCE OF TQM

Powell (1995) found that TQM increases business value as well as organizational performance through empirical research. The vast majority of businesses that adopt TQM see significant improvements in productivity and efficiency [81]. However, data suggests that by the third year of adoption, "most organizations have already had sufficient space to adjust, integrate, and settle under the new method," results start to trickle in (Powell, 1995,

pp 23). In addition, since TQM was developed in a manufacturing setting, that is where it is most frequently applied today. Author also discovered a positive correlation between TQM performance and the degree to which a company adopted TQM's core tenets, wherein capability is contingent upon both complimentary organizational resources and the firm's ability to adopt and integrate TQM principles over time. Relationships with both customers and vendors improve TQM performance. Research found that "TQM can cause economic benefits to the organization..." Executive buy-in, transparency in the workplace, and staff autonomy appear to be more important to TQM's performance than the TQM standard fare of benchmarking, training, flexible production, and better metrics (Powell, 1995, pp 29).

Bardoel and Sohal (1999) looked examined the results of TQM adoption and the perceived benefits of the initiative at seven Australian construction enterprises. According to the findings, establishing a quality management program led to increased process control, which in turn led to more uniformity throughout the whole product lifecycle, from conception to distribution. In a similar vein, the construction cycle time was shortened, and fewer materials were lost or damaged during transport or building [82]. Moreover, the amount of time it took to get supplies to the site was cut in half, and chemical spillage was decreased. At the same time, TQM deployment boosted performance measurement and improved customers' views of the building itself.

Similar research into the effect of TQM's focus on customer satisfaction on business results was conducted by Sandbkken (2006, quoted in Hasan et al, 2013). As the level of customer satisfaction increases, so does the firm's ability to innovate and improve, and so does the organization's performance, according to the study's findings.

TQM characteristics including customer attention, process management, and leadership are favorably associated to quality performance, according to research by Arumugam, Ooi, and Fong (2008). Similar findings were reached by Miyaga and Yoshida (2010), who found that the degree to which TQM components are implemented affects organizational performance. Leadership, information quality, strategy execution, satisfying customers' needs, and managing human resources all remain crucial.

Similarly, Wang, Shieh, and Tang's (2010) research found that effective leadership and HRM have a favorable impact on business outcomes. In addition, "with the aid of visionary

leadership, subordinates will use their latent potential more favorably towards the organization, resulting in enhanced performance" (Hasan et al, 2013, pp 5).

Newer research by Timothy et al. (2011) confirms that transactional leadership improves business outcomes. The exchange process is the most notable feature of transactional leadership since it improves the efficiency of the business as a whole.

In addition, Valmohammadi's (2011) study of TQM's application in manufacturing finds that process management and customer factors have a significant, beneficial effect on business results. According to the findings, these elements have a favorable and significant impact on productivity. Leadership boosts performance by establishing an environment that encourages productivity, while process management and customer focus do the same for their respective organizations by emphasizing quality enhancement.

"The TQ culture varies from firm to company and from industry to industry," write Harrington, Voehl, and Wiggin (2012, page 353). Despite these variations, all members of the TQ culture have a commitment to eliminating waste, cutting expenses, enhancing the company's standing in the community, and expanding its share of the market. Since TQ goals are inherently evolving, they require regular revision and improvement.

Also in 2013, an empirical study was undertaken by Hasan et al., 2013 to examine the connection between TQM aspects and business success. Specifically, the study looked at the influence that TQM characteristics including leadership, people management, customer focus, process management, strategic planning, and information analysis had on the performance of 120 chosen manufacturing enterprises in the Pakistani manufacturing sector. Findings from this study support the claim made in the title, showing that TQM features are crucial to improving productivity in Pakistan's manufacturing industry [83]. Correlation analysis also shows that all study factors, with the exception of data and analysis, are strongly and positively linked to the research's dependent variable, company performance. When compared to the other variables in this study, however, customer focus stands out as having a significant impact on organizational performance (Hasan et al, 2013, pp 14).

2.14 QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION

The history of the globe is littered with disasters that occurred because of subpar building materials. It was established in the first chapter that quality is of paramount importance in the building trade. Quality management in construction has gained a great deal of importance in recent years, especially in light of devastating events like the collapse of high-rise structures during natural catastrophes and the failure of bridges and highways due to the poor quality of the construction materials employed [84].

Construction industry "components have a propensity to be imprudent to changes being thrust on them, such as economic, political, and technological constraints," write Asim, Zaman, and Zarif (2013, p. 26).

" Product quality in the construction sector may be regarded as a key element in achieving quality in the supplies, tools, and technology used to construct infrastructure, whereas "process quality" may refer to achieving quality in the way the project is organized and managed during its three key phases: planning and design, construction, and operability (David & Gunaydin, 1997, cited in Asim & Zarif, 2013: p. 27)".

Thus, TQM can be argued as a practical answer to the cost overruns, worker productivity, occupational health and safety, and other quality-related issues that plague the construction sector. Applying TQM principles in building ensures higher-quality work. What must be established, however, is that building quality management differs significantly from manufacturing quality management. Therefore, quality control techniques and quality management systems vary greatly in terms of how they are implemented and how effective they are from industry to industry and from company to company.

Since TQM has been so widely adopted and successfully implemented in manufacturing (Polat, Damci and Tatar, 2011, pp 1116), the construction sector has looked to manufacturing for inspiration and tried to do the same.

2.14.1 Construction Quality Control Versus Manufacturing

Arditi and Gunaydin (1997) contrasted the construction industry's adoption of quality control with that of the manufacturing sector. Though the findings suggest a parallel between the

development of quality assurance in building and that of manufacturing, they also highlight several key differences. These distinctions are summarized by Asim, Zaman, and Zarif (2013, p. 27) as follows:

- a. All construction jobs are different.
- b. These items are made to order and produced only once.
- c. Production sites in the construction industry are notorious for having wildly varying circumstances, in stark contrast to most other sectors, which tend to settle on a single location with consistent working conditions.
- d. A construction project has a substantially longer lifespan than the average consumer good.
- e. Construction projects are typically evaluated subjectively because there is no clear and uniform criterion for evaluating overall construction quality like there is in evaluating manufactured objects and materials.
- f. Construction projects are often single-order design projects; therefore the owner has significant input into the manufacturing process.
- g. Owner, architect, general contractor, subcontractor, and material are all players in the construction project.

When these distinctions are taken into account, it is clear that the quality control procedures that are optimal for manufacturing companies are not appropriate for the construction business. Because the quality processes that have proven to be most successful in the mass production industry may not be deemed adequate or effective by building enterprises, quality control in the construction industry has not advanced to the level that has been established by the manufacturing industry [85]. This is one of the reasons why the construction industry does not have the same level of quality control as the manufacturing industry.

The construction industry "has a tendency to confound TQM with Quality Control (QC) and Quality Assurance (QA), holding that conformity with QA Standards is all there is to the claim of TQM on building projects," as stated in one source (Asim, Zaman, & Zarif, 2013, p. 27). In order to promote a culture of quality management in the construction industry, it is still important to grow the contractor, subcontractor, and supplier teams. However, maintaining a quality mentality at all times is necessary to guarantee high-quality procedures.

2.14.2 TQM's Advantages for Construction Companies

TQM has become an industry enabler. Many highly competitive firms worldwide have used it to boost performance and efficiency, especially in the service and manufacturing sectors. In a similar matter, TQM has evolved from an operational component to a business strategy. TQM is one way many companies strive for perfection. It could improve product quality, customer satisfaction, and profits. All three are interconnected. The only way to survive in today's severe business environment is to become a total quality management powerhouse, according to many businesses. Businesses need a quality assurance and control system to satisfy customers. However, adopting TQM requires a management change, a culture change, and the ongoing participation of all employees in quality development [86]. The most important result of a successful TQM deployment is a meaningful product or service for consumers and the market. TQM helps the organization spot problems before they get out of hand, he said. In a similar line, the idea that firms should focus more on preventing problems than fixing them has spread, almost eliminating building site errors. TQM's transparency and trust will also assist the construction company's leadership. TQM improves customer, employee, training, and retention. High-level management buy-in, faultless first runs, no changes, and minimal budget impact are necessary [87]. TQM improves delivery, administration, and product quality while staying within budget and meeting deadlines. Table 2.4 lists TQM's building industry benefits.

Table 2.4: TQM's Advantages for Construction Companies.

1. Highly loyal clients.
2. Lessening of rework
3. Increased job satisfaction for employees.
4. Better communication with architects and engineers.
5. Increased output.
6. A decline in claims
7. Less employee churn
8. Increased efficiency of the schedule.
9. A better connection.
10. Prequalification increases your chances of winning the auction.
11. Change order reduction.
12. Increased client loyalty and better customer satisfaction
13. More provides all the essential were reduced.
14. Reduces resource waste, including those of labor, materials, and money.
15. Lower cost for the poor.
16. An edge over rivals due to increased competition.
17. The company's long-term strategic plans are successfully realized.
18. Prequalification increases your chances of winning the bid.
19. Better performance with the budget.
20. Expands market share.
21. Increased chances of success for contractors in foreign markets.
22. Increased job satisfaction among employees.
23. Better opportunities to acquire contracts in the domestic market.

2.14.3 Obstacles to TQM Implementation in The Construction Industry

According to the literature and real-world examples, there are many barriers to really applying TQM on building projects. For instance, Baden-Hallard (1993) argues that construction firms typically treat cost as an extra expense, rather than the investment return

that results from quality management program investment. Anticipation and assessment expenses related to non-conformance costs are the primary drivers of cost accumulation in the construction sector. Furthermore, Sommerville and Robertson (2000) argue that it is impractical to develop uniform quality criteria to evaluate building projects because of their personalized character and individuality.

Because of the individualized nature of these efforts, there is no tried-and-true method for evaluating their level of quality. This is due to the fact that they are designed to fulfill the requirements of certain customers [88]. The authors Asim, Zaman, and Zarif (2013) state that "the construction business has a soaring number of organizational breakdowns, particularly during a recession inside of the economy" (p. It is possible that subscribing to TQM policies and strategies would be a waste of time and resources due to the fact that the benefits associated with doing so might not become apparent for a very long time, if at all.

In the construction sector, putting TQM into practice can be a challenging process due to a number of factors. These factors include the one-of-a-kind characteristics of each building projects, an underqualified labor force, a lack of authority from senior management, and many more. According to Polat, Damci, and Tatar (2011), many construction companies continue to view quality initiatives as an additional expense. This is because these businesses are not fully aware that the value of non-conformance to quality is significantly higher compared to the expense of operating a quality program. This cost includes the cost of revisions, waste, errors, complaints from consumers, budgetary deficiencies, and schedule delays.

3. METHODOLOGY

The research approach that underlies the study is described in this chapter. It provides insight into the nature of the research, identifies the research paradigm to which the investigation corresponds, and goes into detail about the research approach guiding the current study. The research design is also covered in this chapter, along with the primary and secondary data sources and a review of the primary data gathering tools utilized. The chapter ends with discussion of the research's limitations and the research ethics, which continue to be crucial factors in relation to the current research.

3.1 RESEARCH APPROACH (INTERPRETIVISM VS. POSITIVISM)

Constructivism provides the theoretical grounding for interpretivism, and the focus remains on the practical relevance of concepts developed in social settings. Because of the researcher's central involvement in deducing meaning from the data while it is being collected, this study can be thought of as a field study. Denzin and Lincoln argue that interpretivism's central tenet—that reality is constructed inter-subjectively through interpretations and comprehensions gained through experience and social interaction—arose primarily as a critique of positivist in the social sciences. Because of the researcher's close association with the topic under investigation, he or she cannot be separated from it. The interpretive paradigm says that researchers' perspectives are present throughout the research process because it assumes that reality and our knowledge of it are intricately connected (there is no clear separation between subject and object). Talking things out is how you get to the truth. According to Goldkuhl, several theoretical traditions—including constructivism, critical theory, and deconstructionism—can be found within interpretivism. It is the author's contention that "the interpretative paradigm is fundamental to the goal of comprehending the arbitrary significance of humans in investigated domains." Since subjective meanings are already a part of social reality, interpretivism's guiding principle is to "acknowledge their existence, reconstruct them, understand them, avoid misrepresenting them, and use them as building blocks in theorizing." That's why interviews, observations, and other forms of dialogue between the investigator and the people being studied are so crucial to the interpretative research strategy.

In contrast, positivism "emphasizes the micro level testing in a lab-like atmosphere that excludes the intricate nature of the external world" due to its basic assumption that some patterns of behavior are more pronounced and obvious in a particular group. In this sense, positive research methods (methodological individualism) are best stated as follows (Kaboub, emphasis added). That the researcher is unnecessary is implicit in the positivist view that reality is objective and fundamentally independent of the researcher. The naive realism that Aliyu, Bello, and Martin attribute to positivism is what makes reality objective yet comprehensible, they argue. In this theoretical setup, trying new things out and making adjustments are highly valued. Therefore, positivist research relies heavily on qualitative techniques like hypothesis testing. As the author explains further, positivism "may be seen as a research method and technique that is built on the ontological premise and doctrine that truth and reality are free and independent of the viewer and observer..." Positivism, as described in a number of articles, is the conviction that objective truth exists and can be known with absolute certainty.

All the key requirements for an interpretivist research paradigm have been met, hence this study may be classified as an interpretivist study at its core.

3.2 COMPARING INDUCTIVE AND DEDUCTIVE RESEARCH METHODS

The inductive technique, according to Thomas, is a methodical way of analyzing qualitative data in which the analysis is probably influenced by certain evaluation goals. Such an approach essentially relates to using in-depth readings of the raw data that are then utilized to interpret the raw data in order to develop concepts, themes, and models. Thomas adds that the main goal of the inductive technique is to release research findings from the constraints imposed by organized methodologies and allow them to arise from the common, dominant, or noteworthy themes present in raw data. Inductive research, the author continues, starts with a field of study and enables theory to develop from empirical facts.

Thomas also lists some overarching goals that the inductive research approach seeks to achieve. One, summarizing huge and diverse raw data into concise summaries is possible with inductive reasoning. Furthermore, it helps to ensure both transparency and the creation of clear connections between the research objectives and the summary findings. Thirdly, the

best intervention for creating a theory or model regarding the underlying organization of being studied experiences is inductive reasoning.

In contrast to inductive research, deductive research is going in the opposite direction. Deductive reasoning starts with the general and ends with the specific, whereas inductive reasoning progresses from the specific to the general. Thus, it may be concluded that while induction relates to the testing of theories, deduction refers to the formation of theories. A deductive researcher "works from the top down," according to Creswell and Plano Clark, utilizing a theory of hypotheses to facts as a baseline to either support or refute an existing theory. As a result, data analyses carried out using the deductive research approach frequently agree with the initial researcher-identified assumptions, theories, and hypotheses.

The research at hand is essentially deductive because its main goal is to verify an existing theory in the context of real-world data from an alternative setting to earlier studies, rather than to generate new theories.

3.3 RESEARCH METHODOLOGY (QUALITATIVE VS. QUANTITATIVE)

The key distinction between qualitative and quantitative techniques, according to Soiferman, is how they perceive the essence of reality. And what distinguishes the disciplines is the interaction between the research subjects and the researcher. Onwuegbuzie and Leech claim that while qualitative theorists "believe in multiple constructed realities that generate different meanings for different individuals, and whose interpretations depend on the researcher's lens," quantitative theorists "believe in a single reality that can be measured reliably and validly using scientific principles."

Soiferman asserts that in quantitative research, the researcher is seen as distinct from the research subjects. "The quantitative researcher believes in maintaining an objective attitude to the experiment by remaining in the background," the author continues. Additionally, quantitative research relies on statistical analysis to draw connections between what is already known and what may be discovered through additional research. This approach is based on the idea that "research should be value-free." Furthermore, because the data utilized in quantitative research is primarily numerical, statistical analysis is thought to be the most suitable method for analyzing such data. Understanding and creating correlations among variables using descriptive or inferential statistics continues to be a crucial aspect of

quantitative research. Thus, the researcher can conclude that the fundamental tenet of quantitative analysis is that each person has a unique perspective on the world, which makes it difficult to generalize findings and draw conclusions about the behavior of the entire population from data collected from a sample population.

On the other hand, quantitative research is related to the idea that "the research is impacted to a considerable amount by the researcher's values." As a result, the researcher is not seen as being separate from the study or the participants, even though they are used as a tool to gather data. According to Creswell, qualitative research is "a type of educational research in which the researcher relies on the view of participants, asks broad, general questions, collects data primarily in the form of participant words (or texts), describes and analyzes these words for themes, and conducts the inquiry in a subjective, biased manner." As a result, qualitative research looks for patterns or themes in texts and visuals to draw conclusions and offer interpretations. Soiferman says that the fundamental premise of quantitative research continues to be that knowledge is largely objective. It enables the researcher to extrapolate and make conclusions about the entire population from a small sample size. The most popular techniques for gathering qualitative data include observations, interviews, and document analysis.

Creswell (1998) offers six main approaches widely applied for assessing qualitative data:

- a. As you move from the broadest to the most specific level of data collecting, you should code the information and look for patterns so that you can form a complete picture.
- b. Conduct analyses on the data even as they are still being collected.
- c. The researcher must have the ability to go back and forth between data gathering and analysis in order to use the recursive approach.
- d. Repeatedly perform the analysis, being sure to read and go over the results each time.
- e. Keep an open mind.
- f. Maintain your interpretive stance while providing a descriptive analysis of the evidence.

As a result of the study purpose and primary research questions that were defined in chapter one, the research that is being conducted right now is primarily qualitative in nature. However, to give them a numerical shape and permit comparison, the responses obtained about the qualitative elements from the primary study were then converted into numbers

and/or percentages. This was done to give them a numerical form. Using this method also allowed for the completion of a quantitative analysis.

3.4 RESEARCH APPROACH (PRIMARY VS. SECONDARY)

3.4.1 Primary Study

Kothari defines primary data as unedited information that has been specifically and precisely gathered for the investigation at hand. It is being gathered for the first time and is pertinent to the study questions at hand. Therefore, primary data is unique in nature. based on Hox and Boeigi Primary data are those that have been gathered specifically for the study problem at hand using methods that work best for that research challenge. Every time primary data are gathered, new information is contributed to the body of social knowledge already in existence. Bhattacharyya adds that there are several ways to get primary data, including surveys, questionnaires, focus groups, observations, and interviews.

The top construction firms in the UK were contacted for semi-structured interviews in order to gather primary data for this study's objectives. In-depth information regarding the various quality systems used in the construction sector, as well as their significance in achieving the intended results, had to be obtained through interviews. The semi-structured interviews had a series of preset questions and were planned in advance for a specific period. With the course of the discussion, further questions came up. An interview typically lasted 30 minutes.

2.4.2 Secondary Study

Kothari defines secondary data as already existing information, both published and unpublished, that was gathered by a separate researcher for a different study with a distinct set of research goals. Such data serve primarily as a baseline for the current investigation, providing theoretical, conceptual, and empirical context.

In the second section of the study, secondary research has been carried out through a systematic evaluation of the literature and is provided in the form of a critical analysis. Secondary information was gathered from a variety of sources, including:

- a. Scholarly publications on construction projects and quality management.

- b. Publications and instructions from the industry, the internet, and books on quality management and construction projects.

3.4.3 Justification

Interviews that followed a semi-structured format were found to be the major research intervention that was the most successful for this particular study. The decision to conduct semi-structured interviews was made due to the numerous benefits that these interviews offer in comparison to other methods. According to Saunders, semi-structured interviews provide those who are taking part in the study more discretion in how they respond, and they also give the researcher the opportunity to dig further into the participants' comments by asking follow-up questions. According to Opdenakker's argument, another manner in which semi-structured interviews might remove bias in research is because they do not provide participants with enough time to think carefully about their responses. Bryman believes that primary data gathered in this manner is dependable, comparable, and of high quality. The researcher has the opportunity to watch, understand, and assess the nonverbal behavior of the research participants, such as body language, during semi-structured interviews. This allows the researcher to learn even more. In addition, the examination of different perspectives on the matter at hand is made possible by the use of questions that are designed to stimulate the provision of free-form responses. One of the benefits of semi-structured interviews is that participants are given the opportunity to speak freely. Mitchell and Jolley observe that interviews that are semi-structured are less intrusive to the study respondents, yet they still encourage two-way involvement and serve as an extension tool. This is because the questions asked during the interviews are predetermined.

