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A Quality Management System Implementation Framework for Contracting Companies in Egypt

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A QUALITY MANAGEMENT SYSTEM IMPLEMENTATION FRAMEWORK FOR CONTRACTING COMPANIES IN EGYPT

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ABSTRACT

Customer dissatisfaction due to low quality and performance in developing countries is more notable than technical construction failures. In order to enhance the corporate-level quality, which is reflected later in project-level metrics, quality management systems (QMS) are developed and applied. A quality management system (QMS) defines the organization's structure, processes, procedures, and responsibilities to achieve quality policies and objectives. Successful implementation of a QMS improves service quality, organization performance, and customer satisfaction. Previous research widely explored QMS implementation in different industries; only a few studies focused on the implementation and its influential factors in the construction industry, especially in developing countries. The lack of research addressing QMS in the Egyptian construction industry affects the stakeholders' awareness and acceptance of its implementation, negatively impacting the contracting organizations.

This research aims to propose a simple, systematic, and applicable framework that offers guidance to Egyptian contractors to efficiently implement QMS in their organizations. Towards determining the framework’s key factors, this research identifies and evaluates QMS implementation barriers, benefits, and the critical success factors (CSFs), in addition to identifying and examining the previous QMS implementation frameworks. Accordingly, an extensive literature review is conducted, followed by a survey of 28 contracting companies to examine the significance of the factors that influence QMS implementation. The findings indicated that resistance to change is the most significant barrier to QMS implementation, while the top perceived benefits were improved customer satisfaction and image. In addition, top management commitment and leadership was recognized as the essential factor for implementing QMS successfully.

Eventually, an implementation framework is developed for contracting companies to facilitate the successful implementation of QMS through four steps approach. In-depth interviews were conducted with top management and quality representatives to validate the applicability and effectiveness of the framework. This study provides an insight into QMS implementation in Egypt to facilitate its successful implementation and promotes the improvement of quality and increasing the awareness among construction professionals for encouraging the growth and development of the Egyptian construction industry.

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LIST OF ABBREVIATIONS

BEMs Business Excellence Models

BPR Business Process Reengineering

CSF Critical Success Factors

QA Quality Assurance

QC Quality Control

QMS Quality Management System

SPSS Statistical Package for the Social Sciences

TQM Total Quality Management

CHAPTER 1: INTRODUCTION

1.1 Research Background

The Egyptian construction industry is a main contributor in the national economy. The Ministry of Planning and Economic Development indicated that in 2019-2020, the industry's gross domestic product share was USD 23.75 billion, representing 6.7% of the total gross domestic product. Additionally, the Central Agency for Public Mobilization and Statistics (CAPMAS) estimated that the construction sector employed 14% of Egyptian employment in 2020 (Galal, 2021). Egypt State Information Service (2020) declared the remarkable growth experienced by the construction sector, and Fitch Ratings - a renowned credit rating agency - expects the continuity of this growth over the following years as the average annual growth rate may reach 9%. The Egyptian cabinet's Information and Decision Support Center (IDSC) reported that according to Fitch estimates, the construction sector ranked second in the MENA region in 2020 in terms of value, which equals USD 25 billion. By 2029, it is forecasted to reach USD 89 billion, be the largest sector in the region, and account for 30% of the entire region's construction market (State Information Service, 2020). The construction sector prosperity contributes to providing opportunities for employment and investment, in addition to national development as well.

The construction industry is complex and dynamic due to various participants' involvement with different perspectives and interests, and the governing factors are time and money (Hoonakker et al., 2010). Din et al. (2011) indicated some issues in the industry such as lack of project management experience, skills and knowledge, organization fragmentation, and inadequate change and communication management. Besides, construction projects are unique, complicated, and labor-intensive with high rates of defects, non-conformance, waste, schedule delays, occupation hazards, and rework (Hoonakker et al., 2010; Bubshait and Al-Atiq, 1999). Consequently, it is criticized for its poor quality and performance in many cases resulting in a lack of customer satisfaction, as many contractors seek to increase their profit by delivering the minimum quality requirements and disregard quality improvements (Hafeez et al., 2006). Al-Momani (2000) claimed that technical construction failures in many developing countries are insignificant compared to customer dissatisfaction due to low quality and performance. The exceptional features of the construction industry impeded the application of quality principles used in the manufacturing industry and limited the implementation of quality. A paradigm shift is required to embrace quality and make it the new business philosophy of construction

organizations to improve their image and regain their competitive advantage (Farooqui and Ahmed, 2009).

The term "Quality" has been defined differently by different experts. For example, Crosby (1989) noted that quality is conformance to requirements; Juran and Gryna (1993) referred to quality as fitness for use; Oakland (2004) expressed quality as meeting customer's requirements similar to the definition of Edwards Deming (Rumane, 2018). While Chini and Valdez (2003) defined quality as "a measure of fitness for purpose, in the sense of meeting the needs of a customer, at a price commensurate with the extent of those needs." Although these definitions might be convenient to product quality in the manufacturing environment, the concept of quality needs to be extended to fit the industries of service types. Yasamis et al. (2002) highlighted that quality in construction is more comprehensive than complying with the requirements, and it should be shifted towards the performance of the company as a whole and the consequent client satisfaction. Therefore, a thorough model was proposed for construction quality that integrates project and corporate quality in the contracting company (Yasamis et al., 2002), as shown in Figure 1-1.

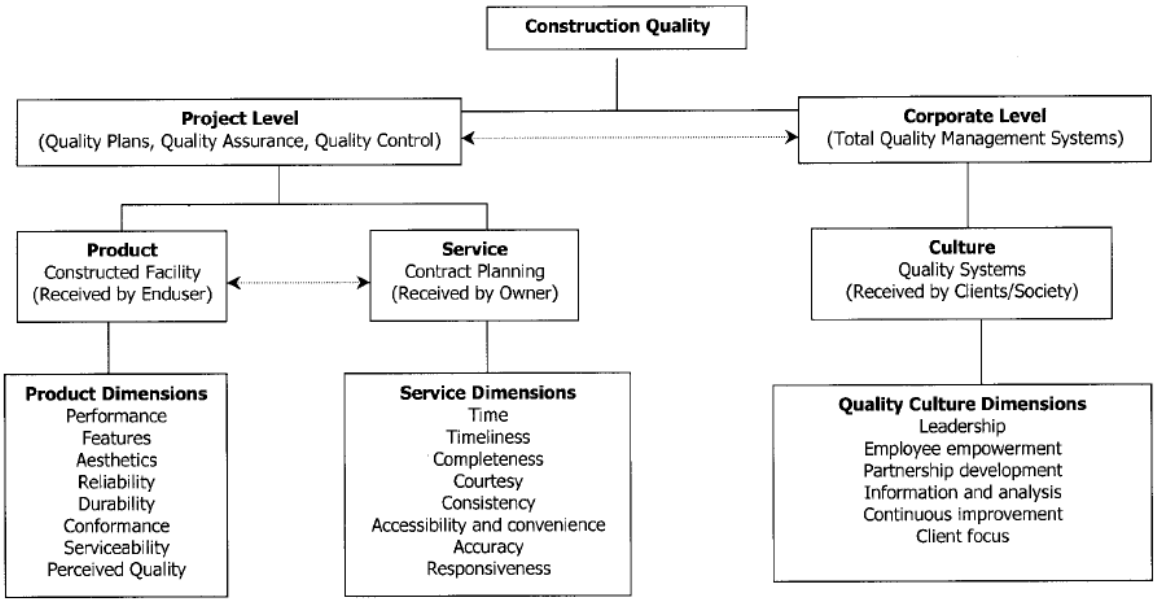

Figure 1-1 Construction quality model (Yasamis et al., 2002)

Project level quality comprises two elements: product and service. The product of the construction project is the constructed facility, and the recipient is the end-user. Product quality refers to achieving quality in the facility design and construction processes such as materials, equipment, and technology used in building the facility (Arditi & Gunaydin, 1999). On the

other hand, transforming resources into a constructed facility is the contracting service and is associated with the owner. Service quality refers to achieving quality through managing the project (Arditi & Gunaydin, 1999). The customer satisfaction experienced with the constructed facility and the contracting service defines project-level quality in construction

Managing quality for a construction project is as essential as operational and managerial processes. Quality management emphasizes the organization's fitness and assists it in offering high-quality service, sustaining its competitiveness, and meeting customers' satisfaction requirements. It has four main elements: quality planning, quality assurance, quality control, and quality improvement (Abdelkhalek et al., 2016). Quality planning guarantees that all the information, requirements, and resources relevant to the product or service are addressed. Quality assurance refers to preparing policies and procedures necessary for the project to assure its conformance to the contract requirements. Besides, it prevents the occurrence of quality problems through planned and systematic activities (Arditi & Gunaydin, 1999).

On the other hand, quality control refers to the activities executed to monitor the outputs and ensure the product or service quality. It is concerned with eliminating and correcting any quality problems resulting in reducing claims and disputes (Othman and Rashed, 2016). Various tools are used to function the quality control process, for example, brainstorming, Flowchart, Cause-and-effect diagram, Check sheet, Control chart, Histogram, Pareto chart, and Scatter diagram (Ismyrlis and Moschidis, 2015). Lastly, quality improvement focuses on identifying potential areas of improvement for products or services and guarantees the continuous improvement process (Yasamis et al., 2002).

Besides project-level quality, construction companies are expected to achieve corporate-level quality as well. Corporate-level quality refers to the quality culture that embraces quality activities and promotes continuous improvement. In order to generate a quality culture, organizations invest in designing and applying a quality management system (Yasamis et al., 2002). A quality management system (QMS) tends to standardize the company’s operations through a structured system that defines, documents, and maintains all activities throughout the company to achieve quality objectives. The proper QMS implementation not only ensures the consistent and reliable management of the client’s requirements and satisfaction; it improves the organization’s performance and competitiveness as well (Abdelkhalek et al., 2016). QMS can be in the form of a quality philosophy such as total quality management, a quality standard such as ISO 9000, or an in-house quality assurance system.

1.2 Problem Statement

According to the significance of quality in performance improvement and organizational success and growth, contractors are persuaded to adopt quality management systems to satisfy customers and sustain competitiveness. However, the construction industry is lagging behind other industries regarding the successful adoption of QMSs. It has been widely explored from the context of different industries and countries, while a few studies addressed it from the standpoint of a developing country and its construction industry. Thus, the limited research addressing the quality management systems in the Egyptian construction industry is insufficient for providing a comprehensive notion about the QMS implementation.

Moreover, the QMS implementation process is complicated with many factors; however, the preceding literature revealed shortage of empirical studies discussing these factors in construction, such as enablers, barriers, and benefits; especially when it comes to Egyptian contracting firms. The lack of awareness for QMS implementation barriers and CSFs and lack of acceptance of the benefits among stakeholders have negatively impacted the contracting organizations. Consequently, extensive research is essential to investigate the QMS implementation in contracting companies and create a holistic list of its influential factors. This study's findings will offer contractors potential guidance to overcome obstacles and implement QMS successfully.

1.3 Research Objectives

This study aims to propose a simple, systematic, and applicable framework that offers guidance to Egyptian contractors to efficiently implement QMS in their organizations. Towards determining the framework’s key factors and achieving the research aim, the objectives are:

1. Provide a better understanding of QMS and examine its implementation aspects in Egyptian contracting companies.
2. Identify and evaluate the barriers encountered by contractors during QMS implementation.
3. Identify and evaluate the benefits received by contractors upon implementation.
4. Identify and evaluate the critical success factors for implementation.
5. Investigate previous frameworks and recognize their similarities and differences.
6. Develop a detailed QMS implementation framework for contractors.
7. Determine the applicability and effectiveness of the designed framework.

1.4 Research Questions

The following questions are explored and tackled through the research:

1. What are the most influential factors that restrain or promote the effective QMS implementation by contractors in Egypt?
2. What are the benefits of QMS implementation perceived by contractors in Egypt?
3. How to successfully implement QMS within a contracting firm in Egypt?

1.5 Research Methodology

In order to achieve the research objectives, the following methodology is pursued, and Figure 1-2 summarizes it along with each step outcomes.

Step 1: An extensive literature review is provided on QMS definition and the common quality management tools adopted in the construction industry. Then, a list of barriers that encounter implementation is identified, in addition to implementation benefits and critical success factors (CSFs). Moreover, a comparative analysis was conducted among previous implementation frameworks.

Step 2: A questionnaire was developed and then distributed among managers and quality management representatives to examine the current QMS implementation state in the Egyptian contracting companies and assess the barriers that occur during QMS implementation (10 factors), implementation benefits (10 factors), and CSFs (10 factors). A total of 28 contracting companies were surveyed, and the results obtained are analyzed statistically using Statistical Package for the Social Sciences (SPSS), and each factor's significance is recognized.

Step 3: An implementation framework is developed taking into consideration the literature review and the collected research data to facilitate the successful implementation of QMS and promote quality management practices improvement in Egypt's contracting companies.

Step 4: The framework's validity was obtained using qualitative interviews with top management and quality representatives who previously implemented quality systems in contracting companies.

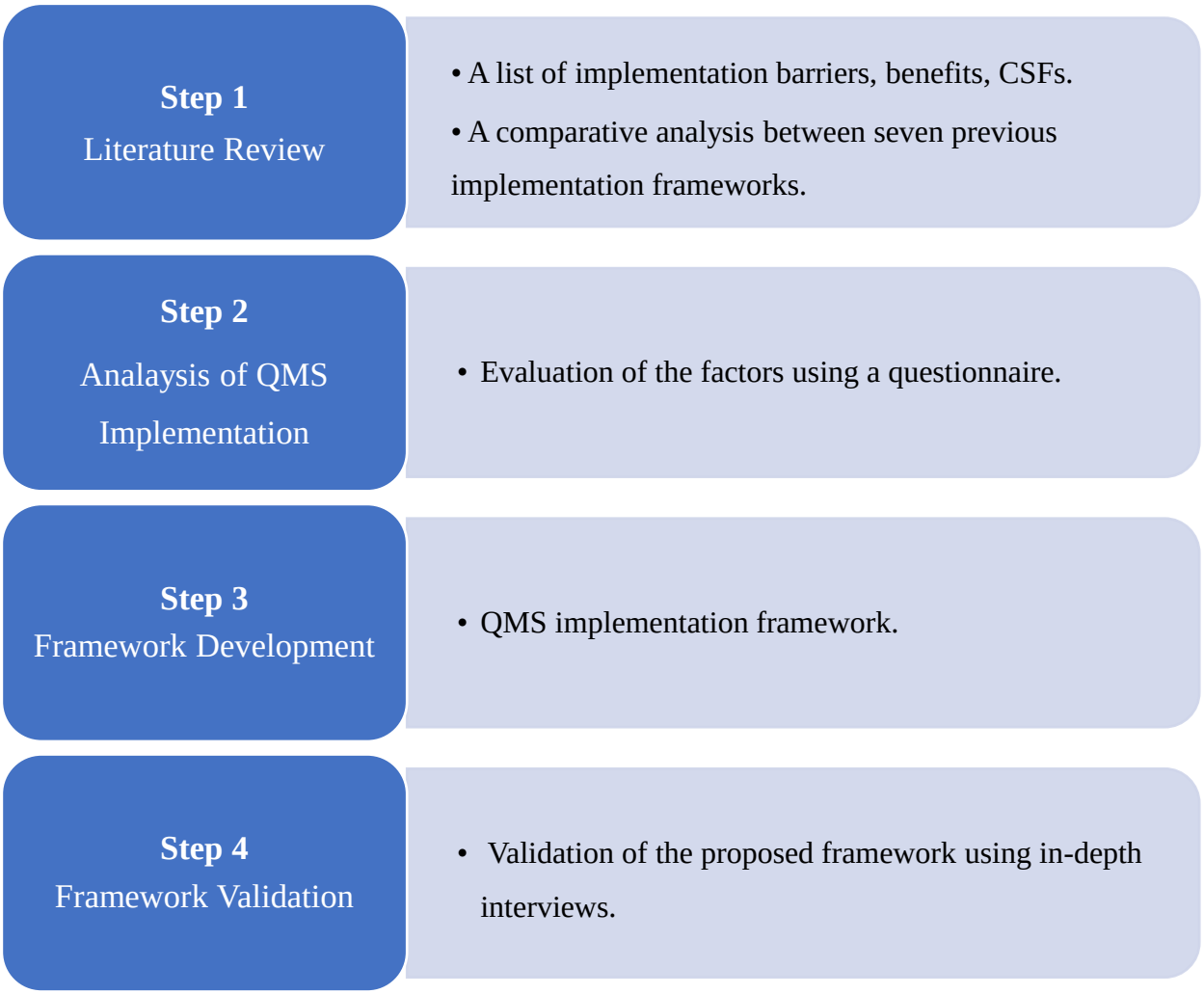

Figure 1-2 Research methodology summary

1.6 Thesis Organization

The thesis is divided into six chapters; the outline and a brief description of each chapter are listed below:

- **Chapter 1 (Introduction):** This chapter provides background to the research topic and the problem statement. It indicated the research objectives and questions then summarized the methodology adopted.

- **Chapter 2 (Literature Review):** This chapter discusses the extant literature associated with the research topic. It examines the concept of QMS, its implementation, and its tools in the construction industry. It determines the barriers that impede the successful adoption of QMS and addresses the benefits and CSFs for QMS implementation. Besides, highlights existing implementation frameworks and compares them according to specific criteria.

- **Chapter 3 (Analysis of QMS Implementation in Egypt):** This chapter describes the approach utilized to fulfill the research objectives and answer the research questions. It presents in detail the questionnaire objectives and design, sampling, and data collection. Then, it focuses on the results and the analysis.

- **Chapter 4 (Proposed Framework):** This chapter proposes the QMS implementation framework and explains its stages and elements.

- **Chapter 5 (Framework Validation):** This chapter evaluates the suitability and applicability of the proposed framework.

- **Chapter 6 (Conclusion):** This chapter summarizes the research findings and discusses the overall conclusions. Finally, it states the limitations that occurred and indicates recommendations for further research.

CHAPTER 2: LITERATURE REVIEW

2.1 Quality Management System Overview

The essential aim of implementing a quality management system for contractors is to have the required job done right the first time and consistently achieve the requirements. The American society of quality (n.d.) has defined QMS as "a formalized system that documents processes, procedures, and responsibilities for achieving quality policies and objectives. A QMS helps coordinate and direct an organization's activities to meet customer and regulatory requirements and improve its effectiveness and efficiency on a continuous basis". Moreover, Rocha-Lona et al. (2013) defines QMS as a set of elements forming an integrated business approach that demonstrates the organization's implementation of quality management models, methods, and tools. These elements are human capital, processes, management models, methods and tools, business strategy, and information technology.

Unlike the construction sector, which struggled to apply QMS to the industry, the manufacturing sector has been successfully implementing it for several years (Sullivan, 2011). This is due to the diverse nature between the two sectors; the manufacturing processes are repetitive while the construction projects are temporary and unique (Sui Pheng and Ke-Wei, 1996). As a result of the dynamic nature of the construction industry, lack of standardization, and many parties' involvement, contractors seeking business excellence should consider developing functional QMS that meets their strategic goals (Hoonakker et al., 2010). The well-known construction industry problems can be tackled by implementing QMS as it creates uniformity; avoids problems reoccurrence by providing the organization the opportunity to restructure and modernize its management (Cachadinha, 2009). Successful QMS implementation would boost continuous improvement and unleash potential advantages as improving the quality performance, overall business outcomes, and competitiveness of construction companies (Debby et al., 2010).

On the other hand, contractors have misconceptions about deploying QMS; they believe it adds unnecessary costs and is unsuitable for any organization. Besides, they claim it increases the documentation and paperwork. QMS can be designed to suit any entity regardless of its business nature or size, as long as it is aligned with its business strategy (Oakland, 2004). The complexity of the established system can vary from one organization to another, it can be a simple inspection and testing system, or it can be a fully comprehensive system (Garza-Reyes

et al., 2015). Although the initial cost of implementing quality may be high, effective implementation minimizes the costs associated with non-conformance to quality, such as rework, waste, errors, cost overruns, and schedule delays. (Pheng and Teo, 2004; Elghamrawy and Shibayama, 2008). Contractors must manage their quality objectives and expectations and accept that their organizations will take time to adapt to the introduced system and apply it effectively to achieve the planned objective (Farooqui and Ahmed, 2009).

Quality is always linked to customer satisfaction, and QMS act as a tool to manage this goal. Al-Momani (2000) defined customer satisfaction as the gap between the customers' expectations and the level of performance delivered. Towards meeting the customer requirements, first, the customer should be determined. In the construction industry, everybody is a customer. There are different customers to every process, whether within or outside the organization; it can be the designer, contractor, or the project owner. For example, the subcontractors are internal customers of the main contractor, and the main contractor is the customer of the quantity surveyor for the bills of quantities. Simultaneously, the quantity surveyor is the customer of the design engineers for the drawings and information required to measure quantities, it is extended further to every process. Therefore, contractors need to develop a system that constantly recognizes customers to identify their needs to maintain in order to maintain their goal in satisfying customers (Sui Pheng and Ke-Wei, 1996; Abdelkhalek et al., 2016).

Organizations attempted to use QMS to enhance their performance, productivity, and profitability. Several successful practices that showed potential in the manufacturing sector are Total Quality Management (TQM), ISO 9001, Six Sigma, Lean and Business Process Reengineering (BPR), Business Excellence Models (BEMs), and others (Garza-Reyes et al., 2015). Although, the essences of all these practices are continuous improvement and quality and performance improvement, ISO and TQM and are the most adopted and integrated by contractors in Egypt.

2.1.1 ISO 9000

In 1987, the International Organization for Standardization issued a set of defined quality management standards under the name of ISO 9000. A family of standards represents a formal quality system associated with quality assurance management and control for organizations and institutions. It aims to formalize methods and processes and create uniformity in order to satisfy the organization and customer needs and expectations and achieve continuous improvement. Moreover, ISO 9000 is characterized by its generic nature as it can be applied to organization all over the world of any size, whether service-oriented or industrial (Hiyassat, 2000; Chini and Valdez, 2003)

ISO 9000 was originated from the British Standard BS 5750, and then it was updated in 1994. The updated version included the following standards (Rumane, 2018):

- ISO 9000: Quality management and quality assurance standards
- ISO 9001: Quality Systems-Model for quality assurance in design, development, production, installation, and servicing
- ISO 9002: Quality Systems-Model for quality assurance in production and servicing
- ISO 9003: Quality Systems-Model for quality assurance in final inspection and test
- ISO 9004: Quality management and quality systems element guidelines

ISO 9000:1994 received negative criticism; it was claimed that it is complicated, rigid, and bureaucratic. These criticisms were addressed by introducing a revised version in 2000, and it was considered a complete rewrite (Farooqui and Ahmed, 2009). ISO 9000:2000 included the following standards:

- ISO 9000: Quality Systems-Fundamentals and vocabulary
- ISO 9001: Quality management systems-Requirements
- ISO 9004: Quality management systems- Guidelines for performance improvement

It provided a flexible, simplified quality system, less paperwork, explicit language, and terminologies. Besides, the three auditable certification standards ISO 9001, 9002, and 9003 were combined into ISO 9001 and presented two new concepts: process approach management and continual improvement. The standard 9001:2000 restructured the 20 clauses of the requirements for the assurance of quality systems presented in ISO 9000:1994 into five sectors: quality management system, management responsibility, resource management, product realization, measurement, analysis, and improvement (Rumane, 2018).

The fourth ISO 9000 edition was published, replacing the 2000 version. ISO 9001:2008 did not present new requirements; however, it clarified some existing requirements and introduced minor changes to enhance compatibility with other standards. On the other hand, ISO 9001:2015 introduced new clauses (Rumane, 2018):

- Context of Organization/Quality Management System
- Leadership
- Planning for Quality Management System
- Support
- Operation
- Performance Evaluation
- Improvement

In order to achieve ISO 9001 certification, an external body audits the organization's management system and assures that it complies with the requirements specified in the standard. The certification body should be nationally accredited and authorized to release a certificate of conformance; otherwise, the certificate will not be credible (Rumane, 2018).

ISO 9000 assists organizations in developing an effective QMS; however, it does not guarantee any improvement. Organizations attempting to improve performance must develop a proper quality assurance system, adopt effective practices, align ISO 9000 requirements with quality objectives to achieve successful implementation (Kim et al., 2011). Unfortunately, some companies did not perceive quality improvement or achieve their quality objectives after certification; additionally, they claimed increased bureaucracy and reduced flexibility and innovation. The failure is due to their misconception about the standard's requirements and certification motives, as certification turned into a marketing tool rather than a QMS implementation tool (Coffey et al., 2011). These companies did not aim for quality improvement primarily; they anticipated that providing the necessary documents to the external auditor would be sufficient to fulfill the standard's requirements and be certified. Therefore, organizations seeking continuous improvement (Willar et al., 2015; Bubshait and Al-Atiq, 1999; Farooqui and Ahmed, 2009).

Farooqui and Ahmed (2009) stated that over 400,000 companies in 158 countries are ISO 9001 certified, while ISO declared that there are over one million companies and organizations in over 170 countries certified to ISO 9001. The rise of the number of certified companies proves the standard's success, and its acceptance as a strategic management tool provides effective

control and best business practice. Similarly, the construction industry has accepted ISO 9000 and considered it a benchmark for successful construction companies; thus, it has become a prerequisite for contracting companies tendering for projects in many countries worldwide (Elbassuni, 2006).

The main feature of ISO 9000 is precise, prescriptive, and achieving certification is well defined and externally validated. ISO 9000 is based on various TQM elements such as leadership, teamwork, customer satisfaction, and continuous improvement. Therefore, researchers indicated that effective implementation of ISO 9000 requirements and principles encourages organizations to achieve a holistic and systematic quality management approach and eventually adopt total quality management (Ahmed et al., 2005; Magd, 2010).

2.1.2 Total Quality Management (TQM)

TQM is holistic management philosophy initiated in Japan in the 1970s (Sullivan, 2011). It is a process-oriented approach that seeks to implement quality in every task and involve all employees to achieve quality objectives. It focuses on exceeding customer satisfaction and creating a continuous improvement culture (Alhwairini and Foley, 2012). Successful TQM implementation depends on the organization's ability to translate, integrate, and ultimately institutionalize TQM principles into its regular work practice (Pheng and Teo, 2004). Polat et al. (2011) and Koh and Low (2010) agreed on eight principles that form the TQM:

- Top management leadership
- Customer management
- People management
- Supplier management
- Quality information management
- Process management
- Learning
- Continual improvement

The research revealed that if these principles are fully understood and implemented, it will enhance the organization’s competitiveness, improve customer and employee satisfaction, improve budget, and schedule performance, and increase market share (Sui Pheng and Ke-Wei, 1996; Polat et al., 2011).

TQM can be applied to any organization type, either public or private, and any industry type, either service or manufacturing (Rumane, 2018). It was initially developed in the manufacturing industry offering resulting in higher productivity and profitability. Although the promising results were aspiration for the construction industry to adopt TQM, the implementation was challenging at first due to employee turnover, projects diversity, geographical dispersion, contractual relationships, and the various forms of waste (Polat et al., 2011). Furthermore, the construction industry's misconception that the TQM concept is similar to QA and QC caused implementation failures. QA and QC are project-based quality processes, and they are elements of TQM; however, TQM is a holistic approach adopted by the organization (Harrington et al., 2012).

TQM is one of the first QMS programs recognized and proved its capability to practitioners and scholars. Although the TQM is the most effective quality management program, the wide acceptance of ISO standards has reduced its use. TQM has no standard implementation method; it provides a conceptual framework that requires experienced and professional leaders to correctly interpret it into the organization. The lack of clear definition and guidelines assisting in the implementation process is causing difficulties and failures (Adams, 1994; Rocha-Lona et al., 2013). The recognition of important factors affecting quality and might cause poor outcomes could be utilized as a foundation for an implementation framework.