3.4.4 Techniques Triangle

For the aim of this study, the three following sources of information were used, applying the methodology triangle concept:

- a. As the main source of information, semi-structured interviews were conducted with leading UK construction firms.
- b. Internet, books, and journals are used as secondary information sources.
- c. Case study methodology to support the conclusions.

3.5 CONSTRUCTION RESTRICTIONS

A heavy reliance on qualitative data and research has several inherent drawbacks. One is that results from qualitative research cannot be extrapolated to other contexts. For instance, it may not be assumed that Asia will gain similarly from the finest quality system discovered for the UK building industry. Second, because study participants have a lot of room to report biased responses, qualitative data suffers from worries about lesser credibility. Thirdly, qualitative research is a labour-intensive procedure that takes a lot of the researcher's time. Finally, the prejudice and quirks of the researcher can affect the findings of qualitative research.

Interviews that are only semi-structured have many of the same problems that their more organized counterparts do. According to the findings of Walsh and Wiggins, the fundamental concern for semi-structured interviews is always the validity of the data being collected. The authors contend that there is no way to know for certain whether a research participant is telling the truth or accurately recalling what took place during a semi-structured interview because there is no way to monitor the participant's responses. Opdenakker contends that it is challenging to record data obtained through semi-structured interviews since it can be embarrassing and intrusive to scribble down what individuals say. He reasons that this makes it tough to capture the data. In addition, if the interviewer is constantly pausing to take notes, the topic of the interview will be disrupted, and it will be challenging to keep up with the natural flow of the conversation. Thirdly, conducting semi-structured interviews requires a significant investment of time and effort, and the subsequent transcription of those conversations into written form consumes even more time. According to Mitchell and Jolley, the trustworthiness of the data gained from semi-structured interviews is probably low, and it may be difficult to compare the responses of various respondents. Moreover, the authors note that this may make it challenging to analyze the data. It is possible for several respondents to arrive at substantially different conclusions, even when they are asked the same questions. This brings up another issue, which is the issue of researcher bias. According to the findings of certain studies, the interviewer has the ability to influence the participants' responses to the standard questions by selecting which responses to investigate further and by deciding how to do so.

3.6 SCIENTIFIC RESEARCH PRINCIPLES

As recommended by Shamoo and Rensik, Bryman, and Bell, the following ethical issues were given considerable weight because the research involved direct interaction with human participants:

It was made sure that no third party was given access to the research participants' identities without the participants' agreement (if need be). As a result, the responders' anonymity was scrupulously protected.

There was no excessive pressure put on the research subjects in any way, shape, or form, and they were not compelled to provide any particular responses. As a result, the results of the primary research were accurately reported without any falsification or deception.

The research subjects suffered no physical, mental, or emotional harm while participating in the study.

Throughout the research procedure, it was made sure that the integrity of the study and the research process were properly upheld.

Finally, in order to promote impartiality and reduce self-deception, researcher bias was deliberately and purposefully avoided in every situation.

3.7 TQM IS SIGNIFICANT IN TODAY'S BUILDING BUSINESS

The engineers concluded that a country's economic foundation is largely its construction industry. The construction sector is a significant contributor to a nation's economic health and is vital to the growth and development of the state's economy. As a result, maintaining quality in building projects is seen as crucial to the sector's success. Additionally, whereas TQM procedures have long been used in manufacturing and related industries, the construction business is relatively new to the idea. The research's findings can therefore be extrapolated to show that TQM in the construction industry has just recently been implemented, with the primary goal of delivering customer happiness.

The engineers highlighted the following as being crucial elements of implementing TQM in the construction sector. The first step in following due process is to obtain the client's

commitment to quality. Plans for project quality assurance are then created, ensuring that quality standards are established for all phases of building activity. The management then continues by educating and raising staff understanding of TQM implementation while also trying to alter their attitudes and beliefs. The steps for continuous improvement are then started after developing a process approach to TQM. Utilizing quality control circles and motivational programs, extensive and ongoing promotion of employee involvement and contribution is undertaken. Finally, performance is evaluated against benchmarks and quality plans are periodically revised.

Contractors and subcontractors stated that the construction business is more complex and entails labor-intensive work when comparing the adoption of TQM in that sector to that in manufacturing and the service sector. Therefore, for TQM to be successfully implemented in construction projects, labor skills, advanced technical skills, and management abilities are all necessary. Additionally, because the majority of the labor is done outside, unreliable weather conditions have a significant impact on the advancement and success of construction projects. Additionally, the construction sector frequently faces overruns from the target date, which also causes cost overruns to surpass the budget predictions. The manufacturing sector is distinguished by steady-state operations, whereas the building sector typically involves one-time processes that produce one-of-a-kind projects. Participants in the study also noted that the construction industry is distinct in terms of staff mobility, geographical dispersion of contractual relationships, diversity in the types and forms of construction projects, and the subtle waste forms that frequently go unnoticed in construction projects.

During the investigation, it was discovered that the construction companies define TQM as a journey rather than a final objective. The evolution of quality management from the conventional method of management is substantially highlighted by this idea. Over time, both in terms of intensity and diversity, the complexity of the construction sector and its clients has increased. In order to deliver higher-quality projects to the end users, TQM is implemented in building projects.

According to the study's findings, construction firms often confuse TQM and quality control. Traditional wisdom holds that ISO 9001 and 9002 compliance is all that's needed to apply TQM to building projects, however this is far from the truth. However, it is crucial to recognize that QA and QC are only ancillary steps in the quality process as a whole. Total

Quality Management (TQM) is an all-encompassing and comprehensive approach to improving the quality of an organization's operations and its products or services through the use of quality assurance (QA) and quality control (QC) practices during construction projects.

Participants in the survey mentioned several important reasons why TQM is important in the construction industry.

3.7.1 Concentrate on Enhanced Quality

Quality is, and will continue to be, the single most essential aspect in determining the overall success of construction projects. Indicative of the quality of the project is the degree to which it is successful in living up to the anticipations of the customer, which in turn results in the satisfaction of that customer. TQM is focused on shifting the focus of control from outside the individual to within the individual in order to keep all key stakeholders accountable for their own performance and sustain their commitment to achieving quality, as demonstrated by all research participants. Therefore, it is commonly understood that quality in building projects must originate with the end user and cannot be required from on high. This is contrary to the conventional wisdom, which holds that quality must originate with the architect. It would appear that a substantial amount of knowledge and expertise on the part of the workers is required in order to realize ongoing improvements on activities and processes. This is necessary in order for TQM to be successfully applied in construction projects, which is necessary in order to enhance overall levels of productivity.

The perception of quality was shown to be a key element in the implementation of TQM in building projects during the course of the research. The deployment of TQM was linked by the contractors and subcontractors to lower costs, but many others still connected it to lower follow-up charges. All contractors and subcontractors agreed that TQM aids in the elimination of flaws and thereby improves quality. Quality was considered as an important characteristic of the construction projects by all research participants.

Participants in the study were asked to define quality for the researchers. Whereas engineers associate quality with defect-free work that delights both internal and external clients, contractors and subcontractors associate quality with cost savings, increased profits, and enhanced value. It's fascinating that workers credit communication and cooperation between

the construction firm, its vendors, and its customers for the high quality of the final product. It was clear from this that teamwork is essential for achieving TQM in construction projects. It was alarming to observe that none of the construction firms had a formal quality management program in place, even if the contractors were in the planning stages of adopting such a program. This finding was especially concerning given that general contractors and subcontractors make up the nation's most successful firms. It's possible that the reluctance to implement TQM in the construction industry is due to a lack of familiarity with the methodology. The government needs to look into it and back the implementation of TQM in the construction industry as soon as possible. Participants in the study generally agreed that TQM was beneficial, but they did not yet report that the strategy had been properly implemented.

Additionally, TQM is regarded as an effective management strategy in the construction sector where organizations, people, and processes are strategically interlaced in the proper way to enable the right things to be done at the right time. Participants in the study concluded that TQM fundamentally places an emphasis on innovation and the application of new technology to improve quality. In the highly competitive corporate world of today, it has emerged as one of the most significant forces driving innovation and has become a crucial element of organizational growth and success in both domestic and international markets.

3.7.2 Finding Mistakes and Continual Improvement

The construction industry is able to pinpoint problems' root causes using the TQM approach, which enables analysis and the implementation of corrective actions. Additionally, locating these flaws and taking corrective action help to ensure the safety of construction projects. Additionally, the employees' mindset might be changed from one of merely monitoring to one of persistently striving for advancement.

Contractors and subcontractors believed that finding and fixing flaws was a key component of quality. Therefore, maintaining quality to them meant doing away with flaws and giving construction enterprises a competitive edge while incurring minimum TQM costs. Although the contractors and subcontractors agree that TQM is a tactical move to cut follow-up costs due to fewer defects, they also point out that there is always opportunity for improvement across a range of construction project-related areas.

Respondents in the study were asked to evaluate the potential for improvement posed by a variety of approaches to building site labor. The engineers determined that on-site monitoring and redesign were the two processes that might profit the most from the application of TQM strategies. On-site testing methods and material certification have been singled out as potential areas for improvement by both general contractors and subcontractors. On the other hand, the construction workers demanded that the TQM development activities should place a higher priority on the management of the personnel working on the project and the safety of the building site. This is because these are the two aspects that the construction workers themselves consider to be the most significant.

3.8 WHY USING TQM SYSTEMS IN BUILDING PROJECTS IS ADVANTAGEOUS

Everyone who took part in the research made a comment about how important it was to include TQM procedures into building projects because of all of the benefits that would result from doing so. A more effective process management led to uniformity from the design phase through delivery, which in turn increased performance and improved the construction company's standing in the eyes of its customers. Reduced construction cycle times, fewer commodities damaged while in transit or while being constructed, and increased delivery speed to building sites are all desirable improvements. The participants on the panel went on to observe that the majority of these benefits have not been realized since the building company's workforce lacks a grasp of customer satisfaction and does not pay enough attention to it. They do, however, emphasize that TQM approaches should be included into every area of construction projects in order to assist in the accomplishment of management goals such as defect-free work, better productivity, satisfied customers, more revenue, and lower costs. The following is a list of some of the most important advantages that can be gained from implementing TQM systems in building projects:

3.8.1 Continual Development

According to the participants in the study, TQM is "simply" a collection of improvement-centered processes and strategies that aim to transform the management environment to initiate and sustain continuous improvement in the functioning of the workplace. This definition was derived from the findings of the study. When quality standards are put into place and continuously followed on a regular, repetitive basis, a strong foundation is built

for continuous improvement and, by extension, ongoing advancements in productivity. This trend, which leads to increases in performance levels, also encourages innovative thinking because it leads to higher levels of performance. In the same way that it is typically more cost-effective to discover problems through inspections and then take the necessary steps to rectify these defects, preventing faults through the implementation of quality programs is typically an approach that results in lower costs overall. In order to successfully use the TQM's continuous improvement process in construction projects, it is essential to place an emphasis on procedures in order to maximize their efficiency.

The application of TQM in building projects comes with a number of benefits, one of which is the continuous improvement idea, which includes the enhancement of processes. To put it another way, statistical process controls are the backbone of any successful endeavor to improve a process. They provide the workforce and the construction company with the accurate information they need to make decisions based on accurate and complete data. According to the general contractors and the subcontractors, quality improvement teams are established in order to analyze the factors that contribute to quality issues and to suggest potential remedies. Following the presentation and evaluation of a number of prospective solutions, the most promising one is selected for implementation, and its results are then monitored and assessed. Enhanced productivity and product quality are the yardsticks by which success is judged.

A number of misconceptions regarding the advantages of implementing TQM for continuous improvement were brought up during the course of the research by the participants. To begin, there is a common misconception that TQM cannot be implemented across the board in the construction business because every single building site is unique. The fact that building procedures, as well as approaches and techniques, remain virtually the same regardless of the place where the project is being worked on is, unfortunately, one of the reasons why the problem continues to exist. Because of this, virtually every building site and construction project can gain something from placing an emphasis on ongoing progress toward betterment. On a large project, it is possible to deal with errors and delays, but this is not the case with a small project. No matter how large or small a project is, the risk of errors and delays can reduce the overall quality of the work, but TQM employs the principle of continuous improvement to reduce the likelihood of these issues occurring. There is also a

widespread misunderstanding that the two have no link to one another. TQM initiatives have a reputation for being excessively expensive due to the costs associated with educating staff members and transforming the mindset of the firm as a whole. However, the expenditures that are associated with utilizing TQM in a process of continuous improvement are significantly outweighed by the benefits that are gained from doing so.

3.8.2 Increased Productivity

According to the findings of the study, implementing TQM on construction projects has a cumulative effect of boosting cooperation, communication, and efficiency, which ultimately results in increased output. Through increased productivity and adaptability, Total Quality Management (TQM) helps construction projects become more competitive in the market. Getting things correctly the first time around, saving money, and fostering constant process improvement are the core focuses of Total Quality Management (TQM). Engineers are of the opinion that the introduction of TQM will be beneficial to construction projects as a result of the following improvements in quality, competitiveness, employee relations, operations, customer satisfaction, and financial performance. This will, in the long term, lead to an increase in production. A culture that emphasizes continuous improvement will, in direct proportion, result in increased human and machine efficiency.

The participants in the survey came to the conclusion that Total Quality Management (TQM) is now a fundamental philosophy for improving the effectiveness, competitiveness, and profitability of construction businesses. TQM is fundamentally client-driven, which means that it places less of an emphasis on internal efficiency and more of an emphasis on planning to optimize customer satisfaction through the delivery of projects of the greatest possible quality.

3.8.3 Extremely satisfied clients

Research participants cited increased customer satisfaction as one of the most notable and desirable benefits of employing TQM in construction projects. Customers are more likely to return for future purchases when they obtain projects of a higher quality, which is the consequence of efficient work practices that always seek improvement. The engineers concluded that, whether the client is internal (a department within the same organization) or external (the eventual recipient), maximizing satisfaction is the primary objective of

incorporating TQM into construction projects. They also mentioned that figuring out what it is that customers want, and turning that into measurable criteria, could be the most crucial stage. They understood that satisfying customers required more than just meeting their needs, and that continuous development was essential.

Participants in the study claimed that there are four crucial processes that are fundamentally responsible for customer satisfaction in building projects. One is that the relevant construction firm informs its clients—internal and external—of the quality management measures it has implemented. Second, in order to streamline operations and procedures, client expectations are precisely determined and specified. Thirdly, client satisfaction levels are accurately assessed and reported. Finally, the necessary steps are done to raise the current levels of customer satisfaction.

3.8.4 Lower Costs

The expenses of the current construction projects are of utmost importance to the contractors and subcontractors. They make it very evident that the costs associated with failing to adhere to quality standards outweigh those of putting TQM systems into place. Fundamentally, failure to apply quality processes leads to a status quo in which excessive expenses persist and improvements are not made.

The engineers determined that accidents, omissions, errors, subpar product quality, and time delays are among the different consequences of non-conformance. All of these eventually lead to redoing work, recalling it, expediting it, removing items from the punch list, extending deadlines, raising insurance costs, and frequently incurring additional costs and damages through litigation. The builders and subcontractors go on to say that TQM offers the chance to save money by making modifications on a number of different times. TQM implementation, for instance, can lower inspection and review expenses. In a similar vein, expenses associated with subpar work, such as rework, revisions, dispute settlement, insurance premiums and coverage, removal and replacement costs, write-offs, past-due receivables, inefficient trade coordination, etc., can be decreased. In essence, the labor representatives divided quality expenses into four groups. Expenses involved with preventing faults in the project, from design through delivery, are referred to as preventive costs. All expenses related to the guarantee of compliance with quality standards and

regulations are considered appraisal charges. Internal failure costs, or all expenses related to reviewing and revising the design before it is made available for construction. Last but not least, there are external failure costs, which include all expenses related to the product as well as intangible costs like diminished reputation and goodwill.

3.9 BEST QUALITY CONTROL FOR BUILDING PROJECTS

Participants in the study were charged with describing the most essential components of the ideal quality management system for building endeavors. When referring to the quality management system (QMS) of a corporation, the phrase "best construction project quality management system" (QMS) refers to a QMS that completely addresses all aspects of quality policy, objectives, and duties. These processes incorporate quality assurance, quality control, and quality improvement in some way, shape, or form.

Participants in the study further talked about how internal and external variables are typically included in quality systems. The contractors determined that internal quality systems, also known as quality management systems, primarily encompass the actions intended to give management confidence that the desired level of quality is being met (QMS). The successful deployment of a QMS fundamentally results in improved project quality, higher project efficiency, decreased waste, and ultimately increased firm profitability. An external quality system, on the other hand, entails actions that are intended to give the client confidence that the supplier's quality system will unquestionably support the project and meet the client's quality expectations and criteria. The term for this is Quality Assurance System (QAS).

3.10 ISO 9000-9001

It has been determined that ISO 9000 is the quality management system that is the most successful in the construction business. They came to the conclusion that this quality approach is the most well-known and is used extensively in the construction sector all over the world. Furthermore, based on its track record, it has good future potential. ISO 9001 is focused with the regulations that businesses must meet, whereas ISO 9000 is based on the eight management principles.

Participants talked about the numerous components of quality management that are relevant to building projects and how different clauses in ISO 9001 address those areas. In Clause 4,

we see a demonstration of the fundamentals of the QMS, including the requirements for general use and documentation. Clause 5 outlines a variety of management tasks, including commitment, customer focus, planning, quality policy, management review, and others. Clause 7 covers topics such as strategies for interacting with customers, the development of products and services, product and service design, sourcing, manufacturing, distribution, and quality assurance. In a manner similar to that of clause 7, this one discusses topics of monitoring, measuring, controlling for nonconformity, analyzing data, and improving the situation. It is an essential prerequisite for meeting the requirements of the ISO 9001 standard.

The engineers, contractors, and subcontractors determined that an ISO 9001 certified QMS for construction projects consists primarily of four key components:

- a. Management duties: Participants in the study concluded that top management commitment and involvement are essential elements for guaranteeing ongoing QMS improvement in a building project. Without the backing and commitment of top management, a QMS cannot be developed or implemented, and neither can client expectations nor desired quality standards be met. This necessitates senior management involvement in terms of routine monitoring, the creation of quality standards and targets, annual evaluations, and making sure that resources are available for efficient resource use.
- b. Resource management: According to the participants in the research, construction resources like on-site personnel, subcontractors, and suppliers on other resources like machinery and materials need to be acquired, deployed, and regulated in line with the requirements of the project. Other resources like materials also need to be controlled. The contractors also emphasized the need of correctly planning and arranging things such as inspection and testing schedules, construction drawings, method statements, specifications, project quality plans, and so on. According to the engineers, efficient resource management in the context of building projects requires not only the timely scheduling and delivery of supplies and equipment but also programs to increase labor resource skill sets.
- c. Planning: remains an indispensable component of a strong quality management system for building projects. According to contractors and subcontractors, in order for an

organization to effectively plan a project, it is necessary for the organization to have a detailed construction method statement, a complete work program, a cost program, a project quality plan, a labor, material, and plant schedule, as well as a labor, material, and plant schedule. Control and conformity are made much easier when they are incorporated into the very beginning of the building process. Planning for quality still necessitates putting together a capable group of people who are able to develop actionable plans, elaborating on the result that the quality system is supposed to provide, and keeping a constant eye on the needs of the client.