2.2 QMS Implementation Barriers

Previous studies claimed that implementing quality is capable of decreasing and solving problems occurring in the construction industry. However, organizations intending to implement QMS face obstacles that affect the process negatively. Towards an effective implementation process, recognizing the barriers that may hinder the contractors is required to understand their severity and proactively solve any problem. Ahmed et al. (2017) categorized barriers that affect QMS adoption into six categories according to their origin: managerial, organizational, financial, cultural, educational, or auditing. A study on the Indian industries suggested that the main barrier in implementing QMS is the lack of benchmarking, employee resistance, and inadequate resources (Subrahmanya Bhat and Rajashekhar, 2009). Rogala (2016) approved that insufficient resources may affect the successful implementation of QMS, in addition to the staff's poor involvement. On the other hand, employees' resistance to change and attitude towards quality were the top-ranked barriers in the Indian service industries such as healthcare, banking, and hospitality industries (Talib et al., 2011).

During the competitive bidding process, contractors may reduce quality to reduce costs and maintain profit margins. Aichouni et al. (2014) concluded that awarding contracts to the lowest bidder is the main barrier affecting QMS implementation in the Saudi construction, along with the lack of an effective team and skilled workforce. According to 208 contractors surveyed in the U.S., similar results were obtained (Hoonakker et al., 2010). In the Turkish construction industry, the prolonged implementation process, increased expenses, and unacceptable critics are the top barriers that confronted companies (Turk, 2006). However, out of 18 potential barriers, lack of top management commitment, support, and leadership were the top three scored barriers by the Turkish contractors. According to the survey, top management’s apathy and disregarding QMS implementation value may lead to its failure (Polat et al., 2011).

Elbassuni (2006) investigated the barriers faced by Egyptian construction companies during implementation. The results revealed that resistance to change, lack of management commitment, and unclear benefits for employees are the three most significant barriers, this conclusion is consistent with the results obtained by manufacturing firms in Egypt (Magd, 2010). On the other hand, managers in the Indonesian construction companies agreed that the misconception about QMS implementation purpose and the lack of a reward system are the two significant barriers they face (Willar et al., 2015). Table 2-1 illustrates summary of the barriers to QMS deployment gathered from the relevant literature.

Table 2-1 QMS implementation barriers summary

Barriers	References
1. Poor quality action plan	(Subrahmanya Bhat and Rajashekhar, 2009); (Willar et al., 2015)
2. Difficulties in understanding the quality system	(Othman and Rashed, 2016); (Willar et al., 2015); (Sadikoglu and Olcay, 2014); (Turk, 2006)
3. Lack of top management commitment	(Elbassuni, 2006); (Polat et al., 2011); (Subrahmanya Bhat and Rajashekhar, 2009); (Rogala, 2016) ; (Willar et al., 2015); (Sadikoglu and Olcay, 2014); (Talib et al., 2011); (Aichouni et al., 2014)
4. Lack of quality awareness	(Elbassuni, 2006); (Magd, 2010); (Othman and Rashed, 2016); (Sadikoglu and Olcay, 2014); (Talib et al., 2011); (Aichouni et al., 2014)
5. Lack of qualified workforce	(Polat et al., 2011); (Subrahmanya Bhat and Rajashekhar, 2009); (Othman and Rashed, 2016); (Turk, 2006); (Aichouni et al., 2014)
6. Lack of a well design reward system	(Willar et al., 2015); (Subrahmanya Bhat and Rajashekhar, 2009); (Sadikoglu and Olcay, 2014)
7. Lack of continuous improvement culture	(Talib et al., 2011); (Sadikoglu and Olcay, 2014)
8. Ineffective communication and feedback between departments	(Elbassuni, 2006); (Othman and Rashed, 2016); (Willar et al., 2015); (Talib et al., 2011)
9. Resistance to change	(Elbassuni, 2006); (Magd, 2010); (Subrahmanya Bhat and Rajashekhar, 2009); (Willar et al., 2015); (Sadikoglu and Olcay, 2014); (Talib et al., 2011)
10. Awarding of contracts to the lowest bidder (low bid mindset)	(Hoonakker et al., 2010); (Othman and Rashed, 2016); (Aichouni et al., 2014)

2.3 QMS Implementation Benefits

Organizations seeking continuous improvement need to be aware of its potential benefits to appreciate its significance and allocate the appropriate resources and investments. Benefits differ from one organization to another based on their quality objectives and level of commitment to accomplish business excellence. Table 2-2 presents the benefits of QMS implementation collected from relevant literature. Samsudin et al. (2012) indicated that if a process, people, and documentation are appropriately planned, that will improve the organizations' image and satisfy all the stakeholders. UAE companies agreed that QMS implementation benefits their internal operations, as the four most important benefits are process and procedures improvement, employees' quality awareness, product or service quality improvement, and better customer service (Zaramdini, 2007).

Consistently, Turk (2006) specified the benefits that return to the Turkish contractors from QMS application are improved image, improved processes, improved communication internally and externally, and better definition of responsibilities. Nevertheless, they claimed that the application did not affect their business volume or market share. Another survey delivered to the Turkish contractors by Polat et al. (2011) indicated different acquired benefits: customer satisfaction and confidence, repeated customers, and reduced rework and nonconformities. Othman and Rashed (2016) claimed that implementation improved the contractors' performance, image, and competitive advantage. Improvements in construction processes and employee satisfaction are considered more significant, while profit, savings, and customer satisfaction less significant. (Aichouni et al., 2014)

On the other hand, contractors in the U.S. emphasized that more repeat customers, reduced rework, and improved job satisfaction are important benefits, whereas better chances in the bidding process and reduced change-orders are considered less significant; however, many companies benefit in those areas (Hoonakker et al., 2010). Ng et al. (2012) claimed that the benefits from implementation for contractors are categorized into cost reduction and improved management systems. These groups include reduction of cost overruns, disputes, and rejected claims. Quality managers recognized nine benefits for QMS implementation in the Egyptian construction companies; the most important benefits are the improvement of records and the retrieval of information efficiently for litigation and claims, increased customer satisfaction, and improvement of traceability of quality problems (Elbassuni, 2006).

Table 2-2 QMS implementation benefits summary

Benefits	**References**
1. Improves service quality	(Zaramdini, 2007); (Khan and Farooquie, 2016); (Polat et al., 2011)
2. Improves budget and schedule performance	(Polat et al., 2011); (Khan and Farooquie, 2016); (Turk, 2006); (Othman and Rashed, 2016); (Elbassuni, 2006); (Samsudin et al., 2012); (Hoonakker et al., 2010)
3. Improves customer satisfaction and confidence	(Elbassuni, 2006); (Samsudin et al., 2012); (Hoonakker et al., 2010); (Polat et al., 2011); (Othman and Rashed, 2016); (Zaramdini, 2007); (Turk, 2006); (Khan and Farooquie, 2016); (Aichouni et al., 2014)
4. Improves the image of the company	(Samsudin et al., 2012); (Zaramdini, 2007); (Turk, 2006)
5. Reduces rework	(Hoonakker et al., 2010); (Polat et al., 2011); (Othman and Rashed, 2016); (Zaramdini, 2007)
6. Improves processes and procedures	(Zaramdini, 2007); (Turk, 2006); (Aichouni et al., 2014); (Elbassuni, 2006)
7. Increases competitive advantage	(Polat et al., 2011); (Othman and Rashed, 2016); (Zaramdini, 2007); (Turk, 2006)
8. Gains entry in new markets	(Elbassuni, 2006); (Samsudin et al., 2012); (Hoonakker et al., 2010); (Polat et al., 2011); (Zaramdini, 2007)
9. Enhances continuous improvement	(Elbassuni, 2006); (Samsudin et al., 2012); (Othman and Rashed, 2016)
10. Reduces inefficiencies and waste	(Samsudin et al., 2012); (Polat et al., 2011); (Othman and Rashed, 2016); (Khan and Farooquie, 2016)

2.4 QMS Implementation Critical Success Factors

Critical success factors (CSFs) are the enablers that assist the organization to implement QMS successfully, and they can be used to evaluate an existing system (Ahmed et al., 2017). Despite the significance of identifying the factors, there is no agreed universal list of CSFs in the construction industry. Therefore, each study seeks to specify the factors according to their context, scope, and purpose (Rocha-Lona et al., 2013; Ahmed et al., 2017). Kumar and Sharma (2017) identified 20 CSF from the literature and introduced them to three companies. They concluded that the importance of CSFs is different between each company. Failing to identify and recognize CSFs is considered an implementation barrier as the organization may struggle to implement QMS or enhance its performance (Garza-Reyes et al., 2015).

Chin and Choi (2003) indicated that the most significant CSFs in the Hong Kong construction industry are top management commitment, strategic decision making, and effective implementation of decisions. Top management commitment encourages the organization's commitment to quality and continuous improvement, which results in improved performance, reduced resistance to change, enhanced problem-solving, effective human resources management, and increased competitive advantage.

Magd (2010) presented eleven factors for Egypt's manufacturing industry; the respondents evaluated them and suggested top management commitment, a well-structured system of procedures, and the organization's internal auditors are the main CSFs. Ahmed et al. (2017) identified twelve CSF and agreed that top management commitment is the top factor, followed by leadership support and management feedback.

Aichouni et al. (2014) mentioned that the Saudi construction companies perceive employee satisfaction, customer satisfaction, teamwork and people involvement, leadership, and process improvement as success factors. According to Othman and Rashed (2016), the highest factor affecting the construction project's success is the skilled workforce, training, education, and project performance. Table 2-3 demonstrates a list of CSFs from relevant literature.

Table 2-3 QMS implementation CSFs summary

Critical Success Factors	**References**
1. Top management commitment and leadership	(Garza-Reyes et al., 2015); (Magd, 2010); (Ahmed et al., 2017); (Othman and Rashed, 2016); (Aichouni et al., 2014); (Chin and Choi, 2003); (Kumar and Sharma, 2017)
2. Effective communication within the organization	(Garza-Reyes et al., 2015); (Magd, 2010); (Ahmed et al., 2017); (Othman and Rashed, 2016); (Chin and Choi, 2003); (Mohammed et al., 2015); (Kumar and Sharma, 2017)
3. A well-structured system of procedures and process	(Magd, 2010); (Aichouni et al., 2014); (Garza-Reyes et al., 2015)
4. Customer satisfaction	(Ahmed et al., 2017); (Othman and Rashed, 2016); (Aichouni et al., 2014); (Kumar and Sharma, 2017)
5. Attitude to change	(Ahmed et al., 2017); (Chin and Choi, 2003)
6. Continuous improvement	(Ahmed et al., 2017); (Chin and Choi, 2003); (Kumar and Sharma, 2017); (Mohammed et al., 2015)
7. Education and training	(Ahmed et al., 2017); (Othman and Rashed, 2016); (Chin and Choi, 2003); (Mohammed et al., 2015)
8. Employee's empowerment	(Ahmed et al., 2017); (Othman and Rashed, 2016); (Aichouni et al., 2014); (Kumar and Sharma, 2017)
9. Employee motivation and commitment	(Garza-Reyes et al., 2015); (Magd, 2010); (Chin and Choi, 2003); (Othman and Rashed, 2016)
10. Use of information and communication technology	(Ahmed et al., 2017); (Chin and Choi, 2003); (Mohammed et al., 2015); (Kumar and Sharma, 2017)

2.5 Quality Management Systems Frameworks

A framework answers the question of 'what is' and 'how to,' it displays an overall roadmap of activities and presents the network of interactions between them to achieve the required goals. Experts have been proposing frameworks to guide organizations during QMS implementation because of the difficulties experienced. Quality implementation framework links theoretical concepts and practical application to provide a structure for initiating quality and guidance for maintaining the required quality to achieve the planned goals (Yusof and Aspinwall, 2000; Delgado-Hernandez and Aspinwall, 2008).

In order to understand the current status of existing implementation frameworks, a sample of seven frameworks are identified from the literature and summarized. Garza-Reyes et al. (2015) discussed some issues that accompanied implementation, summarized some previous frameworks subsequently proposed a conceptual and generic framework that guides organizations to implement or improve QMS and business processes. It consists of five stages, respectively: QMS and business processes diagnostic, strategic planning, selection of the right models, methods, and tools, QMS implementation, and evaluation of the QMS and business processes. The authors presented this framework based on their industrial experience designing, implementing, and improving QMS for multinational organizations.

Elghamrawy and Shibayama (2008) performed a comparative analysis of a local contractor and a Japanese contractor working in the Egyptian construction field to examine TQM implementation. Accordingly, a framework was derived for implementing TQM in the Egyptian construction industry. This framework's steps are management commitment, orientation on TQM, planning of the program, training on TQM, conducting quality projects, improving job site quality, and measuring results.

Othman and Rashed (2016) studied the implementation of quality management in West Bank contracting companies by distributing survey questionnaires and interviewing local contractors. A framework was developed to facilitate the successful implementation of TQM in construction projects in West Bank, Palestine. The framework is an iterative process where quality standards, top management commitment, quality training, benchmarking, and quality deployment were deemed the main elements in the framework.

Pheng and Teo (2004) studied two construction companies in Singapore that implemented TQM, and according to the research findings, they suggested an implementation framework.

The framework's steps were outlined starting with understanding TQM requirements such as continuous improvement, process management, communication system, and top management commitment, followed by developing a strategic implementation plan, allocating budget and resources, producing training plans and monitoring process, and finally, obtaining proper feedback.

Alhwairini and Foley (2012) derived from the examined literature a conceptual framework for Saudi organizations. It is based on the equal influence of leadership and employees on achieving organizational goals, customer satisfaction, and service quality. The authors emphasized the value of employees as they are considered e the organization's sources of knowledge. Top management's effective utilization of human resources enhances improvement and innovation activities, fulfilling customers' needs and expectations. Therefore, the framework connects top management, employees, and customers.

Koh and Low (2010) used the literature review and the research data to identify eight operationalize TQM in construction companies, and each element comprises a series of practices and factors. The authors combined the primary practices associated with each TQM element to construct a TQM implementation framework. Top management and leadership commitment are the essence of this framework as the top management is responsible for defining the quality requirements and creating the organizational system, process management system, and improvement system. The organization system includes other elements such as customer, people, supplier, and quality information system. Adopting of the envisioned mechanism directs to quality performance on the corporate and the project level leading to client satisfaction.

Ahmed et al. (2017) attempted to develop a framework that integrates internal and external factors affecting QMS implementation in the construction industry. They addressed from previous studies the most common barriers to QMS, in addition to a list of CSFs for QMS adoption in construction. Then, qualitative in-depth interviews were used to identify external factors and CSFs for QMSs adoption, while a quantitative survey was employed to quantify the factors collected from the literature review and interviews analysis. A conceptual framework was designed connecting barriers and CSFs to the successful implementation of QMS by considering the effects of external factors.

Reviewing the seven frameworks allowed the drawing of comparative analysis in terms of six criteria:

1. Framework stages
2. Framework type
3. Application sector
4. Consideration of barriers
5. Consideration of CSFs
6. Framework validation

Table 2-4 summarizes the comparison between the identified frameworks. Most of the frameworks adopted step approach structure where the framework is demonstrated in the form of systematic stages and activities. Each framework used different terms and elements; however, they are based on the Deming Cycle (PDCA), plan, do, check, and act. Deming cycle is an iterative model for processes continuous improvement consists of four stages:

1. Plan: Establish the objectives and processes necessary to fulfill the customer requirements and the organization's policies.
2. Do: Implement the processes.
3. Check: Monitor and measure the performance against policies, objectives, and requirements and record the results.
4. Act: Apply corrective actions to continually improve process performance (Harrington et al., 2012).

On the other hand, Alhwairini and Foley's (2012), Koh and Low's (2010), and Ahmed et al.'s (2017) frameworks adopted a different approach called system approach structure, where sets of elements and practices are presented in the form of clusters linked together to clarify the framework's general outline. Regarding the application sector, some frameworks tend to be complicated or specified for a particular industry or region, while others are generic and can be modified to adjust to any variable.

Othman and Rashed (2016), Pheng and Teo (2004), and Ahmed et al. (2017) studied unsuccessful implementation. They investigated barriers to the effective deployment of QMS and considered them in their proposed frameworks. While Garza-Reyes et al. (2015), Othman and Rashed (2016), Alhwairini and Foley (2012), and Ahmed et al. (2017) focused on identifying CSFs and their influence on the implementation. It is necessary for developing an implementation framework to consider both barriers and CSFs, to ensure that the adoption of

the CSFs has a positive impact on overcoming the barriers and fulfilling the framework's objectives. Othman and Rashed (2016) and Ahmed et al. (2017) addressed both barriers and CSFs in their studies. The validation of the developed framework was assessed in two studies out of the seven. Moreover, Ahmed et al. (2017) used a focus group approach to validate the framework, while Alhwairini and Foley (2012) tested the framework validity using a case study of a single organization; the process included questionnaire distribution and semi-structured interviews with the staff.

Reviewing the existing seven frameworks has revealed some limitations. The major limitation is the lack of validity assessment; most of the existing research did not conduct any interviews or case studies to validate the findings and test the fitness of the proposed framework. Another limitation is that most frameworks did not describe the detailed input, expected output, or feedback loop. Eventually, this comparison provides an overall perspective and understanding of the identified frameworks and highlights their main similarities, differences, and limitations for further framework development.

Table 2-4 Existing Implementation frameworks Comparison

#	Author	Framework	Stages	Framework Type	Sector	Consideration of barriers	Consideration of CSFs	Validation
1	Garza-Reyes et al. (2015)	QMS implementation framework	QMS and business processes diagnostic→ strategic planning→ selection of the right models→ methods and tools→ QMS implementation→ evaluation of the QMS and business processes	Step approach	Generic	None	Yes	None
2	Elghamrawy and Shibayama (2008)	Framework for implementing TQM in Egypt	Planning of the program→ training on TQM→ conducting quality projects→ improving jobsite quality→ measuring results	Step approach	Construction	None	None	None
3	Othman and Rashed (2016)	Framework for implementing quality management in West Bank	Quality standards→ top management commitment→ training→ lunch TQM implementation→ evaluate the system implementation → benchmarking→ deployment of TQM	Step approach	Construction	Yes	Yes	None

#	Author	Framework	Stages	Framework Type	Sector	Consideration of barriers	Consideration of CSFs	Validation
4	Ahmed et al. (2017)	A conceptual framework of QMS implementation	Successful implementation of QMS→ Barriers to implementation/CSFs for implementation/effects of external factors	System approach	Construction	Yes	Yes	Focus group
5	Pheng and Teo (2004)	Framework for implementing TQM	TQM requirements→ feedback system/continuous improvement/encourage teamwork/reduce suppliers/process management/communication system/top management commitment→ decision to implement→ strategic plan→ communicate TQM/allocate budget→ produce goals and targets→ produce training plans and monitoring process→ monitoring	Step approach	Construction	Yes	None	None

#	Author	Framework	Stages	Framework Type	Sector	Consideration of barriers	Consideration of CSFs	Validation
6	Alhwairini and Foley (2012)	Conceptual framework for implementing TQM in Saudi Arabia	Top management→ innovation and continuous improvement processes→ employees' empowerment→ customers' requirements	System approach	Generic	None	Yes	1 case study
7	Koh and Low (2010)	Framework for TQM implementation	Top management→ organizational system→ process management→ improvement system→ quality performance→ client's satisfaction	System approach	Construction	None	None	None

2.6 Conclusion

This chapter reviewed the previous research to provide an overview of QMS definitions, implementation impact, misconception, and practices explicitly focusing on ISO 9000 and TQM. Additionally, it outlined the existing QMS implementation barriers, benefits, and critical success factors. Seven implementation frameworks previously developed by researchers and practitioners are highlighted. Then, a comparative analysis is performed to outline their similarities, differences, and limitations.

CHAPTER 3: ANALYSIS OF QMS IMPLEMENTATION IN EGYPT

This chapter outlines the questionnaire objective, design and describes the sampling and data collection methodologies. The collected data is statistically analyzed, then the results are presented and discussed to provide a comprehensive understanding of QMS implementation barriers, benefits, and critical success factors for Egyptian contractors.

3.1 Questionnaire Objective

According to the reviewed research work relevant to QMS implementation and factors affecting it, a questionnaire was developed to investigate QMS implementation in Egyptian contracting companies. The questionnaire method is used as a quantitative approach in order to gather holistic knowledge from various organizations to assess the current status of QMS implementation and measure the significance of the following factors within the Egyptian contracting companies:

- The barriers occurred during the implementation
- The benefits gained upon implementation
- The CSFs for successful implementation of QMS

Later, the results gathered from the questionnaire are quantified and analysed to develop a QMS implementation framework suitable for the contractors in Egypt.

3.2 Questionnaire Design

The questionnaire was designed based on the topics reviewed in the literature, and the implementation variables were listed based on the most occurrence from previous studies. The design should be simple, straightforward, understandable, and time-efficient for the respondents, and the analysis and interpretation should be easy for the researcher. Therefore, all the questions were closed-ended, multiple choices, yes or no answers, checklists, and rating scales. For the sake of validation, five practitioners participated in pilot testing to ensure the clarity and accuracy of all the statements and eliminate any mistakes or errors. Received comments and feedback were taken into consideration. The questionnaire consists of 4 parts with a total of 17 questions:

Part 1: Personal Information

Questions from 1 to 3 collect the respondents' personal information such as education background, job position, and years of experience.

Part 2: Contractor's Information

Questions 4 to 9 identify the respondent company's characteristics, including type of works, grade level, type of ownership, years of establishment, and size of the company.

Part 3: Quality Management System Status

Questions 10 to 14 examine a quality department's existence and the application of QMS and quality tools within the contractor's company.

Part 4: Perception of Contractors on QMS Implementation

Based on the respondents' experience, it is required to rate each factor using a five-point Likert rating scale.

Question 15 investigates the significance of QMS implementation barriers. A list of 10 barriers is collected from the literature.

Question 16 identifies the importance of the benefits of QMS implementation. A list of 10 benefits is gathered from previous research.

Question 17 evaluates the impact of CSFs on the successful adoption of QMSs. A list of 10 factors is identified in the literature.

3.3 Sampling and Data Collection

The questionnaire was directed to contracting companies in Egypt, whether they were implementing a formal QMS or not. It is not easy to reach an official database or directory that comprises all local companies. Therefore, a stratified random sampling method and snowball sampling were used to select respondents representing the companies for this research.

The questionnaire was addressed to top and middle-level managers and quality management representatives as it requires in-depth knowledge of the quality management practices and participation in the QMS implementation process within their contracting companies. Each organization is represented by only one response. The target sample was contacted by phone, and then a covering email with the electronic questionnaire link was sent to the intended recipient. They were asked to respond within a week, and then follow-up actions were taken for the non-responses.

A sample of 55 contractors received the questionnaire, 36 responses were returned, and eight responses were excluded from the analysis due to repetition, non-qualified respondents, or inconsistent responses. Therefore, the total valid responses are 28, which is almost similar to the number of responses of previous studies by Debby et al. (2010) was 23 responses; Elbassuni (2006) 30; Chini and Valdez (2003) 36. The response rate of 50.9% is considered satisfactory due to the low response rate and lack of participation of construction contractors (Hoonakker et al., 2010).

3.4 Analysis & Discussion

The quantitative data collected were statistically analyzed using the Statistical Package for Social Sciences (SPSS 28). First, a descriptive statistical analysis of frequency distribution was conducted to provide an overview of the respondents' profile, characteristics of the contractor, and quality management system status. Then, a descriptive analysis, along with T-test statistical analysis, has been used to evaluate the significance of barriers, benefits, and CSFs. The factors are analyzed and ranked using their mean values. Eventually, Pearson Correlation is performed to assess the relationships among the implementation variables statistically.

In order to ensure the questionnaire's reliability and validity, a reliability test that measures the internal consistency and homogeneity of elements of the same group is performed. Cronbach's Coefficient alpha is the indicator of the uniformity of a measurement scale used for questionnaires with rating scales; its value should be within a range of 0.70 to 1.00 (Aichouni et al., 2014). The Cronbach alpha value for QMS implementation barriers equal 0.794; benefits equal 0.833, and CSFs equal 0.827. The results shown in Table 3-1 present the Cronbach’s alpha values, these values are acceptable and indicate the high reliability and consistency of the instrument used for this research.

Table 3-1 The reliability test results

Implementation Variable	No. of items	Cronbach’s alpha
Barriers	10	0.794
Benefits	10	0.833
Critical Success Factors	10	0.827

3.4.1 Respondents' profile

Table 3-2 summarizes the respondents' profile as the respondents' qualifications ranged from Bachelor to Ph.D., their job title and years of experience also varied. The respondents' education level is 7.1% doctoral degree holders, 39.3% master's degree holders, and 53.6% bachelor's degree holders. The results present that most of the top and middle-level management at the Egyptian contracting companies have a bachelor's degree.

According to the job position, only one respondent is the chairman of the company, 28.6% of the respondents are general managers, 21.4 % are quality managers, 14.3 % are department managers, 21.4 % are project managers, and 10.7 % are senior engineers. Besides, most of the respondents have a long working experience as 25 % have more than twenty years' experience, 14.3 % have from sixteen to twenty years, 32.1 % have from eleven to fifteen years, 21.4 % have from five to ten years, while 7.1 % have less than five years' experience. These figures indicated that the surveyed population is qualified for this research.

Table 3-2 Respondents' Profile

Respondent's Profile	Frequency	Percentage
1. Education Level		
PhD	2	7.1
Master	11	39.3
Bachelor	15	53.6
2. Position of the Respondent		
Chairman	1	3.6
General Manager	8	28.6
Quality Manager	6	21.4
Department Manager	3	14.3
Project Manager	6	21.4
Senior Engineer	3	10.7
3. Number of Years of Experience		
Less than 5 years	2	7.1
5-10 years	6	21.4
11-15 years	9	32.1
16-20 years	4	14.3
More than 20 years	7	25.0

3.4.2 Characteristics of Contractor

The sampled companies' primary projects sector is building works with 47.1%, while companies that perform infrastructure works are 14.7%, electro-mechanical are 26.5%. However, the companies that work in all sectors are 11.8%. The Egyptian Federation for construction and building contractors classifies contracting companies into seven grades, where grade 1 is the highest and grade 7 is the lowest. It is based on paid capital, years of establishment, the number of employees, owned equipment, and the highest value of project performed. The results show that 60.7% are grade one, 3.6% are grade two and three, 25% are grade four and five, and 10.7% are grade six and seven.

In addition, the companies are categorized according to types of ownership. The sample comprises six multinational companies, one Shareholding Company, fourteen family-owned companies, and seven sole properties, 21.4%, 3.6%, 50%, and 25% of the total respondents, respectively. According to years of establishment, the companies are grouped as follows, less than five years, between 6 to 10 years, between 11 to 20 years, and more than 20 years. The percentages are 7.1%, 14.3%, 25% and 53.6% respectively. Employee size classification illustrates that 75% are considered large organizations 42.9% of the respondents have more than 500 employees, 10.7% have between 251-500 employees, 21.4% have between 101-250 employees, 14.3% have between 51-100 employees, and 10.7 % have less than 50 employees. Table 3-3 illustrates the contractors' characteristics.

Table 3-3 Characteristics of the contractor

Characteristics of the Contractor	Frequency	Percentage
1. Main projects Sector		
Building works	16	47.1
Infrastructural works	5	14.7
Electro-mechanical works	9	26.5
General contracting	4	11.8
2.Grade Level		
Grade 1	17	60.7
Grade 2,3	1	3.6
Grade 4,5	7	25.0
Grade 6,7	3	10.7
3. Type of ownership		
Sole propriety	7	25.0
Family owned	14	50.0
Government Owned	1	3.6
Multinational Company	6	21.4
4. Number of Years of Establishment		
Less than 5	2	7.1
6-10 years	4	14.3
11-20 years	7	25.0
More than 20 years	15	53.6
5. Size of the organization		
Less than 50 employees	3	10.7
51-100 employees	4	14.3
101-250 employees	6	21.4
251-500 employees	3	10.7
More than 500 employees	12	42.9

3.4.3 Quality Management System Status

In order to explore the quality management system status among contractors in Egypt, quality department existence, QMS application, and certification are examined and presented in Table 3-4. Out of 28 respondents, 16 companies have a quality department; five companies are in the initiating process, while seven companies do not have it. These are promising results as most of the sample is aware of the quality and its existence within the construction company and project.