- d. Control of the construction process: Construction process control is the final element of a successful ISO-9001 certified QMS, according to both engineers and contractors. By doing this, the focus is still on managing the construction activities so that the processes are kept under control. The physical work monitoring and supervision, cost planning, design and specification, and other operations are among the most crucial ones. The experts also point out that the conformity and performance measurement procedure must always be used to inspect and test the finished result of the construction process.
- e. The contractors placed a strong emphasis on the necessity of conducting inspections of the material, machinery, and workmanship on construction projects in order to ensure compliance and measure performance. This is something that may be done on a daily basis, in addition to being done at site meetings on a weekly or monthly basis. The only way to reach the quality targets set for the project is for the project management team to conduct an in-depth study of the process outputs. As a consequence of this, quality control in construction projects is accomplished through the utilization of the following strategies: the formulation of distinct process specifications and workmanship standards; the implementation of stringent process monitoring procedures; the execution of routine inspections and tests; and the recruitment of construction laborers who possess specialized and unique skill sets.

3.11 Quality Management

Contrary to the engineers' opinions, the contractors and subcontractors deemed TQM to be the best suitable quality standard for construction projects. The benefits received from it are explained above, along with the reasons why it is the best suitable intervention. The

distinctions between quality assurance and quality control in a construction project continue to be the main conclusions for this section:

Table 3.1: Comparing between QA and QC.

Quality Assurance (QA)	Quality Control (QC)
A well-organized series of actions to guarantee that the requirements have been established.	A method for evaluating quality against standards.
A procedure for setting up and assessing processes.	An action that determines whether the project complies with the established requirements.
Assists in setting up the procedures.	Carries out the procedures.
Creates measurement strategies to gauge the effectiveness of processes.	Determines whether a project contains certain characteristics or not.
Improve processes by identifying their flaws.	Discovers flaws.
Eliminates flaws.	Finds, communicates, and fixes errors.

3.12 HIGH-QUALITY CONSTRUCTION PROJECT INGREDIENTS

The engineers note that many construction businesses have experienced failure in their attempts to use TQM to raise quality. They were unsuccessful, nevertheless, since they only paid attention to money indicators rather than quality indicators. The contractors and subcontractors also talked about how too much effort put in too quickly, as well as a lack of a solid foundation and implementation focus, are the main causes of TQM implementation failure. Therefore, it is still essential to comprehend the key success elements for TQM adoption in construction projects if you want it to be a success.

3.12.1 Continuous Education

Research has made it clear that TQM is basically a strategy for planning, coordinating, and assessing each step of a construction project. That's why it's so important to keep stressing the significance of TQM's fundamental themes—including the significance of continuous learning and associated ideas like partnership, cooperation, and empowerment. The need for a shift in the construction firm's culture and practices to foster a learning environment is another aspect brought to light by the concept of continuous learning. This supports the idea that TQM in construction projects only facilitates management's acceptance of a strategic view of quality that places greater emphasis on problem prevention than problem discovery, hence guaranteeing ongoing enhancements.

Since the fundamental goal of applying TQM to a building project is to identify and comprehend improved work procedures, this goal can only be achieved by using TQM as a significant organizational transformation. This will necessitate changes to the construction company's culture, procedures, core values, customs and policies, and strategic priorities. The ability to translate, integrate, and finally institutionalize TQM as a fundamental idea ingrained in routine practice and behaviors is the single most significant driver of success for a construction firm employing TQM, according to research participants.

3.12.2 Training and Education

It's possible that engineers, general contractors, and subcontractors may all agree that the levels of education and training that people at the construction site have has a direct impact on the quality of the work that they create. It was underlined that training is vital because it provides employees with the values, skills, and information they need to effectively carry out TQM-related duties and activities on the job. This was one of the reasons why the importance of training was emphasized. The lack of training and knowledge was cited as the reason for the failure of the TQM initiatives by the engineers. For the purpose of bridging the gap between quality objectives and day-to-day responsibilities and activities, the workforce needs to be rewarded to engage in quality-oriented behavior and relevant training.

More generally, the quality objectives must be incorporated into the strategic planning process in order to genuinely put strategic quality management concepts into effect. The engineers identified many strategic planning frameworks that can be used to do this. The contractors and subcontractors saw the possibility of using initiatives like quality function deployment (QFD) to provide detailed instructions for carrying out strategic objectives. They also highlighted the need for developing a strategic quality management system and stressed the importance of implementing new technology.

In addition, it is still very important to have a firm grasp on the value of training when it comes to the implementation of TQM on building projects. The contractors are pushing to have a basic overview of TQM's guiding concepts and practices included in the training programs. The workforce will be equipped with fundamental knowledge as a result of this, upon which more advanced ideas can be constructed. The engineers emphasized the need of developing collaborative skills and receiving training as part of TQM education. This is due

to the fact that Total Quality Management necessitates a collaborative, disciplined, and methodical approach to improving business operations. Training programs should also focus on cost-benefit analysis, team problem solving, core statistical methods, interpersonal communication, and evaluation methodologies for quantitative data, according to respondents working in the field of labor.

3.12.3 Employee Participation and Empowerment

Their input and authority are crucial in matters of staff development and training. Workers' confidence in their own abilities to solve problems and make safe choices without constant management oversight is expected to rise as a result of an increase in employee participation and empowerment. The contractors are of the opinion that encouraging a culture of accountability, responsibility, and motivation among employees is a good way to enhance the quality management procedures of any given construction company. Construction site quality problems, according to the subcontractors, stem from a combination of reasons, including a failure to foster cooperation, the presence of conflict, and an absence of worker participation. Participating in quality improvement activities and initiatives is the most effective way to address these problems. As a result, TQM programs rely heavily on worker buy-in and autonomy during construction projects.

The dedication and direction of senior management, participation, recognition and reward, teamwork, and opportunities for professional development are other elements that have the tendency to increase employee happiness. All research participants emphasized the importance of collaboration for the TQM program to be successful in construction projects. Teams play a key role in TQM programs, especially when it comes to accomplishing project goals. The underlying tenet of TQM is that teamwork is fundamentally superior to solo effort in accomplishing project objectives. Additionally, the contractors and subcontractors emphasized that these teams must include vendors and external customers in addition to internal organizational members. The engineers emphasized that having a group of people working together to achieve quality is the essence of a quality circle.

3.12.4 Customer Contentment

Of all the essential success aspects for a building project, customer happiness may be of the utmost importance. A construction project is deemed successful if it exceeds the competition

in terms of meeting client expectations and criteria. Therefore, the key to producing built facilities that meet or exceed customer expectations will continue to be the ability to anticipate and promptly respond to client requests with innovative concepts (designs) and technologies. The engineers also discovered that utilizing the most recent tools and methods for process development and competent management also tends to raise customer satisfaction levels, whilst neglecting these elements may result in catastrophe. Therefore, it can be concluded that the TQM program will lack the foundations on which to expand the initiatives further in the absence of a client focus.

The contractors and subcontractors also indicated important building project components that must be considered to improve client satisfaction. For instance, they cited direct interactions with customers as a key strategy for raising customer satisfaction. It is still essential to connect with consumers face-to-face in order to better understand their wants and, in turn, be able to meet their requirements. Being approachable and friendly was also mentioned as a crucial component; clients need to know that the business managing their project is polite, approachable, and always open to requests and recommendations. The labor leaders also noted that another crucial way to raise customer satisfaction is to have a well defined customer service policy. This not only saves a ton of time and work in the long run, but also gives customers an easy way to voice their questions and complaints.

Participants in the study were questioned about the many approaches that might be taken to investigate and enhance customer satisfaction. They mentioned a wide variety of approaches, including regularly requesting customer feedback through a system that is properly implemented, conducting extensive market research to understand the needs and behaviors of customers, holding focus groups to learn what customers are thinking, and scheduling routine customer visits to the project site so that they may be aware of the sit's progression.

The labor representatives also compiled a list of crucial metrics for measuring consumer satisfaction with both tangible goods and intangible services. Customers look for a variety of qualities in service providers, including friendliness and courtesy, safety and security, response to requests and inquiries, approachability, a desire to listen, honesty, and the capacity to communicate clearly. Customers look for dependability, beauty, adaptability, usefulness, functionality, and appropriateness in the physical aspects of construction

projects. When all these signs are considered, they add up to a list of crucial success elements for raising customer happiness.

3.12.5 Supply Chain Quality Control

According to the study, TQM understood the value of supplier participation in the construction sector. This argument is primarily supported by the fact that the quality of every given stage of a building project depends on the quality of the stage before it. The contractors used the team of carpenters as an example, who frequently grumble about having to modify their work to match that of the electricians and plumbers. Therefore, it is crucial to carefully define the requirements and show respect for one another's wants. As a result, the TQM concept needs to pay substantial attention to supplier management. Maintaining solid, long-term ties with suppliers helps achieve the highest economy and quality, and it also encourages supplier loyalty. Additionally, keeping lines of communication open with the suppliers might help to better grasp what the clients' needs are. The end result will be construction projects of exceptional quality that go above and beyond client expectations.

Particular emphasis was placed on the necessity of effective supplier management and supplier quality control by the contractors and subcontractors. Having fewer but more dependable contractors and subcontractors, dependable supplier process control, and a significant interdependence between supply and customers are all required. In addition, strict and efficient purchasing guidelines that prioritize value above cost must be put in place. The engineers also emphasized the significance of putting in place suitable supplier assistance programs and supplier quality control methods in order to develop quality. They gave the example of how materials are frequently a primary cause of quality issues, which has a significant impact on customer satisfaction. Therefore, it can be wiser to buy from a select few competent and dependable suppliers who are certified and trustworthy rather than relying on instruments like acceptance sampling to determine material quality.

3.12.6 Design Quality Control

The goal of design quality management is to increase the efficiency of construction project designs in order to lower production and maintenance costs and safeguard the environment. For instance, the environmental impact was significantly decreased when recyclable materials were used in construction. As a result, design management strives to address how

construction projects affect society, the environment, and resources. Additionally, the engineers recognized the significance of excellent designs as a key element in the success of construction projects. They talked about how better designs essentially lead to distinctive competitive capabilities like flexibility and quick project delivery. Prior to construction and before any experimental designs are heavily utilized in structural design, every new design for a construction project is thoroughly scrutinized. Additionally, the ability to avoid repeated redesigns and the clarity of design standards remain crucial to success. The management of design quality also includes crucial elements such detail design, schedule and cost estimates, design evaluations, and control of design activities. Thus, it can be concluded that outstanding design quality management is anticipated to lead to excellent building projects, which will afterwards increase client perceptions of quality and raise client happiness.

3.12.7 Process Control

Process management is one of the most important crucial success criteria for quality improvements in building projects, according to the study's participants. The main objective of process management is to ensure that the building process runs smoothly and without interruptions. To lessen rework and loss caused by incorrect processing parameter specification, the engineers indicated the necessity for process management. The contractors and subcontractors agreed, claiming that process management promotes ownership clarity and reduces dependency on inspection. Pre-work, demobilization, and execution were noted by the labor as crucial elements of process management. Process management is therefore a crucial component of completing high-quality building projects.

3.12.8 Control of statistical processes

According to the engineers, statistical process control (SPC) is a vital strategy for quality assurance and improvement that is mostly based on objective data and analysis. In order to provide high quality projects, this essentially entails managing and controlling production quality using statistical approaches. The engineers stated that in order to enable continuous improvement and a better understanding of client needs, they receive comprehensive training on SPC. The engineers highlight how the strategy fundamentally focuses on processes and decides the quality of manufacturing output by the process that produced that output after

breaking the word down into its three components—statistical, process, and control. The basic premise here continues to be that quality may be enhanced and the overall number of errors can be decreased by concentrating on how work is done and what process elements affect the output of building projects. In light of this, SPC is a technique for gathering and analyzing data on processes in order to enhance our understanding of them. Process improvements eventually result in higher-quality goods and services, as well as fewer waste and rework. Variation and statistics, the second part of SPC, is concerned with the idea that any process variation basically originates from the various systemic variables that interact when the building project is being completed. Temperature, humidity, vibration, etc. are a few examples. In order to quantify variation, determine its sources, and discover solutions to decrease or eliminate the unwanted variation, quantitative approaches and statistical tools can be utilized. Utilizing statistical techniques makes progress monitoring easier as a result. Control, the final element, deals with determining the common and unique causes of variation. While replacing outdated equipment with newer technology is one of the primary causes of variation in construction projects, special causes can also refer to sporadic occurrences like material damage during transit and machine operator illness. Thus, a process is said to be under control if it is only impacted by common sources of variation; as a result, it is stable and its performance can be expected within reasonable ranges of variation.

It's interesting to note that the engineers, while emphasizing the need of control in processes, also talked about the fact that control is only a way of retaining improvements rather than a replacement for continuous improvement. As a result, information gathered through SPC can be effectively leveraged to pinpoint further areas for process and design improvement in projects.

3.12.9 Excellent Culture

The importance of a solid quality organizational culture for the effective application of TQM in building projects was stressed by every research participant. They claim that an organization's culture is more influential than anything else that exists there, and that it affects everything from implementation to how success is actually attained. The contractors and subcontractors discussed aspects of a quality culture in a specific construction company, such as leveraging information for improvement, job security and equal pay, cooperation

and collaboration, and an environment conducive to learning. These elements tend to boost quality and efficiency while also boosting employee and customer happiness. Additionally, the TQM may fail due to a lack of such a quality-oriented culture or a mismatch between the organizational culture and the criteria of quality management systems. More crucially, since business culture and project culture coexist in the construction industry, integration of the two is crucial for TQM success.



4. RESULT AND DISCUSSION

4.1 INTRODUCTION

The goal of this chapter is to determine which methods of TQM are the most efficient and effective. The following data was collected by means of a questionnaire that was made available on the Internet; it will be subjected to statistical examination, and the findings will be presented in the form of charts.

4.1.1 Academic Qualification

Table 4.1: Academic Qualification.

choice	respondents	percent
B.Sc.	103	65.19%
M.Sc.	27	17.09%
Ph.D.	28	17.72%
Totals	158	100.00%

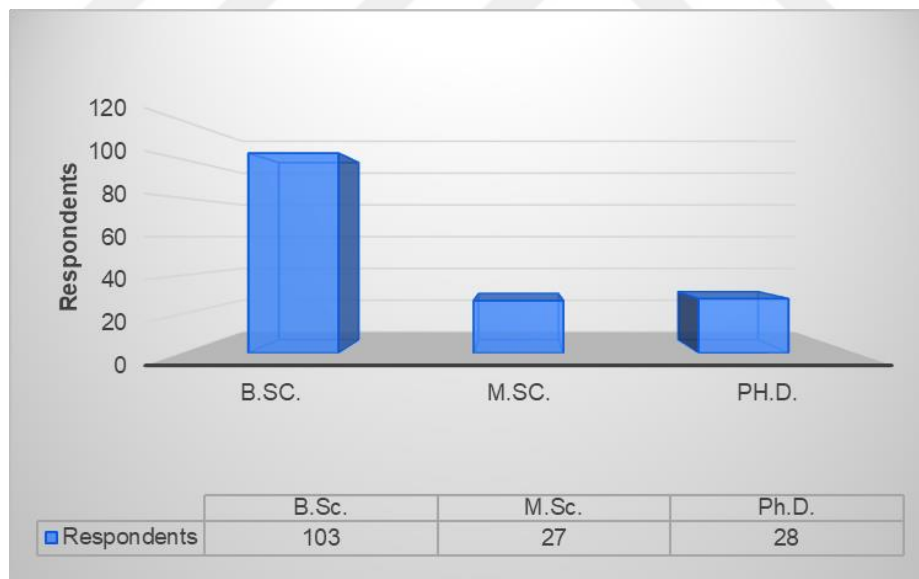


Figure 4.1: Academic Qualification.

Table 4.2 shows that among the respondents, those with a B.Sc. are the most numerous (n=103), while those with a Ph.D. are the second most numerous (n=28), and those with a M.Sc. are the least numerous (n=27).

4.1.2 Job position

Table 4.2: Job.

choice	respondents	percent
Site Engineer	102	64.56%
Job Site Manager	53	33.54%
Company Manager	3	1.90%
Totals	158	100.00%

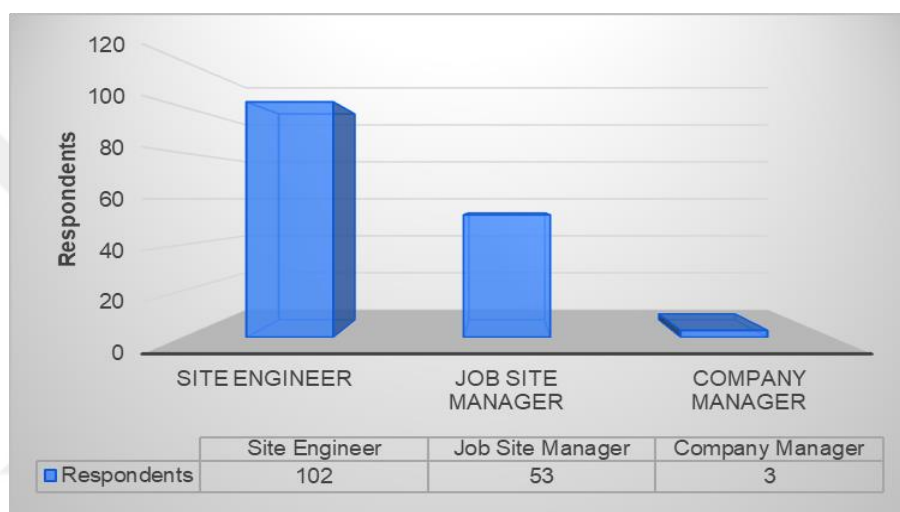


Figure 4.2: Job of Responders.

As can be seen in table 4.2, most survey takers (n=102) are employed as Site Engineers, while just a small percentage (n=53) are employed as Job Site Managers. The smallest percentage (n=3) are employed as Company managers.

4.1.3 Number of Years of Experience

Table 4.3: Years of Experience.

choice	respondents	percent
1-5 Years	1	0.63%
5-10 Years	101	63.92%
10-15 Years	27	17.09%
More than 15 Years	29	18.35%
Totals	158	100.00%

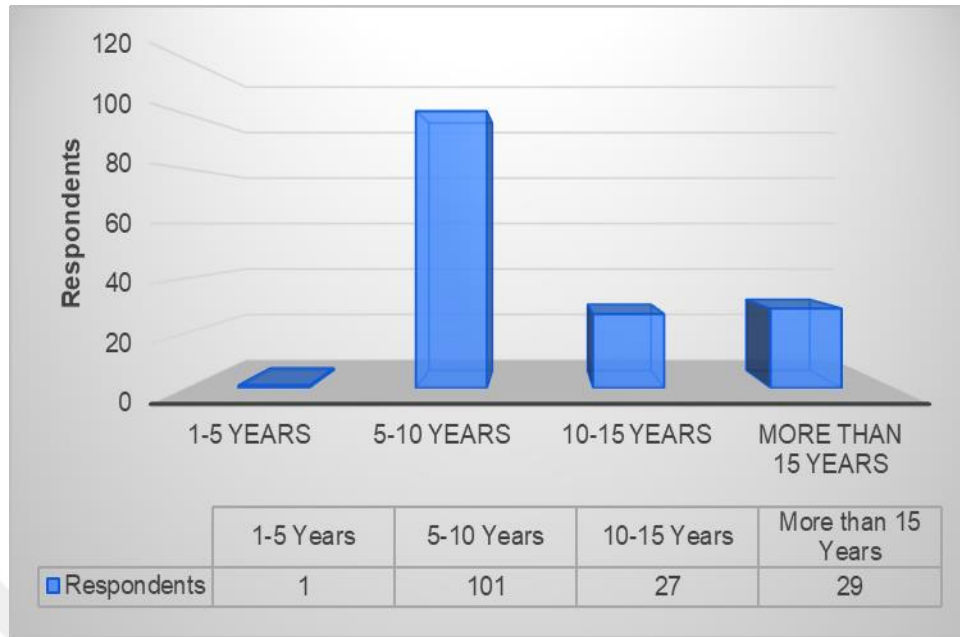


Figure 4.3: Years of Experience.