The responses revealed that companies integrate different tools of QMS to obtain the best results; 18.4% implement TQM, 36.8% implement ISO, 28.9% implement an in-house quality management system, and 15.8% do not implement any QMS. Furthermore, ISO certification is examined; 13 companies out of 28 are not certified. The other 15 companies obtain different ISO certifications as 34.7 % are ISO 9000 certified, 22.4 % are certified ISO 45001:2018 (occupational health and safety management system), and 16.3 % are certified ISO 14001:2015 (environmental management system). The findings represent a good rate of QMS implementation and ISO certification within a developing country.

Table 3-4 QMS status summary

Quality Management System Status	Frequency	Percentage
1. Quality Department Existence		
Yes	16	57.1
No	7	25.0
In process	5	17.9
2.QMS Applied		
Total Quality Management (TQM)	7	18.4
International Organization for Standardization (ISO)	14	36.8
In-house quality management system	11	28.9
None	6	15.8
3. Certification		
ISO 9000:2000 Quality Management System	3	6.1
ISO 9000:2008 Quality Management System	4	8.2
ISO 9000:2015 Quality Management System	10	20.4
ISO 45001:2018 Occupational Health and Safety Management System	11	22.4
ISO 14001:2015 Environmental Management System	8	16.3
None	13	26.5

3.4.4 Perceptions of contractors towards QMS implementation

- ***Perceptions related to implementation barriers***

Table 3-5 describes the mean, standard deviation for the ten barriers identified previously. The implementation barriers are listed in decreasing order by their mean value. Lack of a well-designed reward system and continuous improvement culture are the lowest significant barriers. While, the top three significant barriers are, respectively:

1. Resistance to change
2. Lack of top management commitment
3. Ineffective communication and feedback between departments

According to the survey results, the most significant barrier was the resistance of employees to change. Employees tend to resist continuous changes due to concerns about their implications, lack of knowledge and skills, and unawareness of the potential benefits. Lack of top management commitment was perceived as the second most significant barrier. Top management should demonstrate commitment to quality to enhance effective QMS implementation by prioritizing quality activities, providing the necessary resources for implementation, and encouraging employees' involvement. Additionally, top management is responsible for developing of communication and feedback system, as the lack of an effective system was perceived as the third significant barrier.

Table 3-5 QMS implementation barriers for contractors in Egypt

QMS implementation barriers	Mean	Std. Deviation
Resistance to change	4.50	0.793
Lack of top management commitment	4.21	0.995
Ineffective communication and feedback	4.14	0.932
Lack of quality awareness	4.07	1.152
Poor quality action plan	4.00	0.903
Difficulties in understanding the quality system	3.89	0.875
Awarding of contracts to the lowest bidder	3.82	1.090
Lack of qualified workforce	3.75	1.041
Lack of continuous improvement culture	3.75	1.295
Lack of a well design reward system	3.50	1.106

Table 3-6 compares barriers to QMS implementation in construction in Egypt, Saudi Arabia, and Morocco, ranked in order of their significance. The findings of Egypt and Saudi Arabia

studies were incompatible, as Aichouni et al. (2014) indicated that the three most significant implementation barriers are increased resources and cost, awarding of contracts to the lowest bidder, and increased paperwork. On the other hand, the findings of the present empirical study are in line with the findings reported by Bounabri et al. (2018). It was reported that the three most significant barriers to quality improvement in the Moroccan organizations are resistance to change, poor interdependence between departments, and lack of top management commitment. The findings of the three studies demonstrate poor perception about a QMS implementation and ineffective quality culture within the construction companies.

Table 3-6 Barriers of QMS implementation in Egypt, Saudi Arabia, and Morocco

Egypt (The present study)	**Saudi Arabia (Aichouni et al., 2014)**	**Morocco (Bounabri et al., 2018)**
Resistance to change	Increased resources and cost	Resistance to change
Lack of top management commitment	Awarding of contracts to the lowest bidder	Poor interdependence between departments
Ineffective communication and feedback	Increased paperwork	Lack of top management commitment

T-Test analysis is performed to analyze the difference between the means of two samples, where the difference is significant if the absolute t-value is greater than the critical value at confidence level 95% ($|t| > C$ value, $\alpha = 0.05$) (Bounabri et al., 2018). Table 3-7 displays the results of the t-test of the common barriers between Egypt and Saudi Arabia, while Table 3-8 displays the results of the t-test of the common barriers between Egypt and Morocco. The results indicate high differences between samples that refer to a different perception of the respondents towards the QMS implementation barriers, it could be due to the different culture or work environment in each country.

Table 3-7 T-test values of barriers in Egypt and Saudi Arabia

QMS implementation barriers	Egypt (The present study)		Saudi Arabia (Aichouni et al., 2014)		T-test	C value
	n=28		n=103			
	Mean	SD	Mean	SD		
Lack of top management commitment	4.21	0.995	2.58	1.2	6.5926	1.66
Lack of quality awareness	4.07	1.152	2.59	1.35	5.2967	1.66
Awarding of contracts to the lowest bidder	3.82	1.09	2.87	1.35	3.4291	1.66
Lack of qualified workforce	3.75	1.041	2.66	1.35	3.9601	1.66

Table 3-8 T-test values of barriers in Egypt and Morocco

QMS implementation barriers	Egypt (The present study)		Morocco (Bounabri et al., 2018)		T-test	C value
	n=28		n=94			
	Mean	SD	Mean	SD		
Resistance to change	4.5	0.793	3.479	0.699	6.5754	1.661
Lack of top management commitment	4.21	0.995	3.043	1.135	4.9052	1.661
Ineffective communication and feedback	4.14	0.932	2.84	0.965	6.3051	1.661
Lack of quality awareness	4.07	1.152	2.796	0.95	5.9232	1.661
Lack of continuous improvement culture	3.75	1.295	2.777	1.069	4.0214	1.661

In conclusion, early recognition of the obstacles that may lead to unsuccessful QMS implementation is essential. The findings are beneficial for contractors as they suggest focusing their efforts and resources on overcoming the barriers to quality improvement. For contractors to implement quality effectively, they need to initiate a quality-conscious culture within the organization by encouraging employees' participation in quality improvement and delivering training to provide awareness of the reasons and potential benefits of implementing a quality system.

- ***Perceptions related to implementation benefits***

As retrieved from the literature review, ten implementation benefits have been identified. They are illustrated in Table 3-9, along with their mean and standard deviation. According to mean values, the contractors agreed that the most important benefits are customer satisfaction and confidence improvement, company image improvement, and service quality improvement. Successful implementation of QMS improves the service quality and establishes confidence that the contractor is able to adhere to the requirements, which subsequently improves the company image. On the other hand, they also agreed that the least received benefits are reduction of rework and budget and schedule performance improvement.

Table 3-9 QMS implementation benefits for contractors in Egypt

QMS implementation benefits	Mean	Std. Deviation
Improves customer satisfaction and confidence	4.64	0.731
Improves the image of the company	4.61	0.737
Improves service quality	4.43	0.879
Reduces inefficiencies and waste	4.21	0.686
Gains entry in new markets	4.21	1.031
Increases competitive advantage	4.18	0.905
Improves processes and procedures	4.14	0.932
Enhances continuous improvement	4.11	0.916
Reduces rework	4.04	0.999
Improves budget and schedule performance	4.00	0.903

Investigating the potential implementation benefits provides insight for contractors into what they could acquire. A comparison between implementation benefits in Egypt, UAE, and Turkey is shown in Table 3-10. The significant benefits for the UAE companies are improved processes and procedures, increased quality awareness, and improved service quality **(**Zaramdini, 2007). The Turkish construction industry perceived benefits were enhanced company's image, improved definitions of responsibilities, and better communication with customers (Turk, 2006).

Table 3-10 Benefits of QMS implementation in Egypt, Turkey, and USA

Egypt (The present study)	UAE (Zaramdini, 2007)	Turkey (Turk, 2006)
Improves customer satisfaction	Improved processes and procedures	Enhances company's image
Improves the image of the company	Employees become more quality aware	Improves definitions of responsibilities in the company
Improves service quality	Improved product and/or service quality	Gets better communication with customers

Table 3-11 presents the results of the t-test of the common benefits between Egypt and UAE. T-Test analysis is performed to analyze the difference between the means of two samples, where the difference is significant if the absolute t-value is greater than the critical value at confidence level 95% ($|t| > C$ value, $\alpha = 0.05$) (Bounabri et al., 2018). There is significant difference between the benefits in the two samples as t value is greater than the critical value except for process and procedures improvement. On the other hand, the means of the benefits perceived in Egypt and Turkey are highly different, as shown in Table 3-12.

Table 3-11 T-test values of benefits in Egypt and UAE

QMS implementation benefits	Egypt (The present study)		UAE (Zaramdini, 2007)		T-test	C value
	n=28		n=209			
	Mean	SD	Mean	SD		
Improves customer satisfaction	4.64	0.731	4.06	0.712	4.0353	1.65
Improves the image of the company	4.61	0.737	4.07	0.714	3.7441	1.65
Improves service quality	4.43	0.879	4.16	0.664	1.9385	1.65
Reduces inefficiencies and waste	4.21	0.686	3.79	0.774	2.7303	1.65
Gains entry in new markets	4.21	1.031	3.47	0.809	4.3906	1.65
Increases competitive advantage	4.18	0.905	3.71	0.907	2.5756	1.65
Improves processes and procedures	4.14	0.932	4.28	0.612	1.0593	1.65

Table 3-12 T-test values of benefits in Egypt and Turkey

QMS implementation benefits	Egypt (The present study) n=28		Turkey (Turk, 2006) n=68		T-test	C value
	Mean	SD	Mean	SD		
Improves customer satisfaction and confidence	4.64	0.731	1.1029	0.9485	17.67	1.668
Improves the image of the company	4.61	0.737	1.4412	0.5829	22.364	1.668
Gains entry in new markets	4.21	1.031	0.25	1.2017	15.266	1.668
Increases competitive advantage	4.18	0.905	0.5882	1.1748	14.488	1.668
Improves processes and procedures	4.14	0.932	1.1029	0.9001	14.873	1.668

- ***Perceptions related to implementation CSFs***

This study presented 10 CSF for contractor's evaluation; the results are shown in Table 3-13. The top three high impact factors affecting the successful implementation of quality management system practices in construction organizations are top management commitment and leadership have the highest overall mean value (4.54), followed by education and training (4.21), then attitude to change (4.18). Successful implementation of QMS requires companies' internal stakeholders' commitment to generating effective leadership, strategic planning for quality, and human resources. In order to increase the commitment of the employees to quality, they acquire the knowledge to understand the importance of quality and avoid resistance. Therefore, investing in training and education for all the organization is necessary. However, other factors seemed less important, such as employees' motivation, commitment, and empowerment. Identifying CSFs prior to quality implementation is vital, as it assists the organization in the monitoring and performance measurement processes.

Table 3-13 QMS implementation CSFs for contractors in Egypt

QMS implementation Critical Success Factors	Mean	Std. Deviation
Top management commitment and leadership	4.54	0.637
Education and training	4.21	0.787
Attitude to change	4.18	0.612
Effective communication within the organization	4.18	0.723
Continuous improvement	4.11	0.629
Customer satisfaction	4.11	0.916
Use of information and communication technology	4.07	0.858
A well-structured system of procedures and processes	4.07	0.979
Employee motivation and commitment	4.04	0.881
Employee's empowerment	3.93	0.813

3.5 Conclusion

In this chapter, the quantitative method used is described. The questionnaire objective, design, sampling, and data collection are outlined. Then, the data derived from the respondents are statistically analyzed using SPSS. The results indicated that highest scored barrier that affects the QMS implementation is resistance to change. The top three significant barriers were compared to the top barriers in Saudi Arabia and Morocco. While the top perceived benefit is improving customer satisfaction and the highly significant benefits were compared to UAE and Tukey. Finally, top management commitment and leadership is the most important factor for the implementation success. The results derived from the questionnaire provide a strong basis for the development of a framework for quality implementation and improvement for contractors in Egypt.

CHAPTER 4: FRAMEWORK DEVELOPMENT

4.1 Framework Design

This chapter proposes a detailed framework for QMS implementation for Egyptian contracting companies. The framework aims to provide an opportunity for initiating a quality system, simplify the implementation process for contractors and facilitate its success. It is developed based on a combination of the literature review and a thorough analysis of the previous frameworks, along with the questionnaire results as illustrated in Figure 4-1. For contractors to gain full benefits of implementing QMS, the framework was designed to take into consideration:

1. The limitations of the existing frameworks.
2. The identified barriers to eliminate and overcome any barrier that might occur.
3. The identified CSFs.

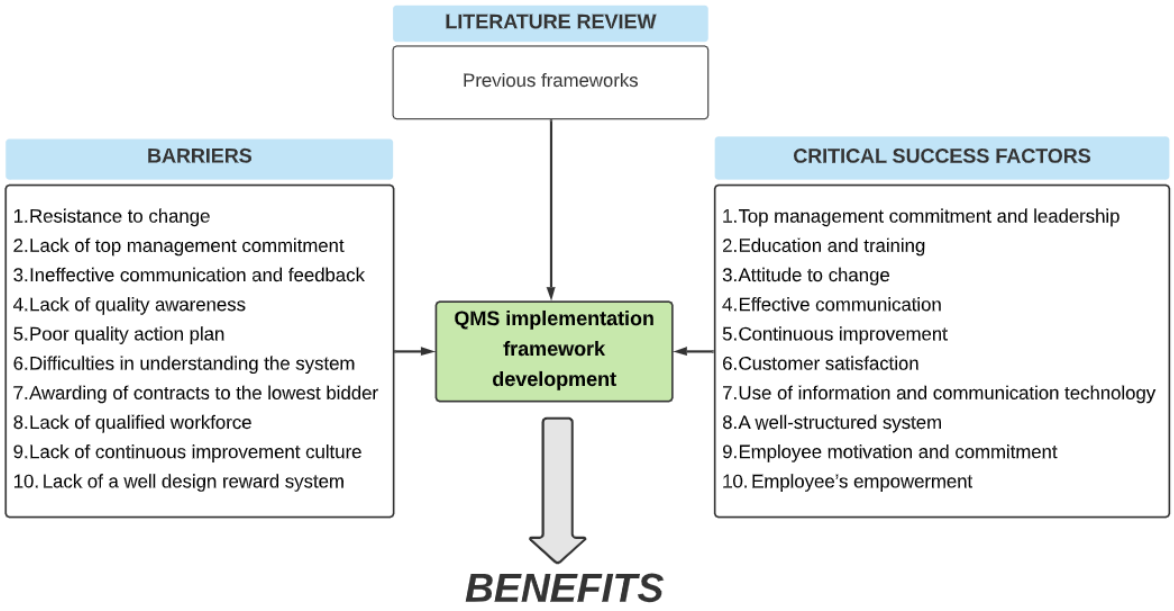

Figure 4-1 Framework development methodology

Delgado-Hernandez and Aspinwall (2008) suggested a list of requirements for building a new framework to increase its feasibility and effectiveness; some of them were considered while developing this framework, such as simple, easy, systematic, well structured, practical, and applicable. The framework's structure is represented by a flowchart diagram shown in Figure 4-2, which displays its stages and activities. The proposed framework has adopted a step approach, and it has been designed in four sequential and iterative stages, where each stage consists of activities. It integrates principles and features of several quality management practices prioritized and organized based on the Deming Cycle (PDCA): preparation, planning, implementation, evaluation, and action. The proposed framework intends to guide contractors seeking quality improvement; however, each organization can select a convenient starting point and modify the framework to suit its strategy and resources.

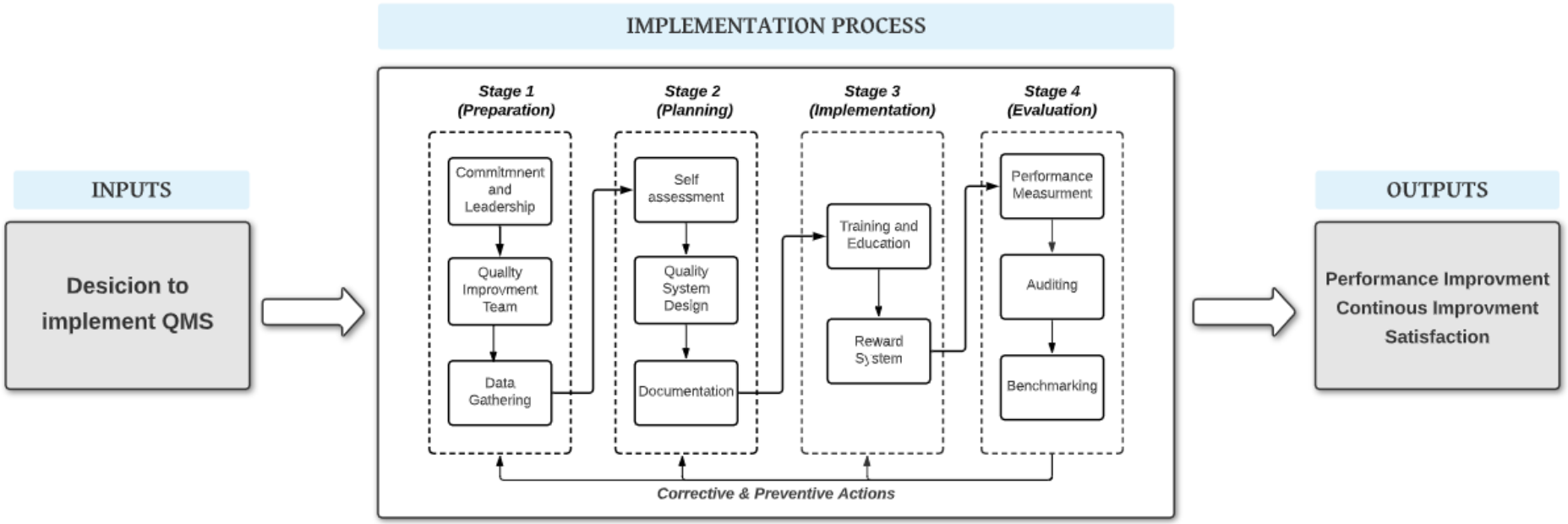

Figure 4-2 QMS implementation framework

4.2 Framework Stages

4.2.1 Stage 1: Preparation

The preparation stage is commenced as soon as the top management decides to initiate a quality system within the organization and choose the appropriate timing to introduce it. This stage is concerned with the manifestation of leadership and commitment from all organization's hierarchy levels, assembling the right team, and collecting all the customer needs. The main outputs of this stage are assigning a steering committee and establishing a list of customers' requirements, expectations, and motivations, as shown in Figure 4-3.

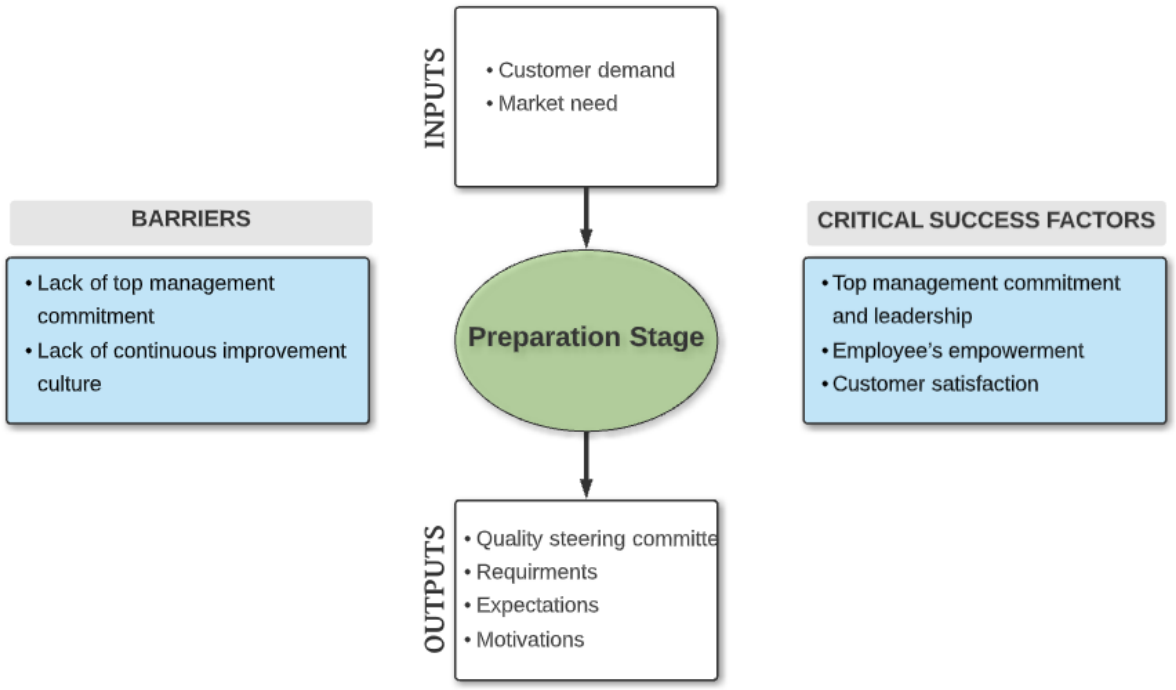

Figure 4-3 Stage 1 details

- ***Commitment and leadership***

Implementing QMS entails major organizational and culture change requiring all organization members' commitment and leadership. The top management has the primary role for starting effective commitment and leadership efforts as it is responsible for defining objectives, originating strategies, and ensuring business excellence and sustainability. Top management must demonstrate their commitment to quality. It could be evident in supporting all related activities, prioritizing quality over time and money, and providing the necessary implementation resources. Besides, Top management is committed to interpreting the quality goals and implementation process to each stakeholder simply, as it must be adopted correctly by the rest of the organization in order to gain full potential.

The successful implementation quality system requires an inspirational, motivational, and innovative work environment. The top management leadership creates a quality-conscious culture that promotes continuous improvement, employee empowerment, communication, teamwork, and learning. Quality culture and change management are considered as the results of top management commitment and leadership. Maintaining a quality culture increases employee awareness, confidence and strengthens commitment (Alhwairini & Foley, 2012).

Efficient commitment and leadership practices are vital to prevent the organization from negative attributes that affect the implementation success, such as one-man show attitudes, inconsistency between strategy and practice, lack of employee empowerment, lack of quality incentives, poor provision of required resources, and not supporting change. Therefore, commitment and leadership are the prerequisites for an effective QMS implementation.

- ***Quality Improvement Team***

Poor organizational structure is considered a major barrier for effective QMS implementation as it impacts the identification of roles, responsibilities, and communication among the organization (Elbassuni, 2006; Subrahmanya Bhat and Rajashekhar, 2009). Organizations seeking quality implementation have to evaluate and reorganize their organizational structure and assign a quality representative and a committee depending on the organization's size.

Small organizations typically appoint a Management Representative (MR) who will plan, organize, and coordinate the QMS implementation activities drawing up the roadmap in which activities are identified along with implementation methodology (Delgado-Hernandez & Aspinwall, 2008). The MR has the responsibility to maintain the quality management system

and ensure that quality processes are carried out properly. He is also responsible for regularly carrying out the internal quality audits, conducting the yearly management review, and reporting to the top management accordingly.

On the other hand, a steering committee is an advisory committee assigned in large organizations to develop the facilitate the implementation process (Harrington et al., 2012). It is represented by the chief executive officer and the department head managers. The steering committee is responsible for identifying the needs of the organization and opportunities for improvement, establishing quality policies, preparing quality manuals, and setting an accurate feedback system (Elghamrawy & Shibayama, 2008). The committee members should meet regularly and schedule periodic system reviews.

- ***Data Gathering***

The first step for achieving customer satisfaction in construction is realizing the customers' needs and translating them into an action plan. The awareness of the customers' current and future needs and expectations assist the organization in delivering high-quality, reliable, and timely service (Sadikoglu & Olcay, 2014). In addition, organizations' motivation for implementing a quality system should be identified and recorded as aligning it with goals and strategies is significant. Therefore, data gathering tools are used to constantly assemble the required data set for an effective QMS implementation.

Structured procedures must be adopted to gather data to ensure the collected data's reliability. Customer surveys are one of the methods that support the collection of data, as well as a well-structured checklist. Furthermore, formal and informal interviews with staff, managers, and directors, questionnaires, examination of the company's documents, and information must be periodically and interchangeably adopted. Most of the methods mentioned above require site visits, which will provide greater objectivity and a means of clarifying and verifying the data collected.

Implementing data gathering methods that regularly generate the customers’ needs, expectations, feedback, and motivations will put the organization at an advantageous standpoint. It will draw a knowledgeable picture of the customer requirements and create a responsive quality culture, guarantee the smooth and effective achievement of the QMS objectives and continuous improvement.

4.2.2 Stage 2: Planning

The planning stage is the most important in implementing quality, as proper planning eases the implementation and saves time. This stage aims to formulate a vision and mission statements, goals, strategy for quality implementation within the organization and align it with the requirements and motivations of customers. Planning for QMS implementation involves self-assessment, quality system design, and documentation. Figure 4-4 illustrates the stage details.

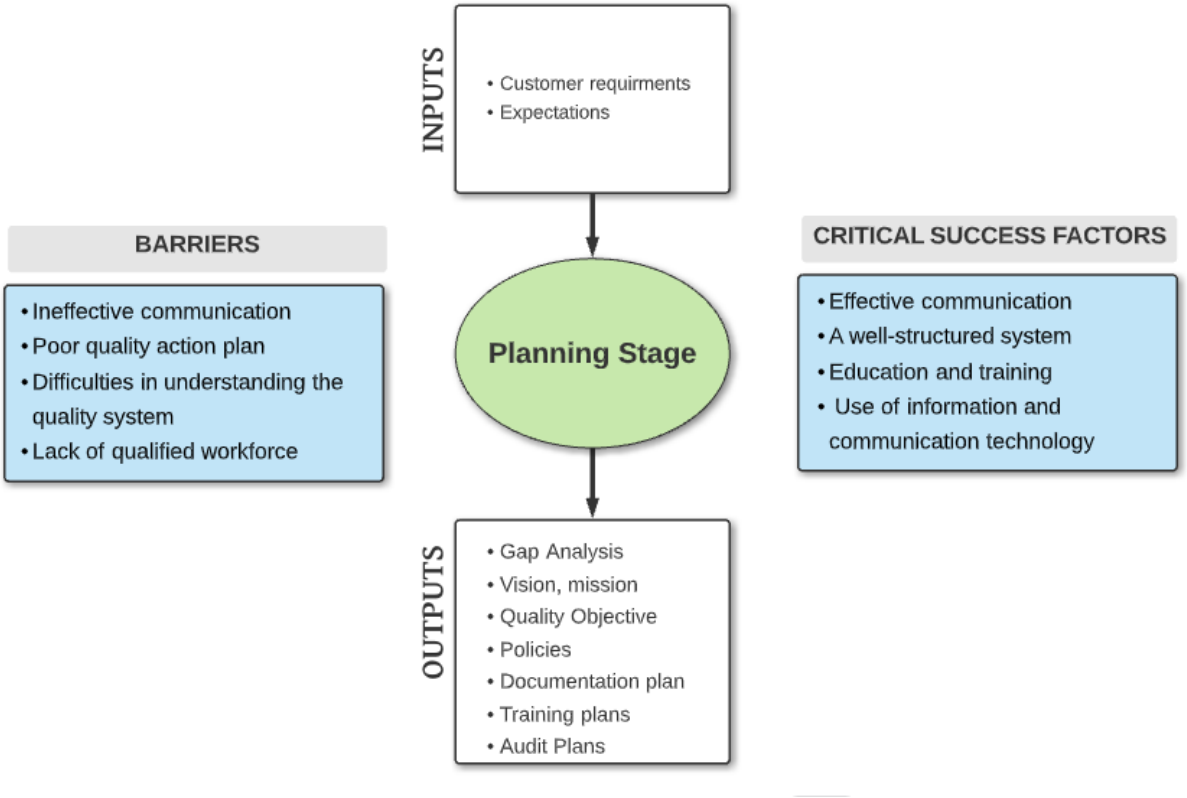

Figure 4-4 Stage 2 details

- ***Self-Assessment***

A thorough self-assessment evaluates the current organization's quality status to provide a clear picture of its quality capabilities, processes, and resources. The assessment process aims to identify target fields for improvement and enhance decision-making by measuring internal performance and examining the organization's processes, performance, strengths, and weaknesses.