According to the table 4-3 about the respondents' years of experience, it is clear that the most respondents have 5–10 years of experience (101), while the fewest have 1–5 years of experience (only 1).

4.1.4 Type of Business Sector

Table 4.4: Business Sector.

choice	respondents	percent
Governmental	102	64.56%
Private	3	1.90%
Contracting Company	27	17.09%
Consulting Office	26	16.46%
Totals	158	100.00%

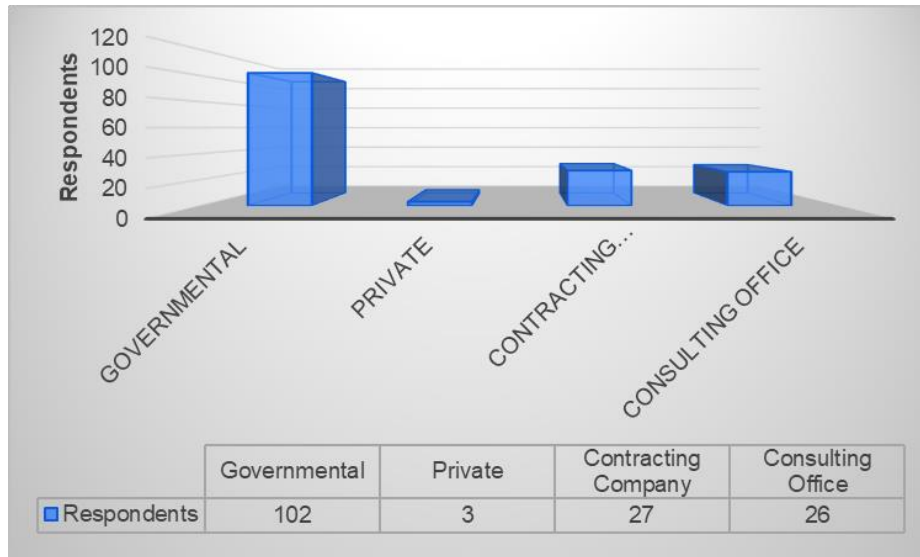


Figure 4.4: Business Sector.

Based on the information in Table 4.4 about where the interviewees work, it's clear that the most people work in the government (102), while the fewest people work in the private sector (3).

4.1.5 The Planning Process

The planning process is comprehensive and detailed, starting from proposing the project idea, passing through the implementation stage, and ending with the stage of handing over the project to the client.

Table 4.5: The Planning Process.

choice	respondents	percent
Fully Operational	29	18.35%
Works partially	128	81.01%
It doesn't work at all	1	0.63%
Totals	158	100.00%

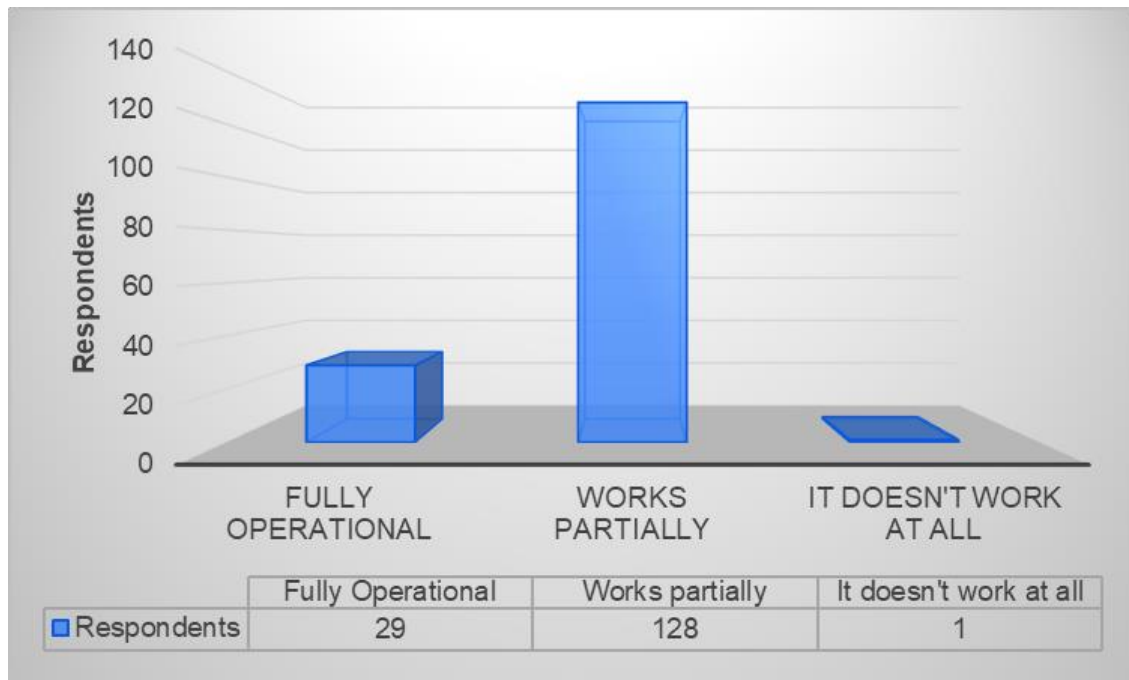


Figure 4.5: The Planning Process.

The researcher asked the interviewees what they thought about the planning process. The table 4.5 shows that the most people chose "Works partially," with 128 votes, and the fewest people chose "Doesn't work at all," with a single choice.

4.1.6 Fully Operational

Table 4.6: Fully Operational.

choice	respondents	percent
Fully Operational	27	17.09%
Works partially	129	81.65%
It doesn't work at all	2	1.27%
Totals	158	100.00%

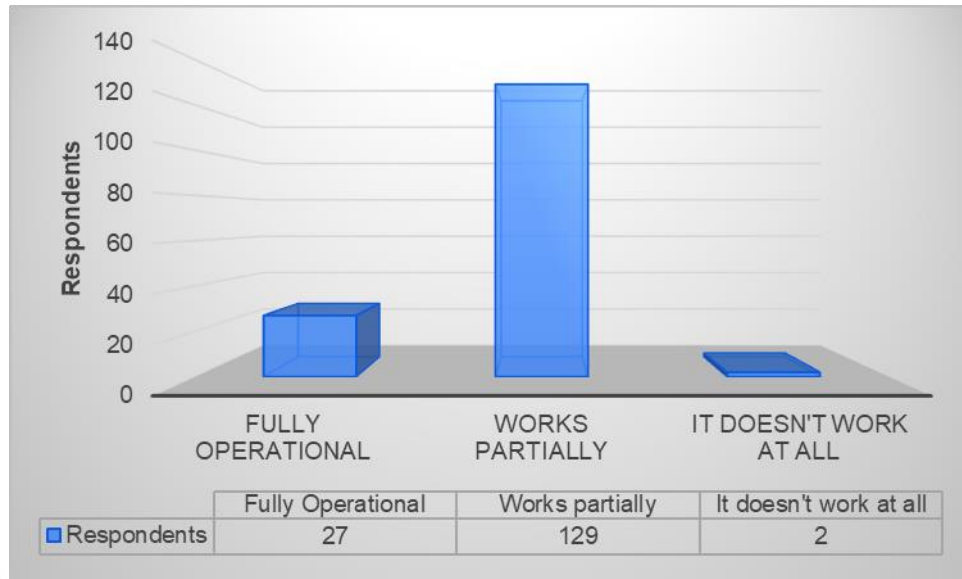


Figure 4.6: Fully Operational.

The researcher asked the people who answered what they thought about their willingness to review and audit each stage of the design and keep track of any changes. Based on Table 4-6, it's clear that the most people who answered chose works partially got the most votes, with 129, while doesn't work at all got the least, with 2.

4.1.7 Determine The Responsibilities and Powers of The Workers on The Design by The Company

Table 4.7: Responsibilities and Powers of the Workers.

choice	respondents	percent
Fully Operational	103	65.19%
Works partially	29	18.35%
It doesn't work at all	26	16.46%
Totals	158	100.00%

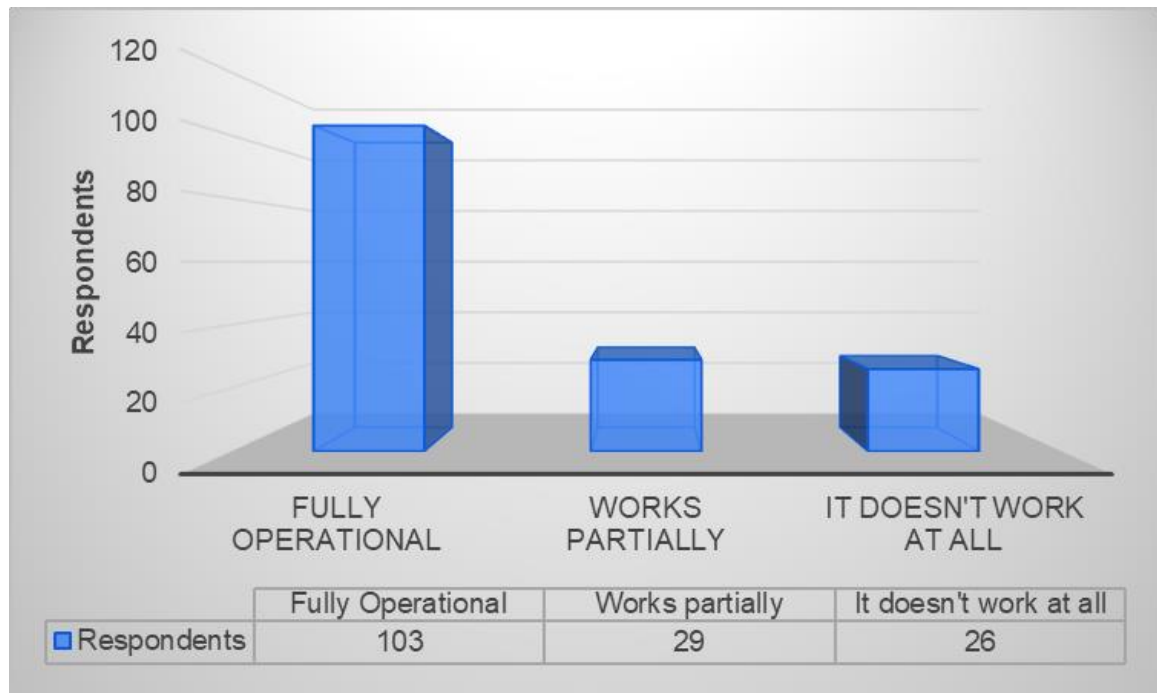


Figure 4.7: Responsibilities and Powers of The Workers.

The researcher asked the respondents about the impact of determination the responsibilities and powers of the workers on the design by the company, according to the table 4-7 the highest no. of respondents choose fully operational.

4.1.8 Product Fulfilments and Quality Requirements

Striving to achieve quality requirements and objectives before starting the project and continuing to do so during implementation through detailed and comprehensive planning of all project activities.

Table 4.8: Product Fulfilments and Quality Requirements.

choice	respondents	percent
Fully Operational	127	80.38%
Works partially	3	1.90%
It doesn't work at all	28	17.72%
Totals	158	100.00%

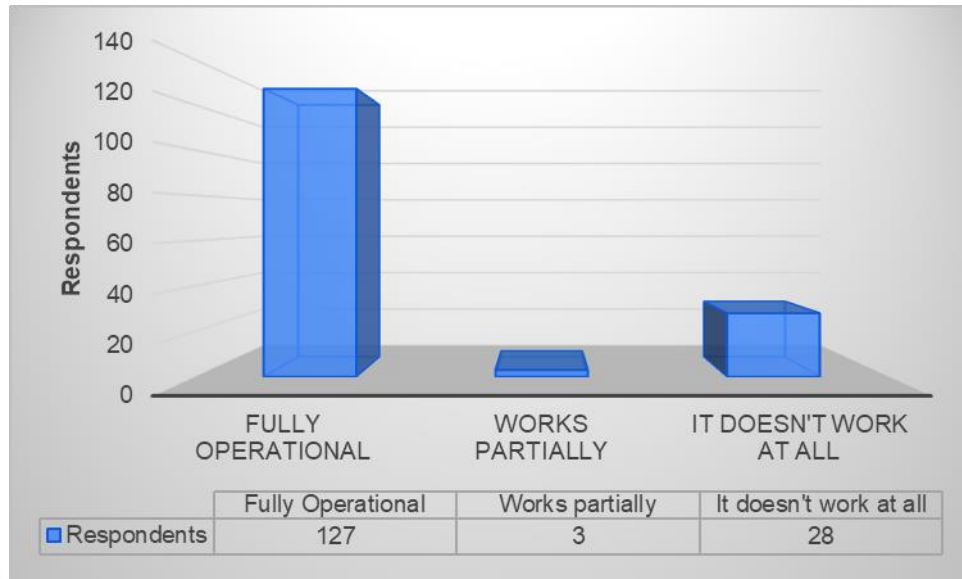


Figure 4.8: Comprehensive Planning of All Project Activities.

The researcher asked the people who answered what would happen if they tried to meet quality requirements and goals before starting the project and kept doing so while it was being done by planning all project actions in detail and depth. From the table 4.8, it's clear that 127 people chose "fully operational," which is the most, and 3 people chose "partially operational," which is the least.

4.1.9 Documented Procedures are in Place During Planning to Verify Product Fulfilment and Quality Requirements

Table 4.9: Quality Conditions in Operations.

choice	respondents	percent
Fully Operational	28	17.72%
Works partially	104	65.82%
It doesn't work at all	26	16.46%
Totals	158	100.00%

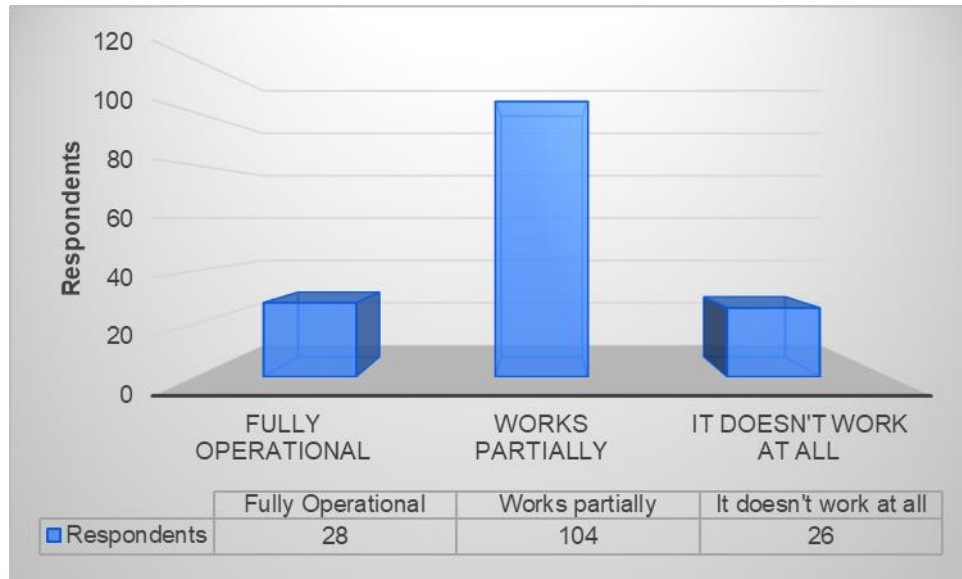


Figure 4.9: Product Fulfilment and Quality Requirements.

The researcher asked the respondents about the impact of documented procedures are in place during planning to verify product fulfilment and quality requirements, according to the table 4.9 it is clear that the highest no. of respondents choose work partially.

4.1.10 Company Has Records Proving Complexes for Quality Conditions in Operations

Table 4.10: Quality Management System and Customer Satisfaction.

choice	respondents	percent
Fully Operational	27	17.09%
Works partially	129	81.65%
It doesn't work at all	2	1.27%
Totals	158	100.00%

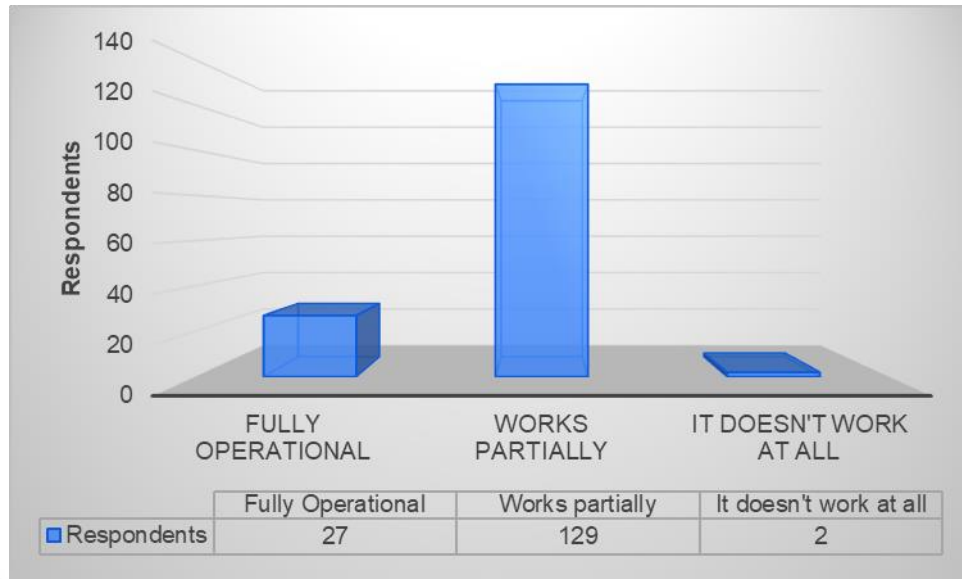


Figure 4.10: Quality Conditions in Operations.

The researcher asked the respondents about the effect of a company's records proving complexes for quality conditions in operations. The table 4.9 shows that the most people (129) chose "partially work," and the fewest people (2) chose "it doesn't work at all."

4.1.11 Product Compliance with Requirements

The company identifies, collects, and analyses data to determine the suitability and effectiveness of the approved quality management system and to achieve customer satisfaction.

Table 4.11: Product Compliance with Requirements.

choice	respondents	percent
Fully Operational	104	65.82%
Works partially	28	17.72%
It doesn't work at all	26	16.46%
Totals	158	100.00%

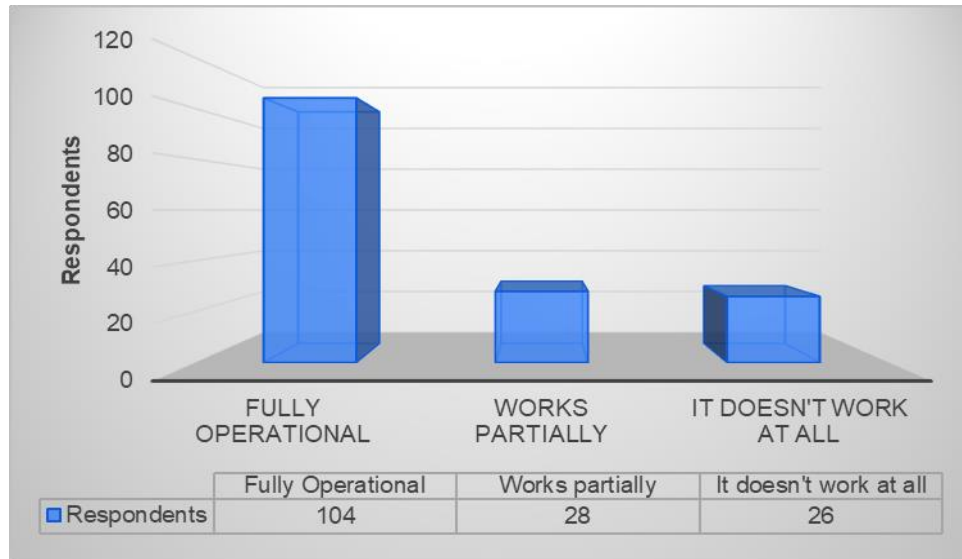


Figure 4.11: Quality Management System and Customer Satisfaction.

The researcher noticed from the results shown in the table 4.13 about the impact of quality management system and customer satisfaction that the highest no. of respondents chooses Fully Operational.

4.1.12 Product Compliance with Requirements Is Verified by Data

Table 4.12: Monitoring Privately.

choice	respondents	percent
Fully Operational	3	1.90%
Works partially	129	81.65%
It doesn't work at all	26	16.46%
Totals	158	100.00%

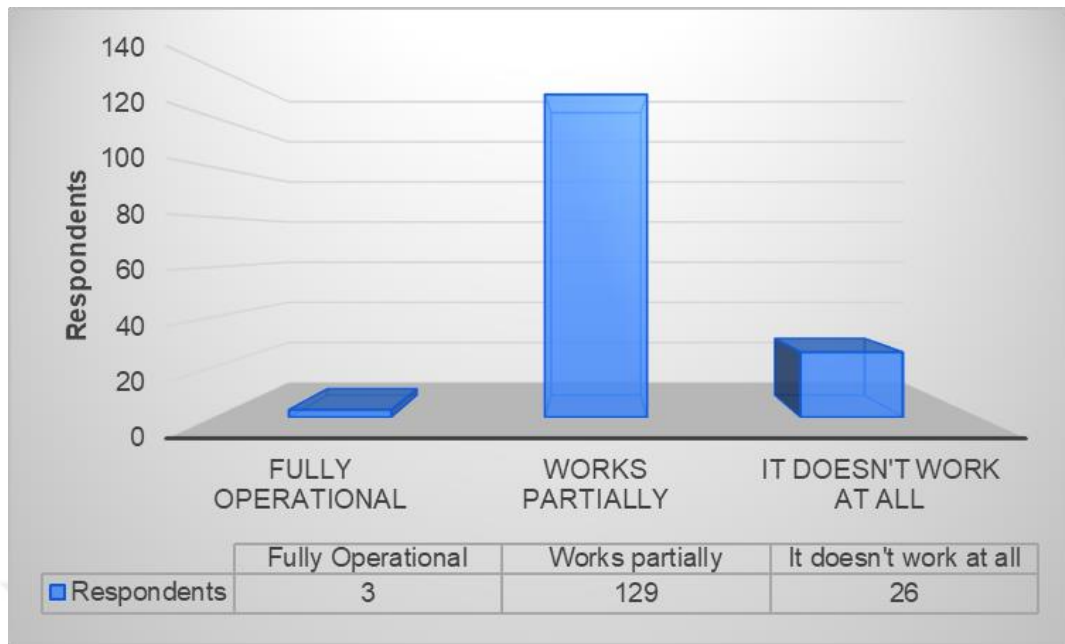


Figure 4.12: Product Compliance with Requirements.

The researcher noticed from the results in table 4.15 about the effect of Product compliance with standards that the most people chose "partially works" (129), while the fewest people chose "fully works" (only 3).

4.1.13 Monitoring Privately is Available to Monitor, Audit and Analyses Company Operations

Table 4.13: Monitoring Privately.

choice	respondents	percent
Fully Operational	37	23.42%
Works partially	76	48.10%
It doesn't work at all	45	28.48%
Totals	158	100.00%

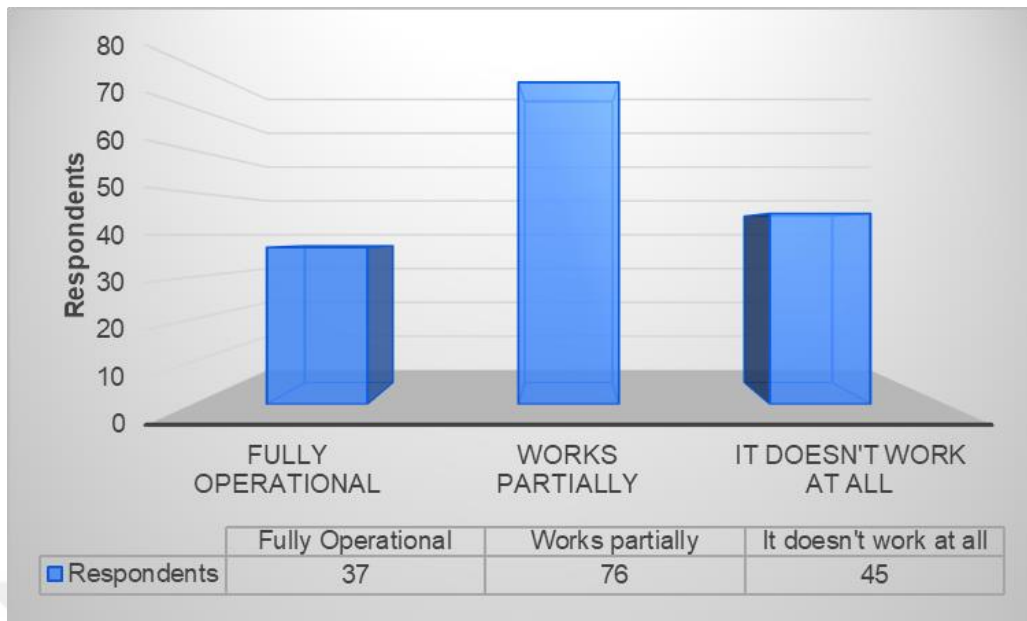


Figure 4.13: Monitoring Privately.

The researcher noticed from the results in table 4.17 about the impact of monitoring privately available to monitor, audit, and analyses company operations that the most respondents (76) chose "partially operational," while the fewest (37) chose "fully operational."

4.1.14 The Company is Constantly Improving the Effectiveness of the Quality System

Table 4.14: Improving the Effectiveness of The Quality System.

choice	respondents	percent
Fully Operational	27	17.09%
Works partially	128	81.01%
It doesn't work at all	3	1.90%
Totals	158	100.00%

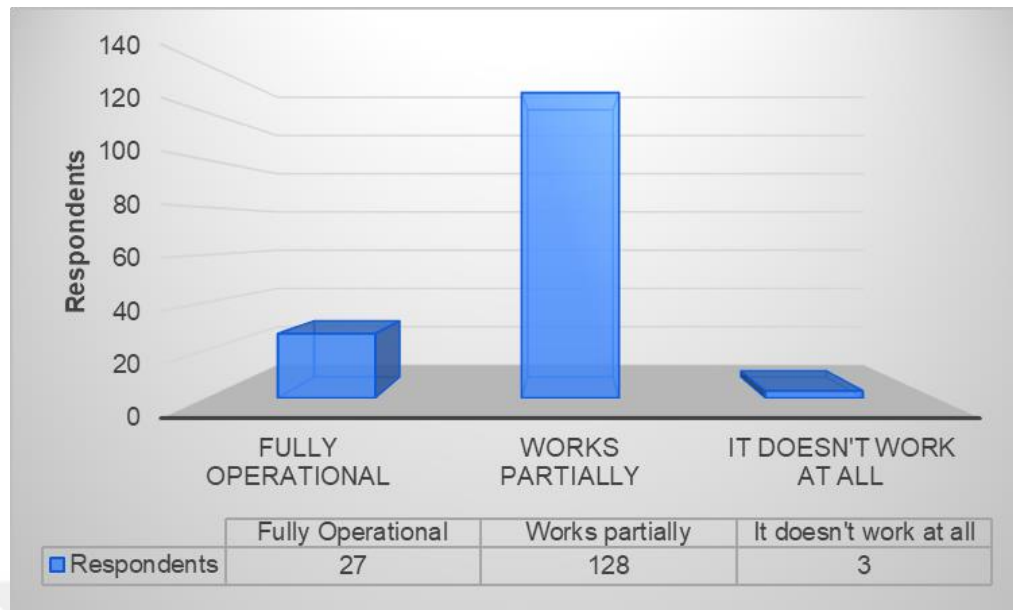


Figure 4.14: Improving The Effectiveness of The Quality System.

Table 4-14 shows the results that the researcher got from the respondents' opinions about how improving the effectiveness of the quality system would affect them. The most respondents (128) said that it would only work partially, while the fewest (3) said that it wouldn't work at all.

4.1.15 Removing Obstacles That Prevent Quality Matches

Correcting procedures by diagnosing the causes of mismatch in the quality of the work and implemented and removing obstacles that prevent quality matches.

Table 4.15: Removing Obstacles That Prevent Quality Matches.

choice	respondents	percent
Fully Operational	127	80.38%
Works partially	29	18.35%
It doesn't work at all	2	1.27%
Totals	158	100.00%

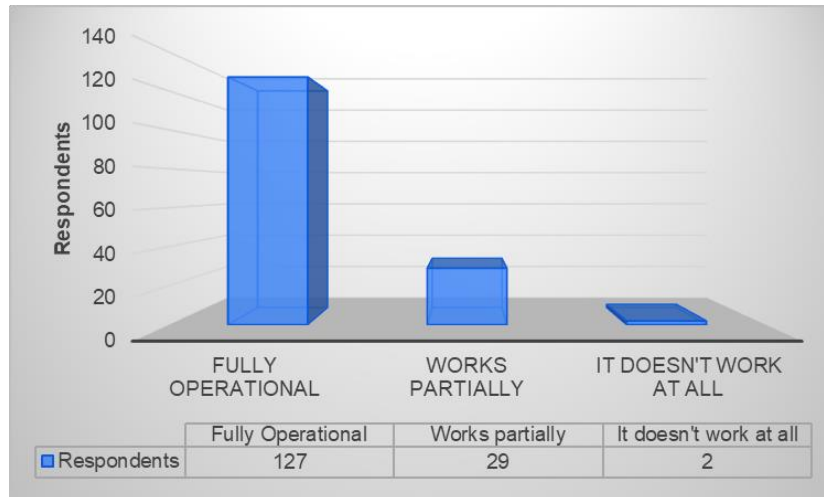


Figure 4.15: Removing Obstacles That Prevent Quality Matches.

Table 4.15 displays the findings that the researcher obtained from the opinions of the respondents regarding the effect of modifying procedures by determining why the quality of the work and how it was implemented do not match up and eliminating factors that stand in the way of quality matches. "Fully Operational" was selected by the largest number of respondents (127), while "It doesn't work at all" was selected by the smallest number (just 2).

4.1.16 Practical Approaches to Achieve Effective and Efficient Process Control Leading to Improved Performance

Table 4.16: Efficient Process Control Leading to Improved Performance.

choice	respondents	percent
Fully Operational	28	17.72%
Works partially	103	65.19%
It doesn't work at all	27	17.09%
Totals	158	100.00%

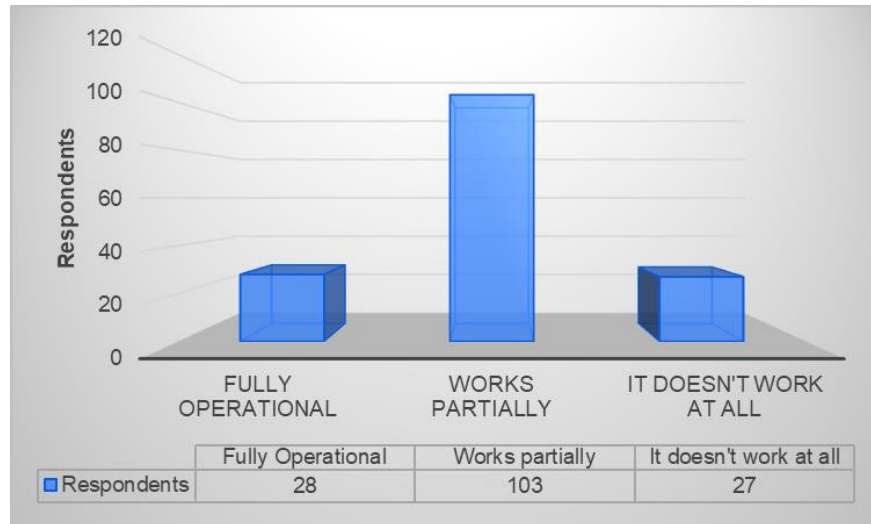


Figure 4.16: Efficient Process Control Leading to Improved Performance.

According to the results shown in Table 4-16, which were gathered by the researcher from the opinions of the respondents about the impact of practical approaches to achieve effective and efficient process control leading to better performance, the highest number of respondents chose "partially works" (103), and the lowest number of respondents chose "it doesn't work at all" (27).

4.1.17 The Company Adopts Specific and Documented Criteria for The Selection and Evaluation of Suppliers

Table 4.17: Criteria for The Selection and Evaluation of Suppliers.

choice	respondents	percent
Fully Operational	29	18.35%
Works partially	27	17.09%
It doesn't work at all	102	64.56%
Totals	158	100.00%

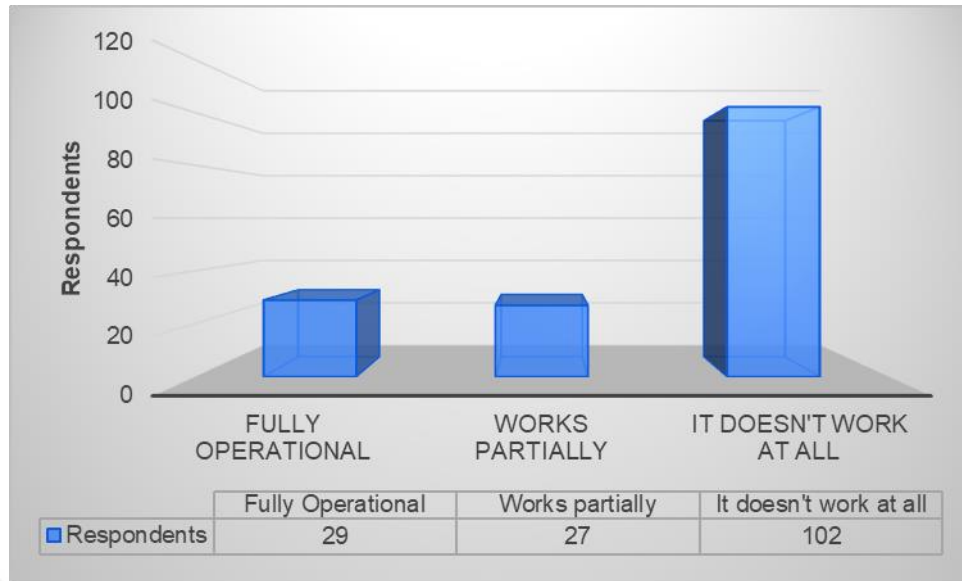


Figure 4.17: Criteria for The Selection and Evaluation of Suppliers.

From the data in Table 4.22 about the effect of criteria for choosing and judging suppliers, the researcher saw that the most respondents chose There were 102 people who said it doesn't work at all, and 27 people who said it only works partly.

4.1.18 Documentations Inclusion Tinder Assistance, Balance and Specialty and other Related Technical Guidelines

Table 4.18: Documentations Inclusion.

choice	respondents	percent
Fully Operational	103	65.19%
Works partially	28	17.72%
It doesn't work at all	27	17.09%
Totals	158	100.00%

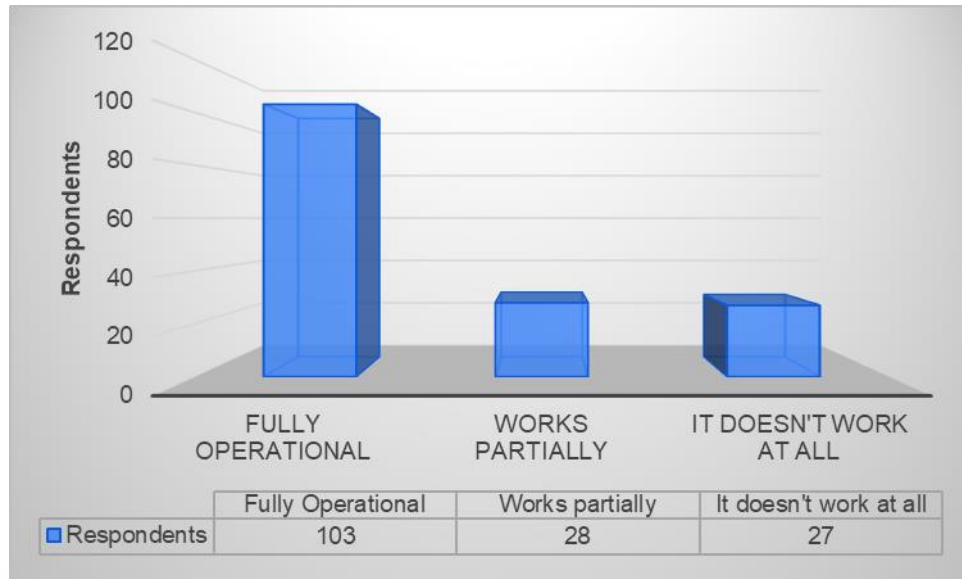


Figure 4.18: Documentations Inclusion.

According to the results shown in Table 4-18, which were gathered by the researcher from the opinions of the respondents about the impact of documentation including tinder assistance, balance, specialty, and other related technical guidelines, the most people chose Fully Operational (103), while the fewest people chose it doesn't work at all (27).

4.1.19 Documentation Procedures That Include the Necessary Checks

There are documentation procedures that include the necessary checks to verify the quality of the product and all items provided by the customer upon receipt and storage

Table 4.19: Documentation Procedures that Include The Necessary Checks.

choice	respondents	percent
Fully Operational	130	82.28%
Works partially	27	17.09%
It doesn't work at all	1	0.63%
Totals	158	100.00%

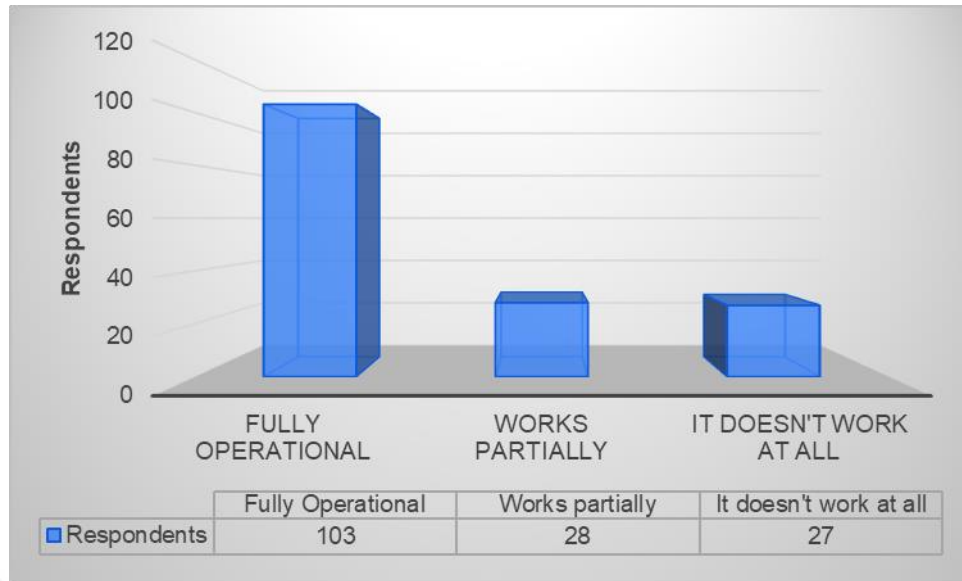


Figure 4.19: Documentation Procedures That Include The Necessary Checks.