Business excellence models (BEM) deliver a powerful self-assessment tool to decision-makers that can be efficiently utilized to provide a detailed overview of the organization's operations and identify the critical flaws that need further improvement. They provide guidelines and scoring criteria for evaluating organizations' quality practices and enhancing continuous improvement. BEMs are developed by national or international institutions such as the Malcolm Baldrige National Quality Award (MBNQA), European Foundation for Quality Management Excellence (EFQM), the Australian Business Excellence Framework, Canada Awards for Excellence, and Singapore Business Excellence Framework. Each award is based on a perceived model of TQM., Malcolm Baldrige National Quality Award (MBNQA) is a widely adopted performance excellence model. MBNQA is awarded annually to organizations capable of harnessing performance excellence practices, thus, enabling organizations to benchmark their performance to an internationally recognized set of guidelines.

In conclusion, the self-assessment process results in understanding the opportunities and constraints for quality improvement. Acknowledging the current performance of an organization’s quality system and processes influences subsequent management decisions to effectively improve its performance.

- ***Quality System Design***

The contractor is responsible for designing an appropriate quality system that fulfills the organization's quality objectives and guarantees satisfaction. Yasamis et al. (2002) referred to the quality system as a well-structured system that identifies, documents, coordinates, and maintains all processes throughout all relevant company and site operations to ensure customer quality satisfaction and performance improvement. Effective system design reduces processes' cycle time, rework, cost and ensures consistent and predictable results. (Kuo et al., 2009).

Adapting a quality system provides control and discipline and a standardized improvement system required for successful implementation. It involves utilizing quality management tools

and techniques to achieve quality planning (Dale, 1995). Furthermore, one of the most important outcomes of a QMS is a quality manual generation which is essential to include at least the following:

- Quality policy
- QMS definition
- Processes definitions
- Procedures required by the QMS

Therefore, a detailed quality system is imperative for the QMS to be implemented effectively and efficiently.

- ***Documentation***

Documentation is considered an essential dimension of successfully implementing and maintaining a QMS. It is relatively crucial to provide the necessary documentation of procedures. The responsibility of maintaining these levels of documentation must be assigned and monitored by the top management.

Ezeldin and Abu-Ghazala (2007) described QMS documentation process that can be achieved through a typical three-level structure

- Level 1: Quality manual

It defines the quality system according to the organization's quality policy, objectives, and requirements.

- Level 2: QMS system procedures

It presents the processes and procedures, thus clearly identifying responsibilities, authorities, and the details of the operations to achieve quality policies and objectives.

- Level 3: Supplementary quality documents

This level includes detailed work guides and standard forms, which is an essential tool to ensure that quality has been conducted in a standardized manner.

Although documentation is beneficial for recording, monitoring, and auditing the quality system, contractors claim it is time-consuming and costly. Information technology could be used to optimize documentation.

4.2.3 Stage 3: Implementation

The implementation stage starts once the plans and systems have been put into place. Its main output is training feedback, recognition system and quality records as shown in Figure 4-5.

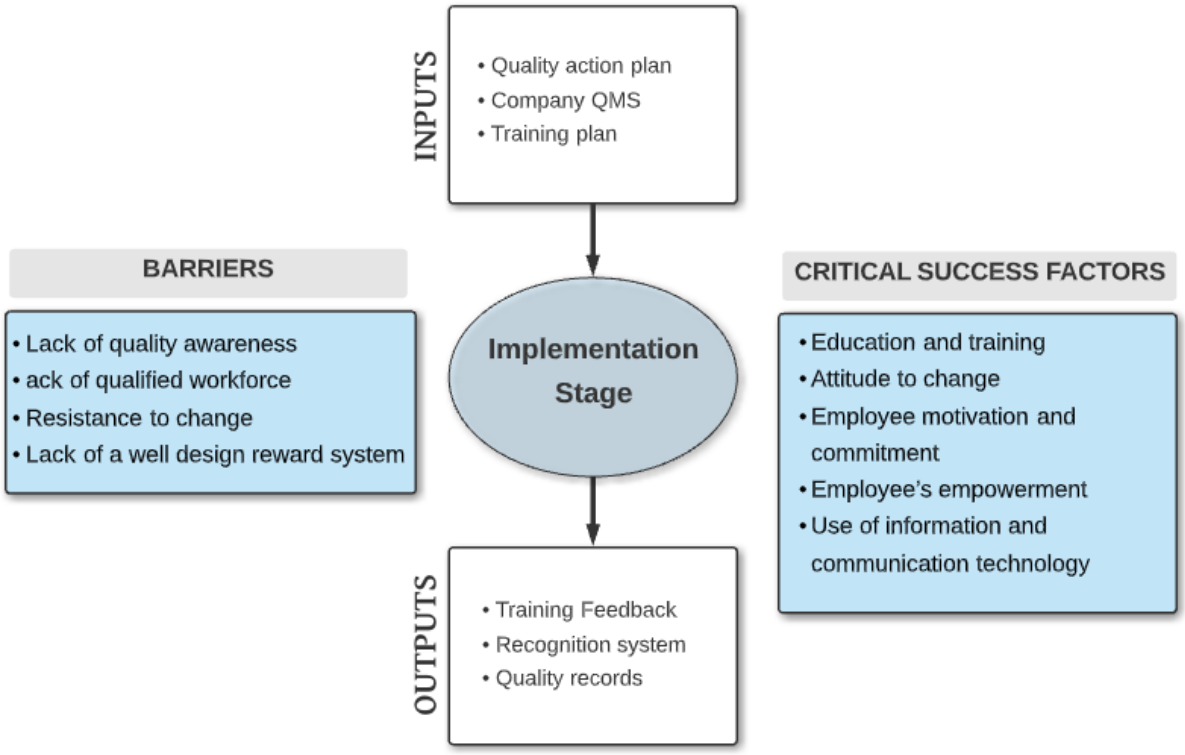

Figure 4-5 Stage 3 details

- ***Training and Education***

The cornerstone of a successful organization is the organization's personnel and not the system alone since the people are the main drivers of any system. Therefore, encouraging the organization's personnel to perform strategically will definitely improve the quality of work. Although the work quality will be improved via an engaging leadership and encouragement of the personnel, encouragement is not enough to achieve the desired level of quality as sometimes it is required to build up the capacity of the personnel and provide them with proper tools in order to reach the desired level of quality and avoid employee resistance (Kuo et al., 2009).

The organization's resistance to change will only be overcome via continuous education and training, thus spreading knowledge and awareness through the entire organization hierarchy. Resistance to change is considered the main blockade to building up the required capacity of the people's body of knowledge and awareness to implement a QMS. Therefore, it is crucial to present successful role models to the organization's personnel and pay attention to the harsh consequences of failing to change. It has been proven that continuous education and training directly related to the performance thus impacting the end results. Accordingly, allocating firm resources to training on quality is vital and pays off for the end result. Moreover, it has been found that well educated employees will increase quality, efficiency, and reliable delivery of the products and/or services. Furthermore, continuous development through trainings and education of the employee will improve employees' loyalty to the firm and increase their motivation for continuous evolvement thus continuously achieving higher levels of performance.

Training and education programs could be conducted in the form of training courses, lectures, seminars, and workshops that familiarize employees with quality concepts and their benefits. It is worth noting that training should be directed at all levels of the organization as leaving senior managers of the organization not embracing the complete understanding of QMS processes will increase the gap between the top managers and the employees, thus creating a barrier to overcoming the resistance to change and to reach a deep and full implementation of a successful QMS within the organization. In other words, top management should be set as an example for others. Afterwards, feedback is obtained through out the training programs to analysis the process effectiveness and identify the training gaps and needs.

At this stage training and education will not only provide the employee with the required set of skills and tools to perform better but will also put the top management in a confident position

to provide their employee with the required empowerment, which fosters the talent of employees and their motivation to participate actively. Employee empowerment could only be achieved by first increasing the employees' self-confidence by providing them the necessary knowledge and tools that set them up as decision-makers and top management confidence leaving enough authoritarian space for the employees to make decisions trusting their knowledge and judgment. Reaching this level of employees' empowerment will allow them to quickly respond to potential errors since they have the knowledge and tools to do so, but most importantly, they have the power to do so.

- ***Reward System***

Employee stimulation is essential for the continuous positive evolvement of the system, so establishing a formal and honest reward system within the organization is vital for maintaining a successful QMS within the organization. As such, a reward system will deliver a solid message to all employees of the organization appreciation towards the distinctive employees who contribute to the company's quality objectives of the company thus creating a stimulating environment within the organization that states that the system pays back to those who deliver. Therefore, creating a reward system or incentives will ensure the team could actually enjoy the system's benefits.

Recognition through rewards will change quality activities into attitudes, therefore, easing up the resistance to change. Recognition through a reward system could be in the form of a financial bonus or promotion. The reward timing is essential, and it has to be administered at known and regular intervals. Therefore, incentivizing employees through professional monetary guarantees will be a strong motivation that must be driven from all levels of management to encourage employees to be fully involved in the company’s quality system.

4.2.4 Stage 4: Evaluation

The evaluation stage is important for highlighting the strength and weakness of the system and evaluate whether the system have maintained the requirements. The purpose of the system evaluation should define opportunities for improvement and improvement activities. The main outcomes of this stage are audit report, feedback report, corrective, and preventive actions. Figure 4-6 outlines the stage details.

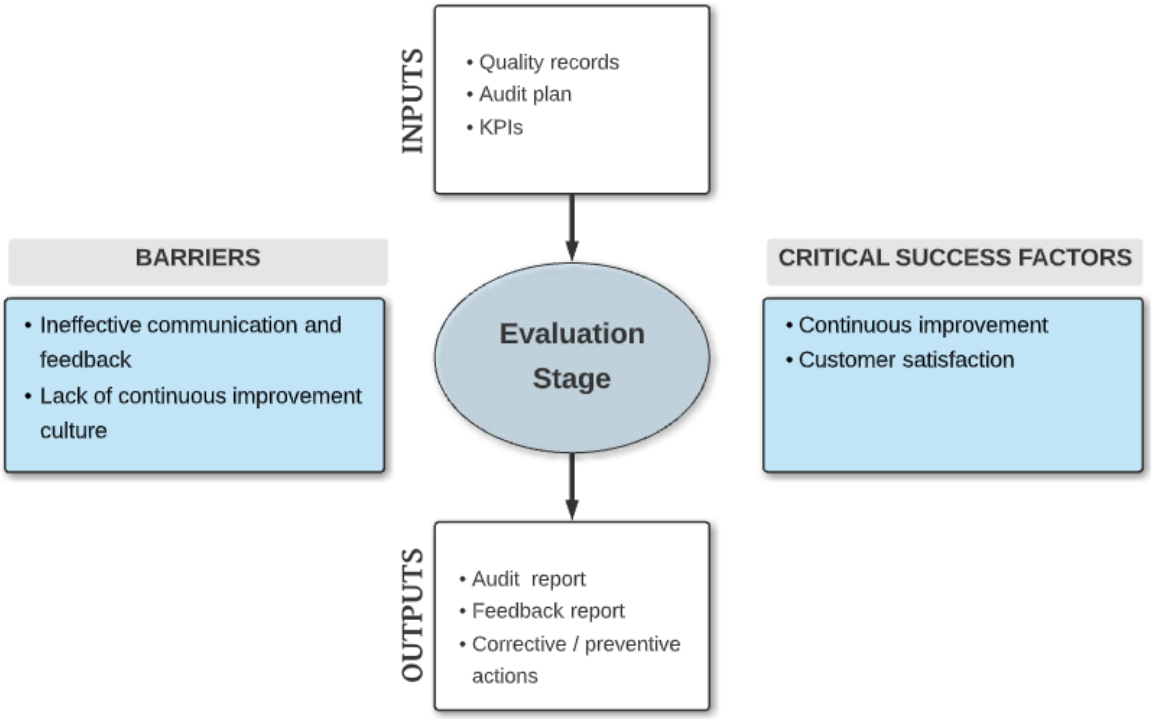

Figure 4-6 Stage 4 details

- ***Performance measurement***

Developing a performance measurement system within the organization is vital in order to assess customer satisfaction, employee satisfaction, service quality and measure key performance indicators. Performance measurement techniques could be in the form of carrying out customer satisfaction surveys and employee satisfaction questionnaires to obtain thorough feedback that will help identify major barriers of TQM implementation help in making strategic corrective actions, thus improving the overall quality system. Performance measuring may also include evaluations to determine whether the current adopted practices benefit the organization or need further improvement or even replacement.

The performance measurement phase must highlight the planned targets versus actual results forming an internal benchmarking process that will ultimately serve the auditing phase. One of the main outcomes of a performance measurement process is compiling the key performance indicators representing the dimensions of the organization's quality performance. These indicators must precisely reflect the current quality practices adopted by the organization, and these indicators are then operationalized within a framework set as the base of the evaluation model.