Table 4-19 shows the results that the researcher got from the opinions of the respondents about the effects of documentation procedures that include the necessary checks. The most respondents chose "fully operational" (103), while the fewest said "it doesn't work at all" (only 1).

4.1.20 The Company Detects and Prevents Non-Conforming Processes and Products

The company diagnoses and controls non-conforming processes or products to prevent their occurrence or unintentional delivery.

Table 4.20: The Company Detects and Prevents non-Conforming Processes and Products.

choice	respondents	percent
Fully Operational	29	18.35%
Works partially	103	65.19%
It doesn't work at all	26	16.46%
Totals	158	100.00%

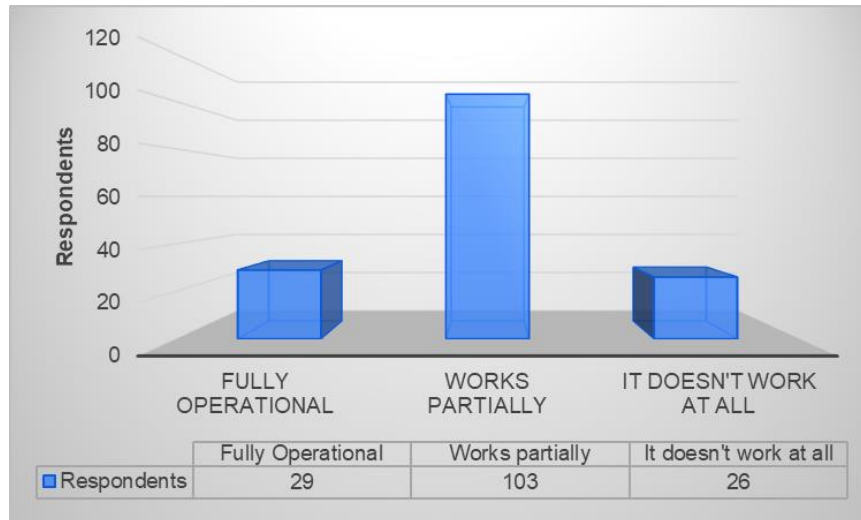


Figure 4.20: The Company Detects and Prevents Non-Conforming Processes and Products.

The researcher noticed from the results shown in the table 4-20 about the impact of company detects and prevents non-conforming processes and products. that the highest no. of respondents choose Works partially.

4.1.21 The Company Fixes Non-Conforming Processes and Goods to Prevent Accidental Use

The company diagnoses and controls non-conforming processes or products to prevent their occurrence or implementation unintentionally and documents.

Table 4.21: The Company Fixes Non-Conforming Processes and Goods to Prevent Accidental Use.

choice	respondents	percent
Fully Operational	29	18.35%
Works partially	29	18.35%
It doesn't work at all	100	63.29%
Totals	158	100.00%

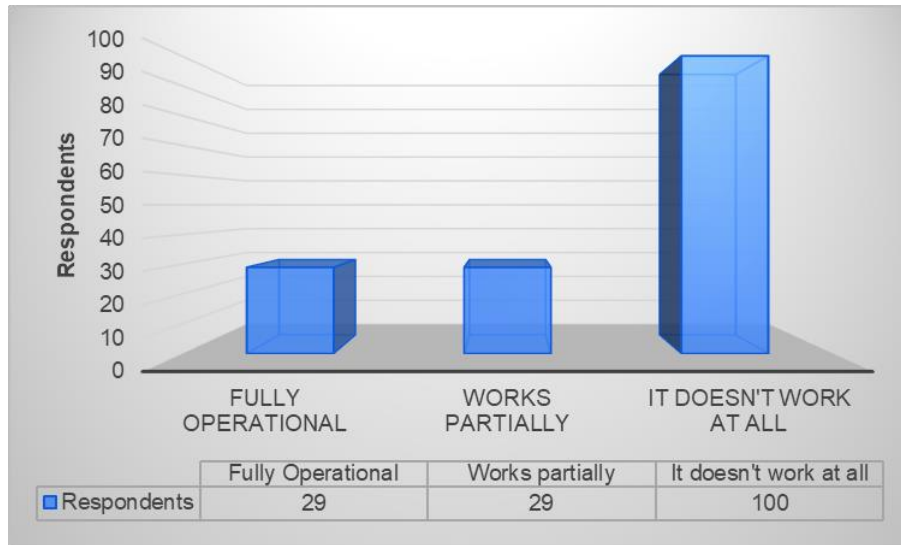


Figure 4.21: The Company Fixes Non-Conforming Processes and Goods to Prevent Accidental Use.

Table 4-21 shows the results that the researcher got from the respondents' opinions about the impact of the company diagnosing and controlling non-conforming processes or products to prevent their occurrence or unintentional implementation and documents. It shows that the most respondents (100) chose that it doesn't work at all, while the fewest (29) chose that it's both fully operational and works partially.

4.1.22 Instead of Throwing Away Resources or Products That Don't Meet Standards, they are Used Again.

The main purpose of using materials or using non-conforming works or products is replaced for other purposes instead of destroying them to reduce waste.

Table 4.22: Resources that don't Fulfil Requirements are Reused.

choice	respondents	percent
Fully Operational	26	16.46%
Works partially	128	81.01%
It doesn't work at all	4	2.53%
Totals	158	100.00%

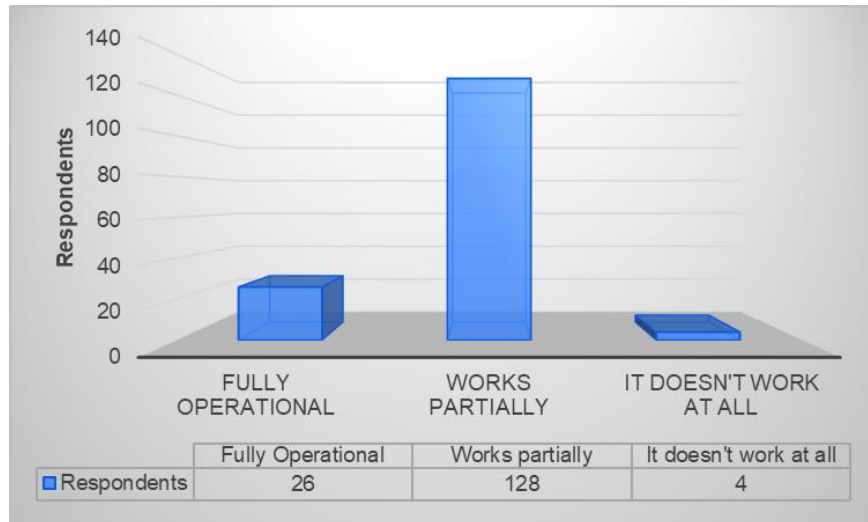


Figure 4.22: Reuse Resources and Goods That Don't Fulfil Criteria.

The results are shown in Table 4.28. The most people chose "partially works," with 128 votes, and the fewest people chose "it doesn't work at all," with 4 votes.

4.1.23 The Business Responds to Any Nonconformity After Delivery or Use Based on How Bad It Is and What It Could Mean

The Company acts in proportion to each case of nonconformity that arises after delivery or use according to its importance, as well as the possible effects of nonconformity.

Table 4.23: The Business Responds to Any Nonconformity After Delivery or Use Based on How Bad it is and What it Could Mean.

choice	respondents	percent
Fully Operational	29	18.35%
Works partially	28	17.72%
It doesn't work at all	101	63.92%
Totals	158	100.00%

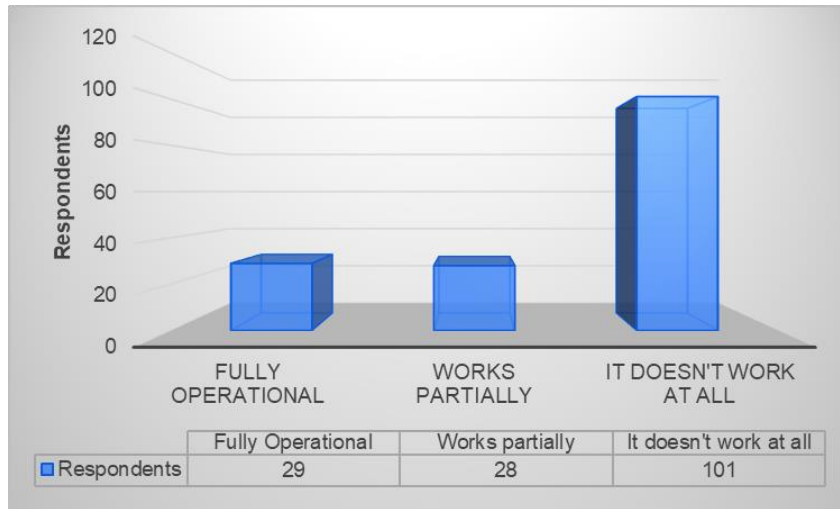


Figure 4.23: The Business Responds To Any Nonconformity After Delivery Or Use Based on How Bad it is And What it Could Mean.

The results are shown in Table 4.30. The most people (101) said it doesn't work at all, and the fewest (28) said it works partly.

4.1.24 To Meet Its Aims, The Organization Monitors Its Quality Management System Processes

The company measures and monitors the processes of the quality management system to see the extent to which it can reach previously planned results.

Table 4.24: To Meet its Aims, The Organization Monitors its Quality Management System Processes.

choice	respondents	percent
Fully Operational	127	80.38%
Works partially	29	18.35%
It doesn't work at all	2	1.27%
Totals	158	100.00%

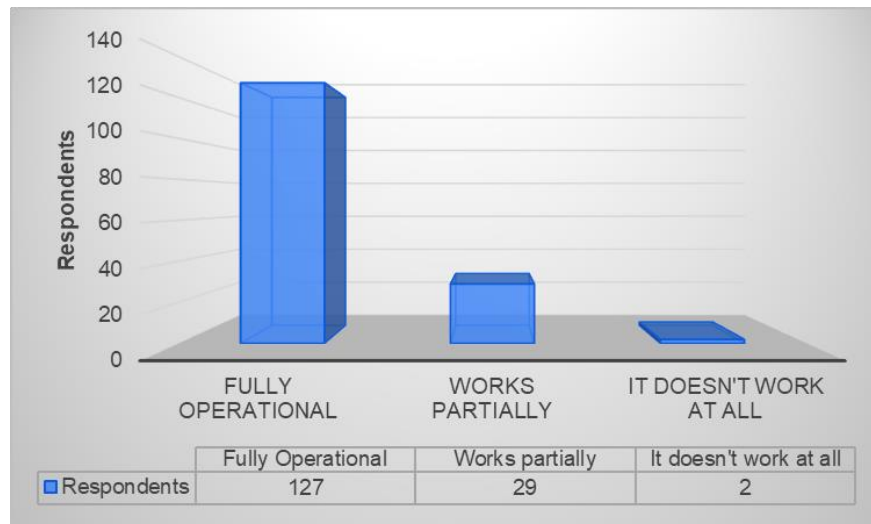


Figure 4.24: To Meet its Aims, The Organization Monitors its Quality Management System Processes.

Table 4-24 shows what the researcher learned from the views of the respondents about the effect of the company measures and keeps an eye on the quality management system's processes to see how well they work at getting the results that were planned of time. This is shown by the fact that 127 people chose "fully operational" and only 2 people chose "it doesn't work at all."

4.1.25 The Organization Develops an Annual Audit Activity Plan for All Quality Management System Systems

The company is committed to developing an annual internal audit activity plan that covers all systems covered by the quality management system.

Table 4.25: All Quality Management System Systems are Audited Annually.

choice	respondents	percent
Fully Operational	28	17.72%
Works partially	29	18.35%
It doesn't work at all	101	63.92%
Totals	158	100.00%

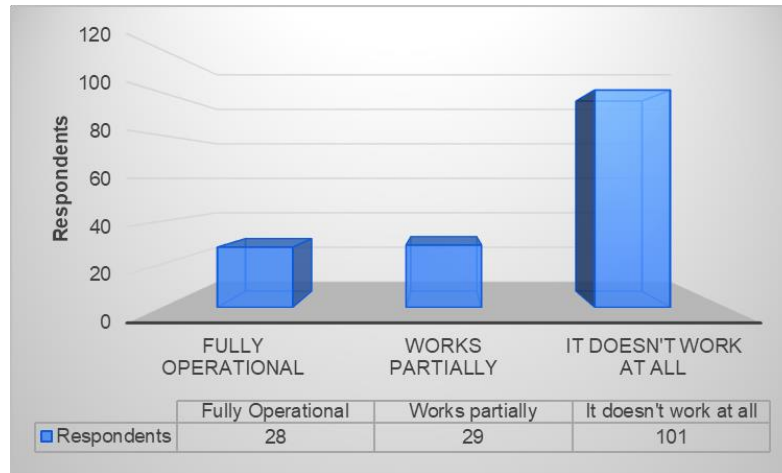


Figure 4.25: The Organization Develops an Annual Audit Activity Plan for All Quality Management System Systems.

According to the responses provided in response to the aforementioned questionnaire statement, as shown in table 4.33, the most significant number of respondents (101 in total) chose that it doesn't operate at all, while the lowest number of respondents (28 in total) chose that it is completely operational.

4.1.26 The Quality Management System Relies on Customer Satisfaction Data

The company examines information related to customer satisfaction as one of the criteria for the effective functioning of the quality management system.

Table 4.26: The Quality Management System Relies on Customer Satisfaction Data.

choice	respondents	percent
Fully Operational	28	17.72%
Works partially	129	81.65%
It doesn't work at all	1	0.63%
Totals	158	100.00%

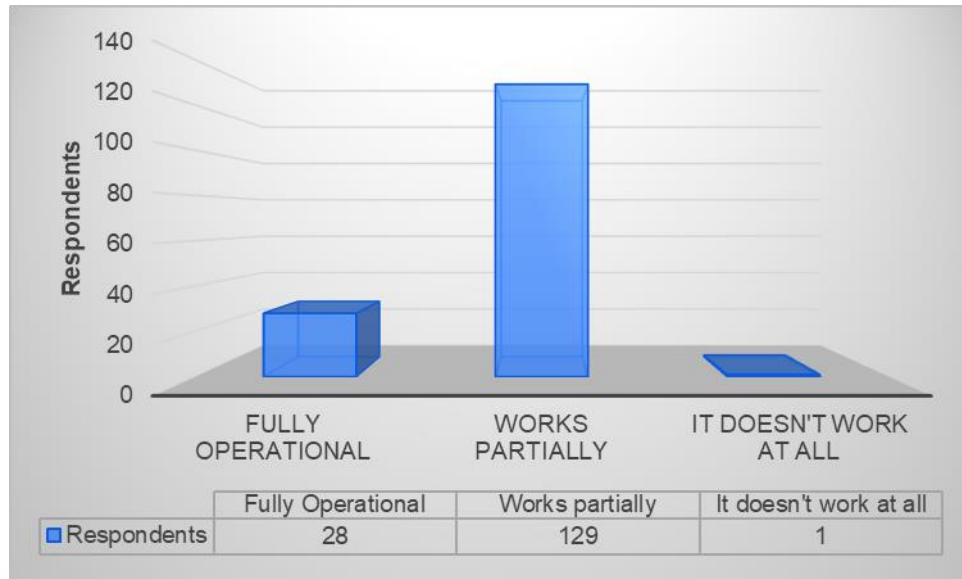


Figure 4.26: The Quality Management System Relies on Customer Satisfaction Data.

The researcher asked the people who answered what they thought about the effect of a company looking at information about customer satisfaction as one of the factors for the quality management system to work well. Based on Table 4-26, it's clear that the most people who answered chose works partly, with 129 votes, and doesn't work at all, with 1 vote.

4.1.27 The Company Determines Consumer Demands Like Reception and Maintenance After Receipt

The Company determines customer requirements, including receiving requirements and post-receipt maintenance services.

Table 4.27: The Company Determines Consumer Demands Like Reception and Maintenance After Receipt.

choice	respondents	percent
Fully Operational	3	1.90%
Works partially	126	79.75%
It doesn't work at all	29	18.35%
Totals	158	100.00%

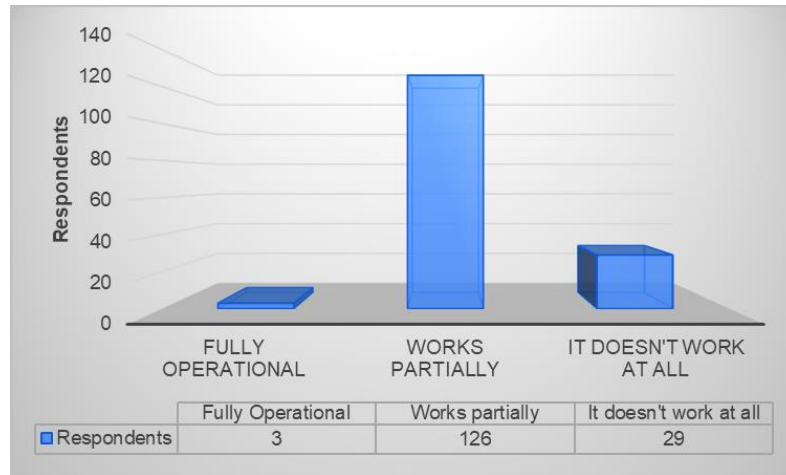


Figure 4.27: The Company Determines Consumer Demands Like Reception and Maintenance After Receipt.

The researcher asked the people who answered what they thought about how important it was for a company to figure out customer needs, such as getting needs and maintenance services after delivery. From the table 4-27, it's clear that 126 people chose "partially works," while only 3 people chose "fully operational."

4.1.28 The Company Outlines Legal and Regulatory Product and Process Duties

The Company sets out the terms of obligations related to the product and process, including legal and regulatory obligations.

Table 4.28: The Company Outlines Legal and Regulatory Product and Process Duties.

choice	respondents	percent
Fully Operational	128	81.01%
Works partially	29	18.35%
It doesn't work at all	1	0.63%
Totals	158	100.00%

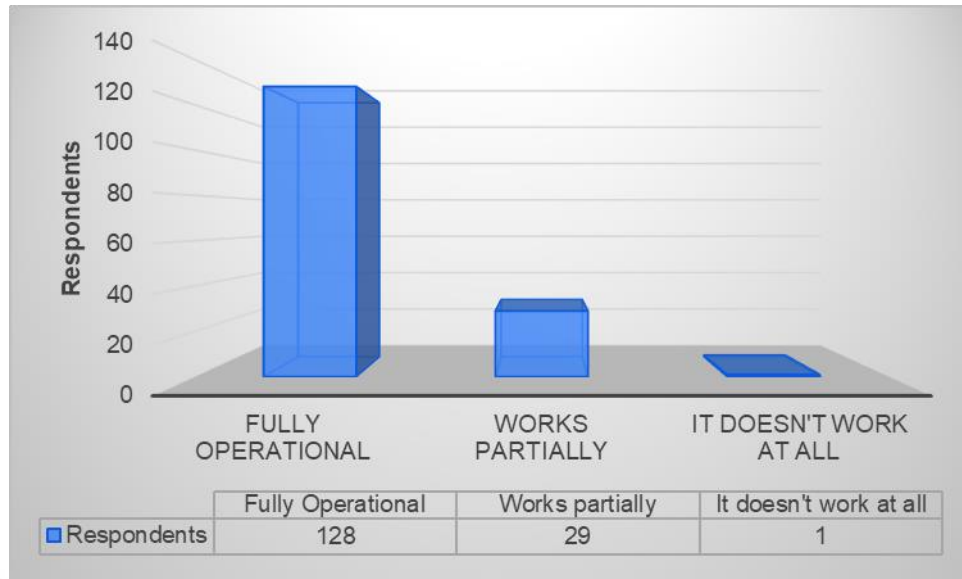


Figure 4.28: The Company Outlines Legal and Regulatory Product and Process Duties.

According to the responses to the questionnaire statement provided above, as shown in table 4.37, the largest group of respondents ($n = 128$) agreed that the statement was accurate, while the smallest group ($n = 1$) agreed that the statement was inaccurate.

4.1.29 The Customer Presents the Amended Criteria to Relevant Divisions and Areas for Feedback Before Signing a Contract

The new requirements are presented by the client to the relevant departments and sections of the organization for their opinions before contracting.

Table 4.29: The Customer Presents The Amended Criteria To Relevant Divisions and Areas For Feedback Before Signing A Contract.

choice	respondents	percent
Fully Operational	27	17.09%
Works partially	126	79.75%
It doesn't work at all	5	3.16%
Totals	158	100.00%

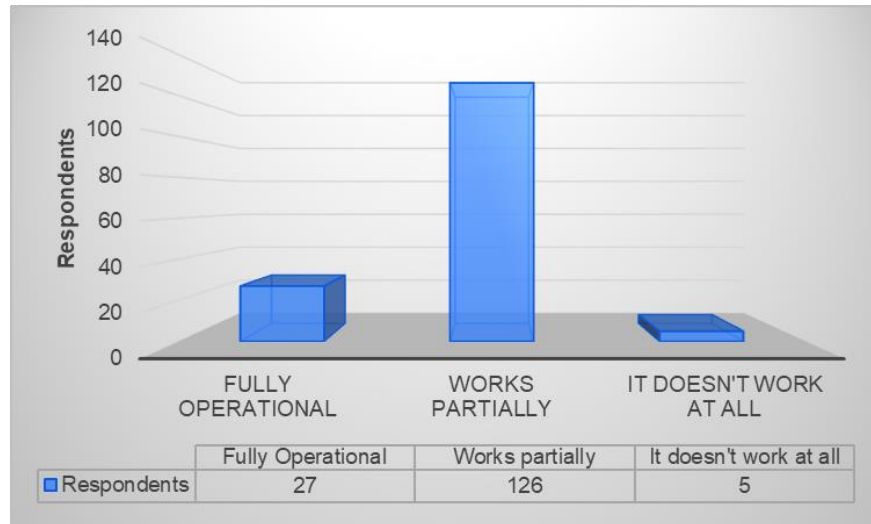


Figure 4.29: The Customer Presents The Amended Criteria To Relevant Divisions and Areas For Feedback Before Signing A Contract.

Table 4.29 displays the findings the researcher observed about the effect of When the client presents the new requirements to the appropriate divisions and sections of the organization for feedback before signing a contract, the majority of those polled (126 out of 255) say that the solution only partially meets their needs.

4.1.30 An Approved Register Will Record Application, Contract, and Procedure Results

The results of the examination of applications, contracts and procedures arising therefrom shall be recorded in an approved register for this purpose.

Table 4.30: An Approved Register Will Record Application, Contract, and Procedure Results.

choice	respondents	percent
Fully Operational	128	81.01%
Works partially	2	1.27%
It doesn't work at all	28	17.72%
Totals	158	100.00%

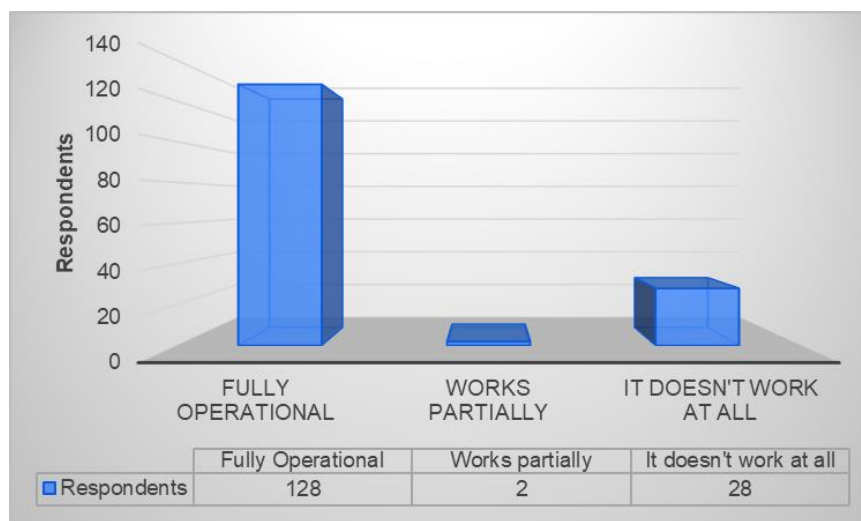


Figure 4.30: An Approved Register Will Record Application, Contract, and Procedure Results.

According to table 4-30, the most respondents (128) selected fully operational, while the fewest (2) selected works partially. These responses will be recorded in a register approved for this purpose.

4.1.31 The Company Ensures the Current and Future Needs of Employees to Ensure Their Safety

Table 4.31: The Organization Meets Present and Future Employee Needs to Ensure Safety.

choice	respondents	percent
Fully Operational	2	1.27%
Works partially	130	82.28%
It doesn't work at all	26	16.46%
Totals	158	100.00%

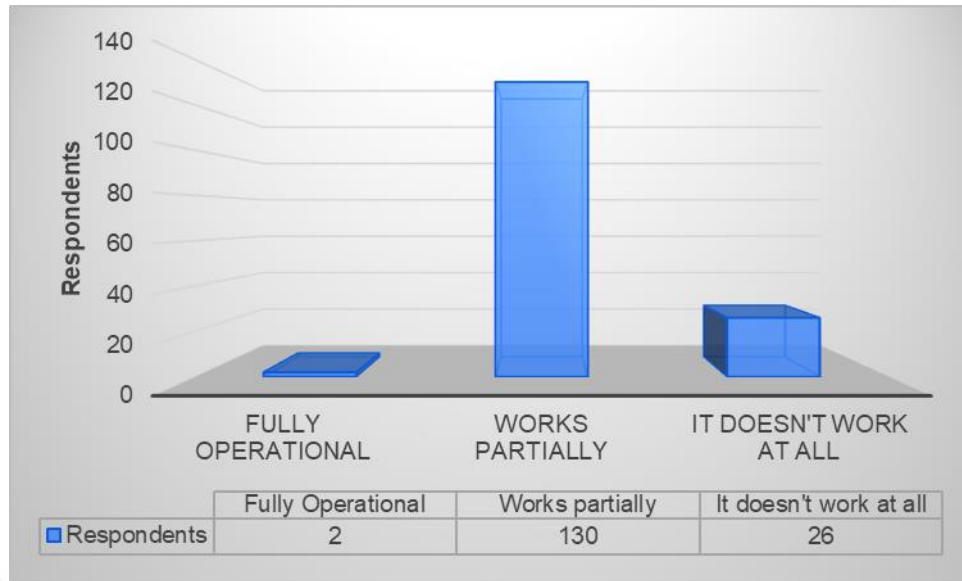


Figure 4.31: The Organization Meets Present and Future Employee Needs To Ensure Safety.

Based on the table 4-31, which shows the impact of a company making sure it's meeting the current and future needs of workers to make sure they are safe, the most people (130) chose "partially work," and the fewest (2) chose "fully works."

4.1.32 Regular Medical Checks Discover Occupational Problems Early and Protect Employees

The company conducts regular medical examinations to ensure early diagnosis of occupational diseases and safety and personal protection measures necessary for occupational health.

Table 4.32: Regular Medical Checks Discover Occupational Problems Early and Protect Employees.

choice	respondents	percent
Fully Operational	28	17.72%
Works partially	129	81.65%
It doesn't work at all	1	0.63%
Totals	158	100.00%

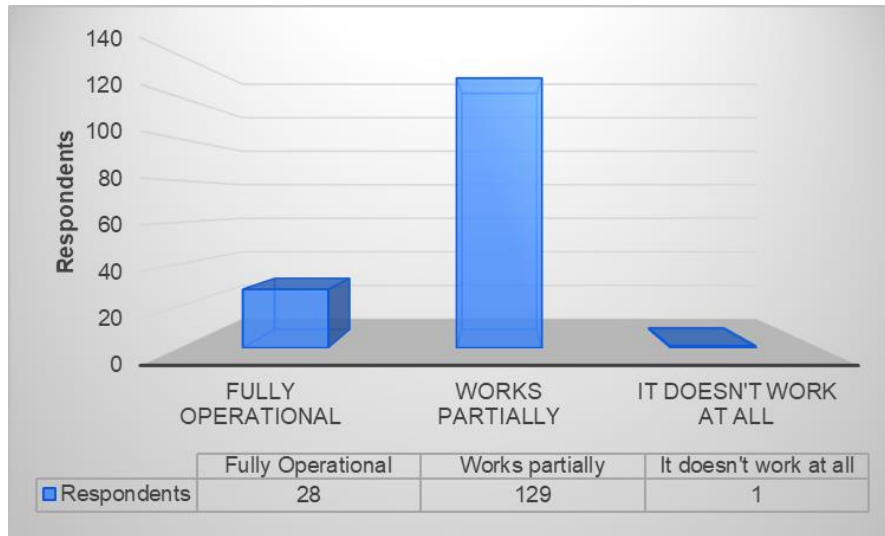


Figure 4.32: Regular Medical Checks Discover Occupational Problems Early and Protect Employees.

Table 4-32 shows the results that the researcher got from the opinions of the respondents about the effect of the company conducting regular medical examinations to ensure early diagnosis of occupational diseases and safety and personal protection measures necessary for occupational health. The most respondents (129) said that it works partially, while the fewest (1), said that it doesn't work at all.

4.1.33 The Organization Implements an Annual Workplace Safety Program for Ongoing Improvement and Development

The company adopts an annual program for occupational safety and follows up its implementation for continuous improvement and development.

Table 4.33: The Organization Implements an Annual Workplace Safety Program for Ongoing Improvement and Development.

choice	respondents	percent
Fully Operational	126	79.75%
Works partially	29	18.35%
It doesn't work at all	3	1.90%
Totals	158	100.00%

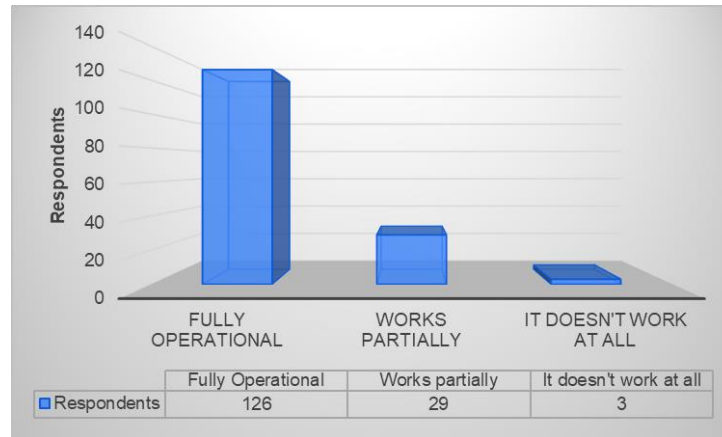


Figure 4.33: The Organization Implements an Annual Workplace Safety Program For Ongoing Improvement And Development.

Table 4-33 shows the results that the researcher got from the opinions of the respondents about the effect of a company adopting an annual program for workplace safety and following up on its implementation for continuous improvement and development. The most respondents (126) said that the program was fully operational, while the fewest (3) said that it didn't work at all.

4.1.34 Senior Management Supports Management and Divides Responsibilities and Obligations in Operations

Table 4.34: Senior Management Assists Management and Shares Operational Duties.

choice	respondents	percent
Fully Operational	28	17.72%
Works partially	29	18.35%
It doesn't work at all	101	63.92%
Totals	158	100.00%

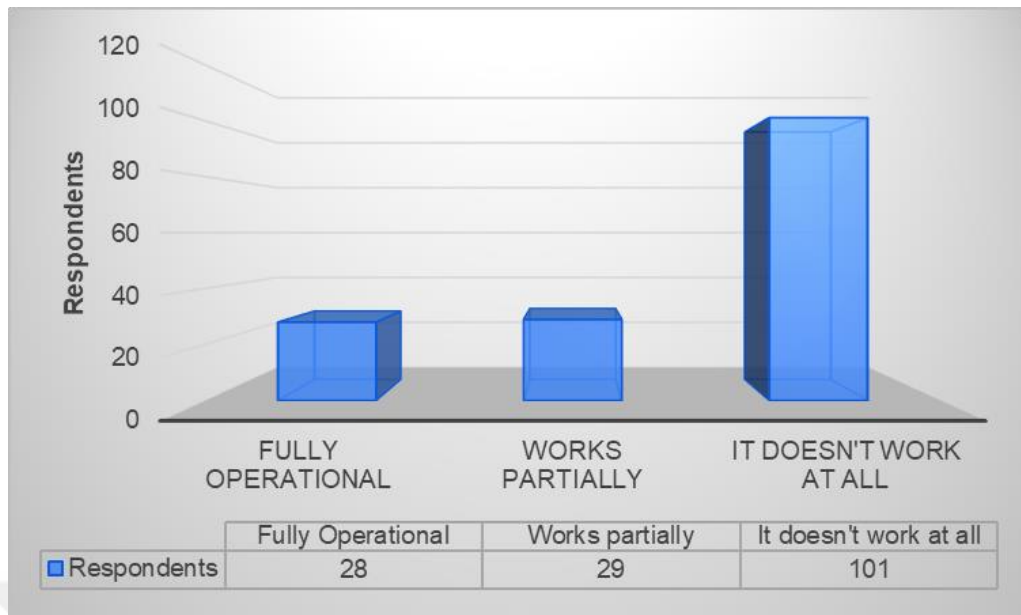


Figure 4.34: Senior Management Assists Management and Shares Operational Duties.

The results of the survey are shown in Table 4.34. The most people chose "it doesn't work at all" (101), and the fewest people chose "fully operational" (28).

4.1.35 Managers Statistically Control TQC

Table 4.35: Managers Statistically Control TQC.

choice	respondents	percent
Fully Operational	127	80.38%
Works partially	29	18.35%
It doesn't work at all	2	1.27%
Totals	158	100.00%

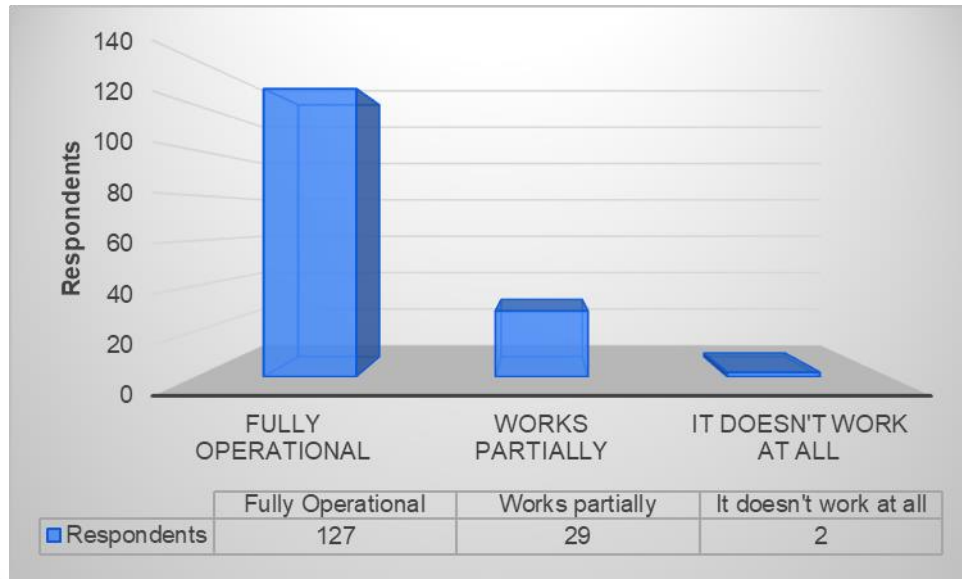


Figure 4.35: Managers Statistically Control TQC.

For example, in table 435, we can see that 127 respondents selected "fully operational," while only 2 selected "it doesn't work at all." These numbers reflect the distribution of opinions expressed by respondents regarding the questionnaire statement.

4.1.36 Management Educates Employees About the Relationship Between Product Quality and Cost

Table 4.36: Product Quality and Pricing are Taught by Management.

choice	respondents	percent
Fully Operational	27	17.09%
Works partially	103	65.19%
It doesn't work at all	28	17.72%
Totals	158	100.00%

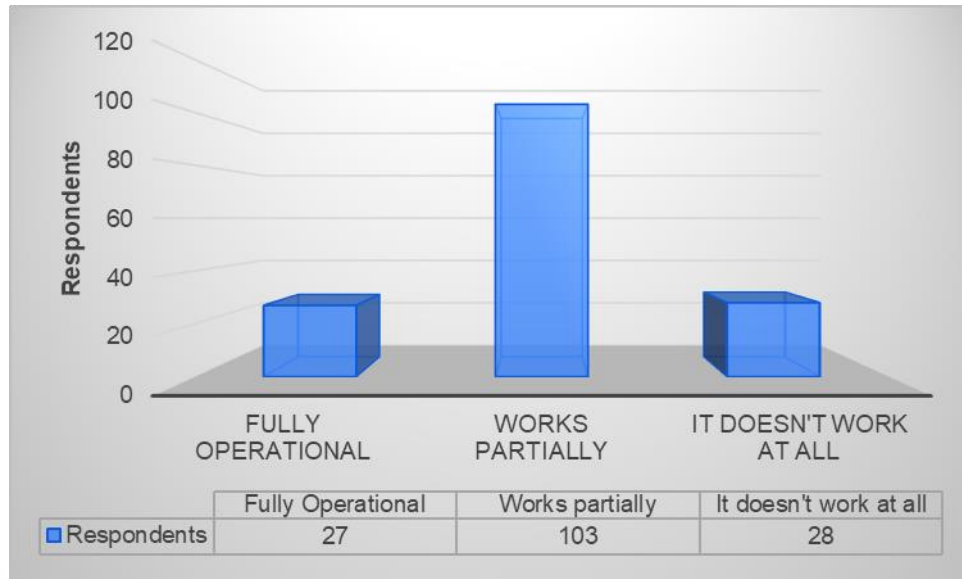


Figure 4.36: Product Quality and Pricing are Taught by Management.

The results are shown in Table 4–36. The respondents' opinions about the quality and price of the product are taught by management, so the most people chose "partially works" (103), and the fewest people chose "fully works" (27).

4.1.37 The Company Considers Direct and Indirect Quality Costs

Table 4.37: The Company Considers Direct and Indirect Quality Costs.

choice	respondents	percent
Fully Operational	129	81.65%
Works partially	28	17.72%
It doesn't work at all	1	0.63%
Totals	158	100.00%

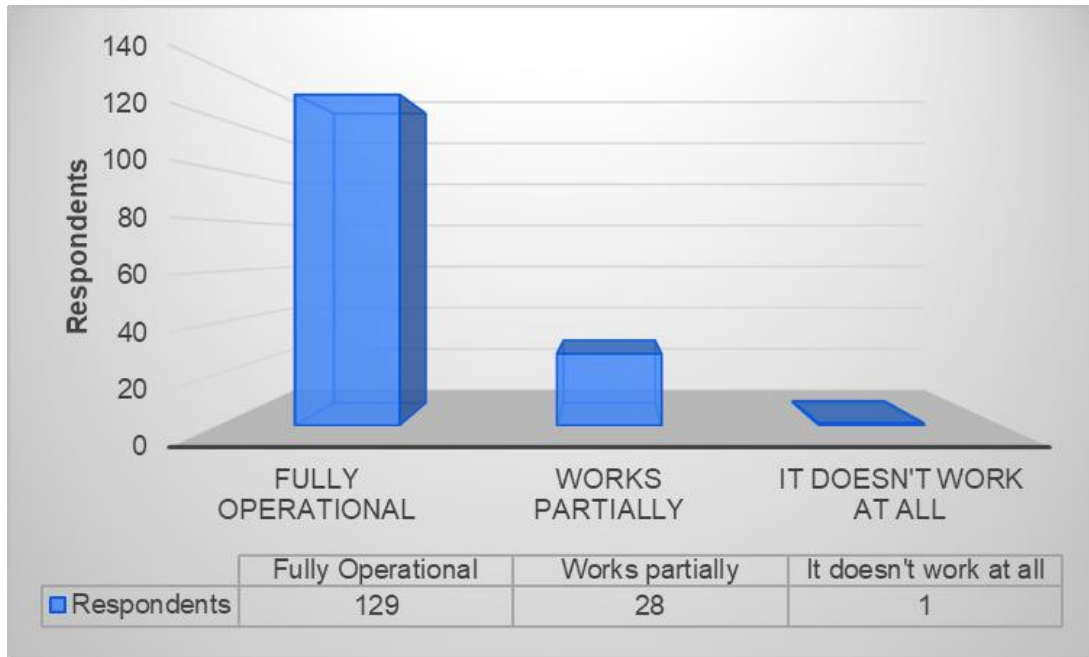


Figure 4.37: The Company Considers Direct and Indirect Quality Costs.