Eventually, the performance measurement process helps assess the internal performances and serves in the benchmarking process. Performance measurement can be utilized to measure the overall impact of the implementation process on the organization and develop corrective action analysis that can be used to identify the roots of poor performance leading to adopting the appropriate corrective actions to eliminate the root causes.

- ***Auditing***

Monitoring and controlling QMS implementation are the keys to measuring the successful implementation of QMS within the organization. Such a measurement can be achieved through a regular quality audit. Understanding the auditor for the paperwork is crucial for the auditor to realize the intended quality management system. Vague documentation and guides aimed at defining and drawing up the quality management system will lead the organization to face the consequences of improper implementation of QMS. Irregular auditing shall be avoided as inconsistency in auditing will cause loss of control over the performed work and ultimately failure of the QMS. Therefore, auditing should be conducted regularly to maintain the system standards and provide proper guidance for system evolution.

QMS is a complex system that comprises several components, and each component unit is composed of many quality requirements. The main role of the auditor is to investigate and validate the quality management process to assess its effectiveness and ensure that it meets the requirements at a component level, thus building up a global assessment piece by piece for the system level. The main outcome of the auditing process is a report that documents and highlights the auditor's findings. The auditing report is vital as it will serve as a concrete base for corrective and preventive actions which need to be taken to eliminate the nonconformities. Audits should be non-biased; thus, they have to be conducted by independent bodies who do not have direct responsibility for the QMS under audit (Lee et al., 2011). Eventually, quality audits are considered mandatory as they help organizations monitor and confirm that a QMS is maintained.

- ***Benchmarking***

Benchmarking allows organizations to evaluate their position relative to the best practices of leading competitors in the same field. It can be considered an essential drive for organizations to enhance their performance via external reinforcement. Thus, significantly improving the processes and eventually increasing the quality level.

Organizations should understand that benchmarking could be considered a tool utilized to identify strengths and weaknesses relative to the best in their field to enhance their market position over time. Eventually, without benchmarking, organizations will not know their performance relative to their competitors, thus failing to design their QMS processes to be competitive within the market.

4.3 Conclusion

This chapter focused on proposing a QMS implementation framework for contracting companies in Egypt. Afterward, the framework design is discussed, along with its main features. The primary purpose of the framework is to act as a road map towards achieving the desired level of quality. In conclusion, the framework structure is presented, and its stages are explained in detail.

CHAPTER 5: FRAMEWORK VALIDATION

5.1 Interview Design

This section aims to validate the proposed framework. Typically, a case study is executed to provide a practical example of using the implementation framework within a contracting company in practice and evaluating its outcomes. However, this method would take a long time, and due to time constraints, the contractors were not asked to implement it in practice, but in-depth interviews were conducted with top management to ensure that the framework is perceived as a practical tool that can be used in the construction industry (Delgado-Hernandez & Aspinwall, 2010).

The study employed semi-structured, online, one-to-one interviews to generate the data required and accomplish the last research objective. The estimated time of each interview is approximately 30 minutes. The interview format was to explain the framework's constructs and flow briefly. Then, it was divided into three parts where all the responses and comments were treated confidentially and transcribed anonymously.

Part 1: The proposed framework was evaluated based on four attributes:

- Easy: Simple and can be easily understood by construction professionals.
- Well-structured: Elements are presented clearly and in order.
- Comprehensive: All the required elements and activities are included.
- Applicable: Credible tool that can be used in real situations.

The respondents were requested to indicate to what extent they agree with the mentioned criteria based on three Likert scales, where one strongly disagreed, and three strongly agreed.

Part 2: The proposed framework was evaluated based on two criteria:

- How well did the framework tackle the identified barriers?
- How well did the framework address the identified CSFs?

The respondents were requested to indicate to what extent they agree with the mentioned criteria based on five Likert scales, where one strongly disagreed, and five strongly agreed.

Part 3: Finally, the respondents were asked to express their opinion, feedback, and suggestions to improve the framework.

5.2 Analysis & Discussion

The purpose of the interviews was to investigate the suitability of the framework's requirements, stages, and flow. Twenty-eight construction companies had participated in an earlier survey, 12 respondents expressed their willingness to participate in this research stage. According to the knowledge required, seven were selected and approached based on the following requirements:

- Respondents' organization has been implementing QMS for two years or more.
- Respondent is either a general manager or quality manager.
- Respondents have at least five years' work experience in construction.

Each interviewee was identified by a letter (A to G) that does not reflect the order in which the interviews were performed. The interviewees' positions and field of work are shown in Table 5-1. Two were randomly chosen as pilots to examine the feasibility of the method, then it was further evaluated by five interviewees.

Table 5-1 Interview Respondent's profile

Respondent #	Years of implementation	Position	Years of experience
A	3-5	Quality Assurance Manager	5-10
B	3-5	Quality Manager	11-15
C	3-5	Quality Assurance Manager	16-20
D	6-10	Quality Assurance Manager	16-20
E	3-5	Systems Development Manager	11-15
F	2	General Manager	5-10
G	2	General Manager	More than 20

5.2.1 Part 1

All interviewees complimented on the graphical representation of the framework, and the highest rates for the entire criteria are strongly agreed; the ratings are shown in Table 5-2. The results confirmed the high awareness level with quality management elements, as all the interviews were familiar with the framework constructs and utilized them effectively. In addition, a reliability test was employed to measure the internal consistency of the instruments used to evaluate the developed framework. The Cronbach alpha value equals 0.95, which is satisfactory. The findings presented in Table 19 increased the authors' confidence that the framework is reliable and can be easily applied by contractors to improve performance and customer satisfaction.

Table 5-2 Framework Rating and Statistical Evaluation

Criteria	A	B	C	D	E	Mean	Cronbach Alpha
Easy	3	3	3	3	3	**3**	**0.95**
Well-structured	3	3	2	2	3	**2.6**	
Comprehensive	2	3	3	2	2	**2.4**	
Applicable	3	3	3	3	3	**3**	

5.2.2 Part 2

First, the respondents rated the proposed framework upon their agreement of its ability to overcome each barrier previously identified, and the results are shown in Table 5-3. Five Likert scales were used, where one strongly disagreed and five strongly agreed. The results indicate the instrument's consistency as Cronbach alpha value equals 0.905.

Table 5-3 Responses on how well the framework tackled the identified barriers

Barriers	A	B	C	D	E	Mean
Resistance to change	3	5	2	4	4	**3.6**
Lack of top management commitment	5	3	2	4	3	**3.4**
Ineffective communication and feedback	4	4	4	3	4	**3.8**
Lack of quality awareness	5	5	5	5	5	**5**
Poor quality action plan	5	4	5	4	4	**4.4**
Difficulties in understanding the quality system	3	5	4	4	5	**4.2**
Awarding of contracts to the lowest bidder	1	1	1	2	1	**1.2**
Lack of qualified workforce	4	5	5	5	4	**4.6**
Lack of continuous improvement culture	4	4	3	5	5	**4.2**
Lack of a well design reward system	4	5	3	5	4	**4.2**

Second, Table 5-4 presents the respondents' rating for the proposed framework addressing each identified CSFs. Five Likert scales were used, where one strongly disagreed and five strongly agreed. The results indicate the instrument's consistency as Cronbach alpha value equals 0.82.

Table 5-4 Responses on how well the framework addressed the identified CSFs

Critical success factors	A	B	C	D	E	Mean
Top management commitment and leadership	5	5	4	5	5	**4.8**
Education and training	5	5	5	5	5	**5**
Attitude to change	3	5	4	4	3	**3.8**
Effective communication within the organization	4	4	3	5	4	**4**
Continuous improvement	4	4	4	5	5	**4.4**
Customer satisfaction	5	4	4	5	4	**4.4**
Use of information and communication technology	2	2	1	3	3	**2.2**
A well-structured system of procedures and processes	4	5	5	4	4	**4.4**
Employee motivation and commitment	4	5	4	4	5	**4.4**
Employee’s empowerment	3	4	2	5	4	**3.6**

5.2.3 Part 3

The proposed framework was positively evaluated and the key statements from the one-to-one interviews regarding the opinion and feedback were highlighted.

Interviewee A

Positive comments were received on the framework. However, the interviewee recommended that a couple of elements be merged, allocated, or clarified. He commented that the documentation phase is part of the quality system design and cannot be separated. While the training and education of practitioners should take place in the planning stage, the training should be accomplished by the start of the implementation phase. In addition, he suggested clarifying the reasons behind the decision to implement QMS. Apart from the comments, the respondent emphasized the importance of top management leadership and commitment towards quality implementation.

Interviewee B

The interviewee's perception of the framework was good, and the quantitative rankings were satisfactory. The respondent offered valuable suggestions to improve the framework during the feedback discussion. First, he proposed to replace the framework input, which is the decision to implement QMS by customer requirements and market needs. These two factors are the main stimulus for deciding on improving quality within an organization. Second, he affirmed that any evaluation activity is not just for spotting and reporting weaknesses. However, the quality team should identify the strong points and enhance them. Third, he considered employee involvement and empowerment as one of the critical factors that affect the success of quality adoption. He insisted that employees have to believe that they are business partners in the company and benefit from quality implementation by applying awareness sessions, training, and education. Employees have to share the organization's vision to create a quality culture and avoid any resistance.

Interviewee C

The overall impression of interviewee C was favorable. He commented that although the objective of implementing QMS is continuous improvement, it is not the framework's output, and it should be included within the stages as an activity. That was the reason for the neutral ranking of the framework structure. The output of the implementation framework should be possessing a solid system and satisfy customers.

Interviewee D

The interviewee praised the developed framework. He stressed the significance of assessing the human resources and ensuring that they are qualified and competent to apply quality activities, in addition to the importance of auditing, whether internal or external. One suggestion was made was to integrate the developed framework with the health and safety and environmental standard to improve the safety and sustainability consciousness.

Interviewee E

The interviewee expressed his positive impression of the framework. He emphasized the complexity of change management and the serious need for all business partners' commitment to ensuring successful outcomes. Similar to interviewee D, he stressed the importance of human resources. It was suggested to monitor the employees' qualifications, turnover rate, and return on investment. Moreover, he recommended measuring the level of satisfaction of suppliers, subcontractors, and consultants along with customers and employees.

In conclusion, participants acknowledged the suitability of the framework for contracting companies in Egypt. The framework offers a well-structured road map for launching quality and achieving quality goals and objectives in a planned manner. The comments and suggestions from the discussion with quality managers were incorporated into the framework to make some future amendments.

5.3 Conclusion

This chapter presented the methodology and results of evaluating the QMS implementation framework for contractors. Validation was obtained from various practitioners in construction who are currently implementing QMS. Seven targeted quality managers were interviewed from the large-scale Egyptian construction companies that adopt quality management. The framework's validity was investigated, and all interviewees agreed on the suitability and validity of the framework for contractors. The findings were considered for minor amendments to the framework.

CHAPTER 6: CONCLUSION, LIMITATION & RECOMMENDATIONS

6.1 Conclusion

QMS represents the mechanism applied across the organization to support achieving quality objectives and confirm that adequate efforts have been made to achieve the planned level of quality. Contractors are persuaded to implement QMS to satisfy the ever-changing demands of the customers and the market. However, the problem of poor performance in the construction industry has been widely recognized, and not enough research addresses quality system implementation and the factors influencing it. Therefore, the present study focuses on exploring QMS perceptions of Egyptian contractors, focusing on all the factors surrounding the successful implementation. This research aims to develop a prospective framework that ultimately improves organizations' quality outcomes.

To achieve the goal of this study, questionnaires were sent to 55 contracting companies in Egypt. A total of 28 questionnaires were valid responses, representing a response rate of 50.9 %. The findings were statistically analyzed and compared with those in other international and regional countries. The surveyed participants agreed that resistance to change, lack of top management commitment, ineffective communication, and feedback are barriers to effective implementation. These findings are highly significant for quality managers to anticipate and eliminate the problems which may arise in the future to produce an effective implementation. Therefore, the organizations can benefit from a better understanding of barriers to successful implementation through proper training, employee involvement, positive leadership, and appropriate communication systems.

Regarding the expected benefits from QMS implementation, improving customer satisfaction and the company image appear to be the leading benefits in Egyptian contracting organizations. Furthermore, the results have identified that the high impact factors affecting the successful implementation are top management commitment, education and training, attitude to change, and effective communication within the organization. On the other hand, the study reviewed various implementation frameworks found in the literature that represents a sample of the most mentioned in different sectors and countries. A comparative analysis highlighted frameworks' constructs, the strengths, weaknesses, similarities, and differences between them.

The top identified factors, along with the comparative analysis and literature review, were utilized to develop a framework for effective QMS implementation in the construction industry. The framework guides quality implementation through four iterative stages: preparation, planning, implementation, and evaluation, where each stage comprises sequential elements. An interview approach was deployed with five quality managers to examine the validity of the newly developed framework. The interview questions will be formulated to evaluate the proposed framework based on its easiness, well-structured, comprehensive, and applicability. It was concluded that the proposed framework developed is applicable for contracting organizations and can improve performance and service quality if adopted and applied correctly.

6.2 Limitations and Recommendations

This research focuses on proposing a QMS implementation framework through studying the existing frameworks and existing influential factors; however, a few limitations were experienced. The first limitation is the small sample size due to the difficulty of reaching the target respondents and the low response rate in construction. Second, the study could not examine the implementation of the framework within a contractor company and assess it empirically. Third, the cost of implementing QMS is not estimated; the benefits and the cost of quality must be quantified to ensure the contractor's commitment to quality.

Finally, based on the findings and limitations of the study, series recommendations are proposed:

- Increase the number of respondents, as the larger sample will provide more accurate results.
- Operationalize the developed framework through a case study and measure its financial and performance impacts.
- Address QMS implementation motivations, as motivations are correlated with organizational objectives and strategies and in order to avoid misleading expectations.
- Integrate time dimension in the framework to indicate the QMS implementation's term and long-term impact on the organization.
- Utilize information technologies to simplify the application of the quality system and ease of communication and documentation.
- Analyze the contracting companies in Egypt applying quality and document its experience as a case study to provide guidance and benchmark for other companies.

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