The results are shown in Table 4–37. The respondents' choices about the product's quality and price were taught by management. The highest number of respondents chose "fully operational" (129), and the lowest number of respondents chose "it doesn't work at all" (1).

4.1.38 Prevention Expenses Include Training, Quality Management, and Supplier Screening

Prevention costs such as training costs, costs of establishing a quality management system and supplier evaluation costs are determined.

Table 4.38: Prevention Expenses Include Training, Quality Management, and Supplier Screening.

Choice	respondents	percent
Fully Operational	27	17.09%
Works partially	106	67.09%
It doesn't work at all	25	15.82%
Totals	158	100.00%

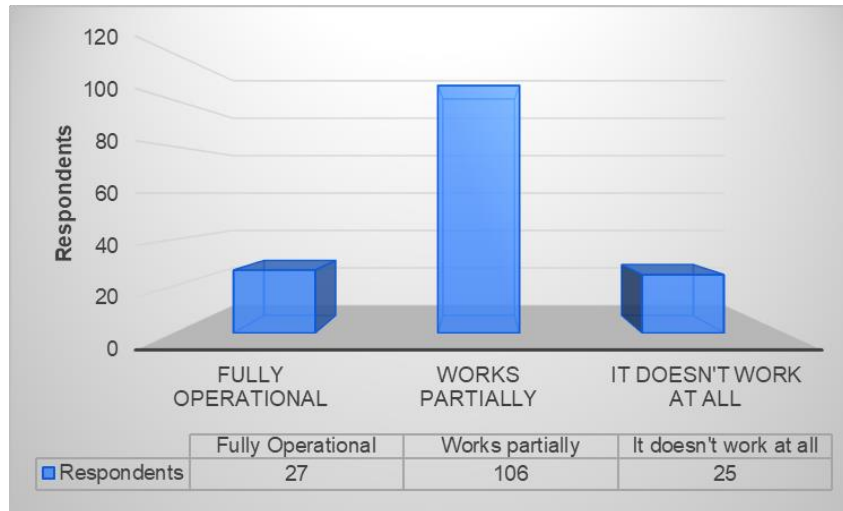


Figure 4.38: Prevention Expenses Include Training, Quality Management, and Supplier Screening.

Table 4-38 shows the results that the researcher got from the opinions of the respondents about the effect of prevention costs like training, quality management, and supplier screening. The most respondents (106 of them) said that it only works partially, while the fewest (25 of them) said that it doesn't work at all.

4.1.39 The Employer Sets the Assessment's Test Costs. Checking for Quality and Specifications

The company determines the cost of the assessment, known as the cost of the required tests Inspection and inspection to ensure that quality requirements are met, and specifications are met

Table 4.39: The Employer Sets The Assessment's Test Costs. Checking for Quality and Specifications.

Choice	respondents	percent
Fully Operational	104	65.82%
Works partially	28	17.72%
It doesn't work at all	26	16.46%
Totals	158	100.00%

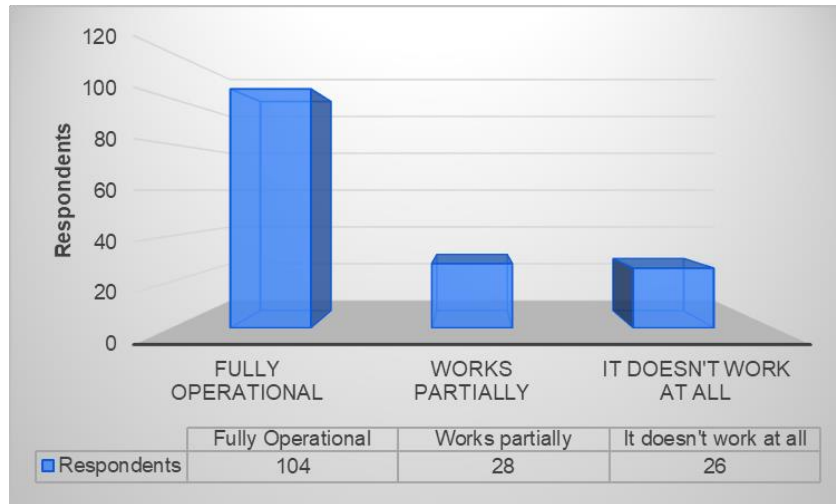


Figure 4.39: The Employer Sets The Assessment's Test Costs. Checking for Quality and Specifications.

The results are shown in Table 4–39. The cost of the assessment, also called the cost of the needed tests, is based on what the respondents said about the company and what they chose. Inspection and inspection to make sure that quality standards and specifications are met, so the most people chose fully operational.

4.1.40 The Company Determines the Costs of Internal Failures Including Breakage, Rework, Re-Inspection and Fault Analysis

Table 4.40: The Company Calculates Internal Failure Costs Such Breakage, Rework, Re-Inspection, and Fault Analysis.

choice	respondents	percent
Fully Operational	30	18.99%
Works partially	101	63.92%
It doesn't work at all	27	17.09%
Totals	158	100.00%

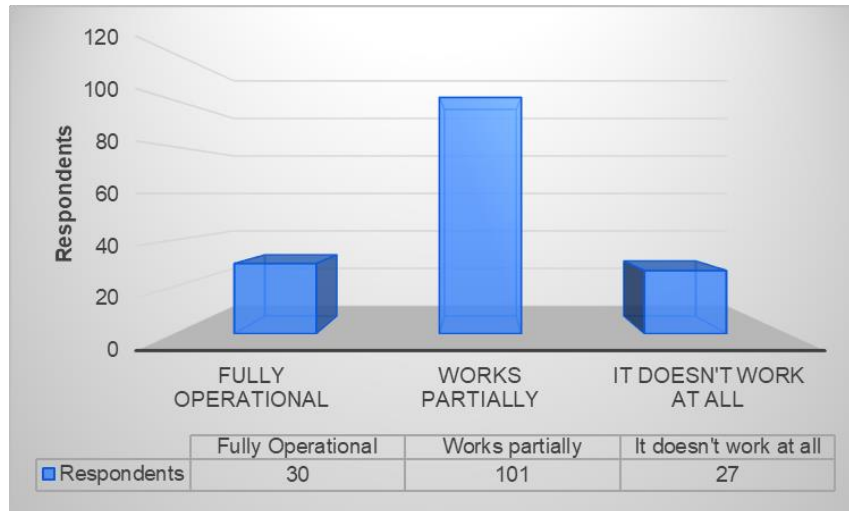


Figure 4.40: The Company Calculates Internal Failure Costs Such Breakage, Rework, Re-Inspection, and Fault Analysis.

The responses to whether the company calculates internal failure costs, such as breakage, rework, re-inspection, and fault analysis, are shown in Table 4.4. The highest number of respondents, 101, chose "partially works," while the lowest number, 27, chose "it doesn't work at all."

4.1.41 The Cost of External Breakdowns Is Determined by The Company, Such as Maintenance Fees and Fines

Table 4.41: Company Maintenance Costs and Fines Cover External Breakdowns.

choice	respondents	percent
Fully Operational	29	18.35%
Works partially	128	81.01%
It doesn't work at all	1	0.63%
Totals	158	100.00%

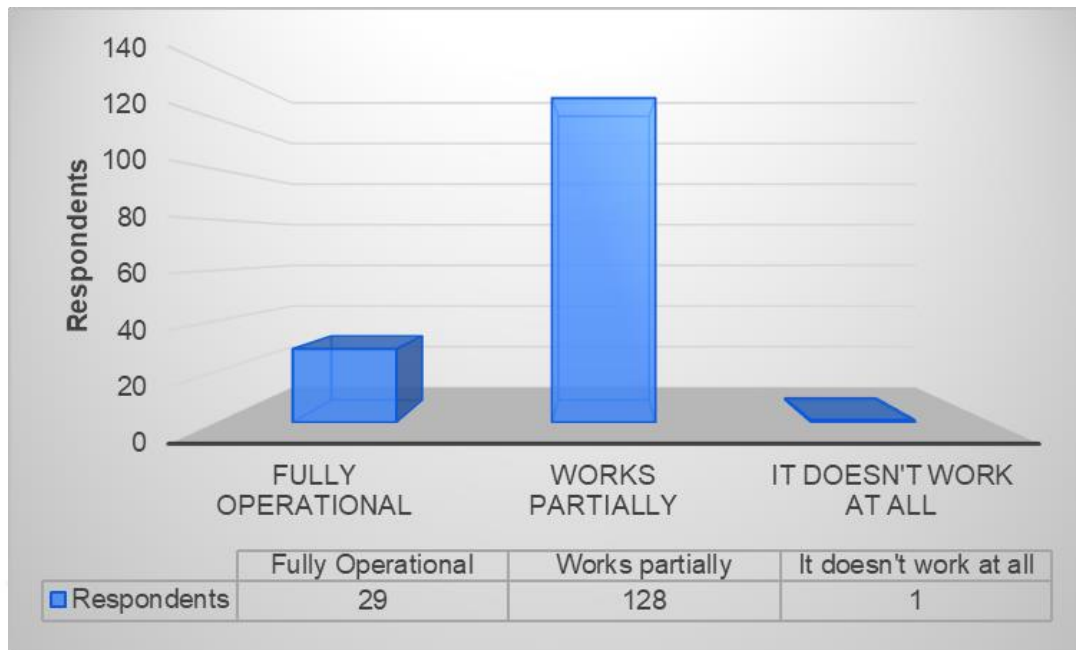


Figure 4.41: Company Maintenance Costs and Fines Cover External Breakdowns.

The results of the respondents' choices about whether the company sets the cost of external breakdowns, such as maintenance fees and fines, are shown in Table 4–41. The most respondents (128) chose that it only works partially, while the fewest (1) chose that it doesn't work at all.

4.2 CONCLUSION

The result founded in this chapter is. Construction businesses in Iraq that start applying TQM procedures will benefit from the study's findings, which have wide-ranging implications for TQM and construction project management. That way, they may see the potential benefits of TQM in construction projects and conquer any challenges that may arise. The findings could also be used as a standard by the building industries of other countries. Given the volatility of the industry and the increasing demands of clients, the survey concludes that TQM implementation is essential for the success of today's building businesses. The current state of TQM in the construction industry and its effects on productivity, competitiveness, and service quality are covered in this study.

5. CONCLUSION AND FUTURE WORKS

5.1 CONCLUSION

The findings have major implications for TQM and construction project management, and construction enterprises in Iraq that begin implementing TQM procedures will gain from them. This will enable them to recognize the purported benefits of TQM in building projects and overcome any potential obstacles. The research might also serve as a benchmark for the construction sectors of other nations. According to the survey, the adoption of TQM is crucial for the survival of modern construction companies in view of rapidly shifting market conditions and rising consumer expectations for high-quality projects. This paper contains current information on the application of TQM in the construction industry and its effects on enterprises' productivity, competitiveness, and service quality.

The final objective of the study is to pave the way for future research studies by academics in Iraq and internationally.

5.2 FUTURE WORKS

- a. In-depth research on the measurement of TQM adoption in the Iraqi construction industry may be conducted using software connected to information technology. It is reasonable, for instance, to recommend that the construction industry develop specialized software that describes the flaws connected with each building process as well as the role of each process within the context of a specific project. Practically all that is necessary to accomplish this is to create a control chart based on quality objectives, and the computer will detect any deviations from these standards. Examining the level of success of this program reveals a wealth of possibility for future research applications.
- b. To identify the effects of the adjustments made to construction companies as a result of the implementation of total quality management, more research can be conducted TQM. The effects of comprehensive quality management on system improvements in the Iraqi construction sector can be measured using a variety of methodologies, including time efficiency, turnover, and market share. This will allow for a more in-depth examination of the topic. This will also make it easier to build an industry-specific strategy that adheres to TQM system implementation best practices.

- c. Similarly, it is feasible to investigate and perform research on the impact of external factors on the implementation of a TQM program in the construction industry. Government laws, political tensions, the nation's general economic health, inefficient machinery, the availability or lack of technical assistance, transportation delays, etc., are only a few instances of these problems. The scope of the research might be narrowed to investigate how a single critical component, such as a government commitment to provide financial and technical support, will influence the overall success of the project and the implementation of TQM.
- d. In addition, the roles of engineers, contractors, and subcontractors in the successful implementation of TQM in the construction industry can be analyzed separately in order to comprehend how each contributes to the overall efficacy of the process. This section may include research on the various phases of construction projects, including the procurement procedure, the design phase, and others, as well as the roles of each essential participant in each phase
- e. It is also recommended that study be done on the optimal levels of human and financial resources, both of which are essential for the effective implementation of TQM in the construction industry. Optimal levels of human and financial resources are vital for the application of TQM in the construction industry. The study might also investigate the psychological connection that exists between workers and the community, as well as the degree to which the community is willing to tolerate the effects that building has on its environment, and other crucial capabilities that have a tendency to improve the administration of construction sites.
- f. Other methods of quality management, such as Six Sigma and Lean Construction, have the potential to be the subject of further research in relation to the Iraqi construction industry. This sector of the economy stands to gain a significant amount from the implementation of such solutions.

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APPENDIX A

TQM QUESTIONNAIRE

1. Academic Qualification
 - B.Sc.
 - M.Sc.
 - Ph.D.
2. Job position
 - Site Engineer
 - Job Site Manager
 - Company Manager
3. Number of Years of Experience
 - 1-5 Years
 - 5-10 Years
 - 10-15 Years
 - More than 15 Years
4. Type of Business Sector
 - Governmental
 - Private
 - Contracting Company
 - Consulting Office
5. The planning process is comprehensive and detailed, starting from proposing the project idea, passing through the implementation stage, and ending with the stage of handing over the project to the client
 - Fully Operational
 - Works partially
 - It doesn't work at all
6. Commitment to review and audit each stage of the design and document the changes that occur to it
 - Fully Operational

Works partially

It doesn't work at all

7. Determine the responsibilities and powers of the workers on the design by the company

Fully Operational

Works partially

It doesn't work at all

8. Striving to achieve quality requirements and objectives before starting the project and continuing to do so during implementation through detailed and comprehensive planning of all project activities

Fully Operational

Works partially

It doesn't work at all

9. Documented procedures are in place during planning to verify product fulfillment and quality requirements

Fully Operational

Works partially

It doesn't work at all

10. Company Has Records Proving Complexes for Quality Conditions in Operations

Fully Operational

Works partially

It doesn't work at all

11. The company identifies, collects and analyzes data to determine the suitability and effectiveness of the approved quality management system and to achieve customer satisfaction

Fully Operational

Works partially

It doesn't work at all

12. Product compliance with requirements is verified by data

Fully Operational

Works partially

It doesn't work at all

13. Monitoring Privately is available to monitor, audit and analyze company operations

Fully Operational

Works partially

It doesn't work at all

14. The company is constantly improving the effectiveness of the quality system

Fully Operational

Works partially

It doesn't work at all

15. Correcting procedures by diagnosing the causes of mismatch in the quality of the work and implemented and removing obstacles that prevent quality matches

Fully Operational

Works partially

It doesn't work at all

16. Practical approaches to achieve effective and efficient process control leading to improved performance

Fully Operational

Works partially

It doesn't work at all

17. The company adopts specific and documented criteria for the selection and evaluation of suppliers

Fully Operational

Works partially

It doesn't work at all

18. Documentation Documentations Inclusion Tinder Assistance, Balance and Specialty and other related technical guidelines

Fully Operational

Works partially

It doesn't work at all

19. There are documentation procedures that include the necessary checks to verify the quality of the product And all items provided by the customer upon receipt and storage
- Fully Operational
- Works partially
- It doesn't work at all
20. The company diagnoses and controls non-conforming processes or products to prevent their occurrence or unintentional delivery
- Fully Operational
- Works partially
- It doesn't work at all
21. The company diagnoses and controls non-conforming processes or products to prevent their occurrence or implementation unintentionally and documents
- Fully Operational
- Works partially
- It doesn't work at all
22. The main purpose of using materials or using non-conforming works or products is replaced for other purposes instead of destroying them to reduce waste
- Fully Operational
- Works partially
- It doesn't work at all
23. The Company takes action in proportion to each case of nonconformity that arises after delivery or use according to its importance, as well as the possible effects of nonconformity
- Fully Operational
- Works partially
- It doesn't work at all
24. The company measures and monitors the processes of the quality management system to see the extent to which it is able to reach previously planned results
- Fully Operational
- Works partially
- It doesn't work at all

25. The company is committed to developing an annual internal audit activity plan that covers all systems covered by the quality management system.
- Fully Operational
 - Works partially
 - It doesn't work at all
26. The company examines information related to customer satisfaction as one of the criteria for the effective functioning of the quality management system
- Fully Operational
 - Works partially
 - It doesn't work at all
27. The Company determines customer requirements, including receiving requirements and post-receipt maintenance services
- Fully Operational
 - Works partially
 - It doesn't work at all
28. The Company sets out the terms of obligations related to the product and process, including legal and regulatory obligations
- Fully Operational
 - Works partially
 - It doesn't work at all
29. The new requirements are presented by the client to the relevant departments and sections of the organization for their opinions before contracting
- Fully Operational
 - Works partially
 - It doesn't work at all
30. The results of the examination of applications, contracts and procedures arising therefrom shall be recorded in an approved register for this purpose
- Fully Operational
 - Works partially
 - It doesn't work at all

31. The company ensures the current and future needs of employees to ensure their safety
- Fully Operational
 - Works partially
 - It doesn't work at all
32. The company conducts regular medical examinations to ensure early diagnosis of occupational diseases and safety and personal protection measures necessary for occupational health
- Fully Operational
 - Works partially
 - It doesn't work at all
33. The company adopts an annual program for occupational safety and follows up its implementation for continuous improvement and development
- Fully Operational
 - Works partially
 - It doesn't work at all
34. Senior management supports management and divides responsibilities and obligations in operations
- Fully Operational
 - Works partially
 - It doesn't work at all
35. Managers statistically control TQC
- Fully Operational
 - Works partially
 - It doesn't work at all
36. Management educates employees about the relationship between product quality and cost
- Fully Operational
 - Works partially
 - It doesn't work at all
37. The company takes into account direct and indirect quality costs

Fully Operational

Works partially

It doesn't work at all

38. Prevention costs such as training costs, costs of establishing a quality management system and supplier evaluation costs are determined

Fully Operational

Works partially

It doesn't work at all

39. The company determines the cost of the assessment, known as the cost of the required tests Inspection and inspection to ensure that quality requirements are met and specifications are met

Fully Operational

Works partially

It doesn't work at all

40. The company determines the costs of internal failures including breakage, rework, re-inspection and fault analysis

Fully Operational

Works partially

It doesn't work at all

41. The cost of external breakdowns is determined by the company, such as maintenance fees and fines

Fully Operational

Works partially

It doesn't work at all