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Professional Research Thesis

Titled

**The role of total quality management in the
success of engineering projects.**

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SUMMARY

Engineering projects are among the vital activities that are constantly evolving amid increasing challenges and rapid changes in work environments.

In this context, the importance of applying Total Quality Management (TQM) concepts and tools emerges as an effective means to ensure the success of such projects. Success in engineering projects is not solely measured by achieving technical and technological objectives, but also by meeting quality standards that enhance efficiency, reduce costs, and save time. This makes the implementation of TQM in this field critically important.

Total Quality Management (TQM) is a managerial philosophy that focuses on process improvement and enhancing organizational performance by involving all employees in improving the quality of products and services.

This philosophy encompasses key principles such as customer focus, continuous improvement, data-driven decision-making, and strong leadership that guides the organization toward excellence. Given that engineering projects require complex coordination among multidisciplinary teams and interaction with various stakeholders, TQM provides an ideal framework for organizing processes and ensuring the best possible outcomes.

Recent studies have shown that the success of engineering projects heavily depends on the ability to identify appropriate quality standards and effectively apply them throughout the project life cycle. By implementing TQM tools and techniques, errors can be minimized,

interaction among various stakeholders improved, and adherence to project timelines and budgets ensured.

TQM is not limited to internal processes alone; it also encompasses effective communication with clients and suppliers, contributing to the development of sustainable relationships that enhance overall project performance.

Amid complex economic conditions and rapid market changes, engineering firms are increasingly required to adopt TQM policies to gain a competitive advantage and ensure the success of their projects.

The aim of this study is to explore the role of Total Quality Management in achieving success in engineering projects by analyzing effective practices and identifying the key factors influencing quality improvement.

The study will also examine how TQM tools can be applied at the engineering project level, with a focus on practical case studies in this domain.

Through this study, the importance of adopting the TQM philosophy in the engineering sector is highlighted as a key tool for achieving excellence, improving performance, reducing costs, and meeting the expectations of both clients and society at large.

The study Problem.

Engineering projects are among the most prominent activities that significantly contribute to the development of infrastructure and the enhancement of economic growth in various countries. With the increasing scale and complexity of these projects, it has become essential to manage them efficiently in order to achieve the intended objectives. However, despite the efforts made to attain these goals, many engineering projects face major challenges, most notably delays in completion, cost overruns, implementation defects, weak coordination among various teams, and non-compliance with required quality standards.

In this context, Total Quality Management (TQM) emerges as an effective tool to address these challenges. TQM aims to improve all aspects of a project—from the planning phase to final delivery—by focusing on meeting customer needs, enhancing performance, and elevating the quality of services provided. Despite the significant importance of this managerial philosophy, its implementation in engineering projects still faces many obstacles, such as a lack of comprehensive awareness of TQM's fundamental concepts among engineering teams and continued reliance on traditional methods that have not been updated to keep pace with rapid technological advancements.

The greatest challenge lies in the failure to fully integrate TQM methodologies throughout all phases of an engineering project. This is where the study problem arises: we aim to understand the impact of these practices on the success of engineering projects and to identify the factors that limit their effectiveness in engineering work environments. The

issue also involves assessing the extent to which engineering firms can overcome the obstacles associated with TQM implementation and how they can utilize effective tools to enhance project performance and reduce the rate of errors and deviations.

Moreover, the fundamental question that must be addressed is: Can Total Quality Management truly make a meaningful difference in the success of engineering projects, and what are the dimensions of its impact on both the technical and administrative levels? Through this study, we seek to provide evidence-based scientific solutions that support the enhanced role of TQM as a fundamental concept for improving the effectiveness and efficiency of engineering projects.

The importance of studying:

The significance of this study lies in highlighting the role of Total Quality Management (TQM) in improving the performance of engineering projects and ensuring their success. Given the increasing challenges faced by engineering projects—such as rising costs, schedule delays, and the growing complexity of operations—the need to apply quality principles has become more urgent than ever. Engineering projects are not merely technical and operational tasks; rather, they are complex environments where numerous factors and variables interact and may influence final outcomes. Therefore, understanding how to apply TQM principles, which aim to enhance efficiency and reduce errors, is of critical importance in achieving project goals.

The importance of this study also stems from its provision of a scientific framework for analyzing the relationship between Total Quality Management and the success of engineering projects. Through this, the study will help engineering firms and organizations understand the positive impacts that TQM can have on planning, execution, and monitoring processes, thereby enhancing their competitiveness in the job market. TQM enables engineering teams to improve workflows, coordinate efforts among various stakeholders, and minimize the risks and challenges that may hinder progress.

Moreover, this study seeks to offer practical solutions and effective tools that enable engineering companies to overcome the challenges they may encounter in applying TQM. At the same time, the study serves as a valuable addition to the literature on engineering project management, offering deeper insights into quality practices within engineering work environments and how to properly leverage them to achieve sustainable success.

This study also aims to strike a balance between theoretical and practical aspects by presenting applicable insights that help leaders and managers in engineering firms adopt effective strategies to ensure project success through enhanced performance quality at every stage of the project. It also contributes to providing recommendations that may improve administrative policies in the engineering sector and strengthen the ability of engineering projects to overcome potential challenges.

Objectives of the study:

- *Analyzing the role of Total Quality Management (TQM) in improving the performance of engineering projects.*
- *Studying the impact of applying TQM principles on the success of engineering projects.*
- *Identifying the factors influencing the effectiveness of TQM in engineering projects.*
- *Exploring the challenges facing the implementation of TQM in engineering projects.*
- *Providing solutions and strategies to enhance the application of TQM in engineering projects.*
- *Evaluating the relationship between execution quality and project success within the framework of TQM.*

Study hypotheses and questions.

Hypotheses:

- *There is a positive relationship between the application of Total Quality Management (TQM) and the success of engineering projects.*
- *Applying TQM principles leads to improved efficiency and reduced costs in engineering projects.*
- *The implementation of TQM contributes to better coordination and collaboration among different engineering teams.*
- *Adopting TQM enhances customer satisfaction and reduces errors and deviations in engineering projects.*

Research Questions:

- *What is the role of Total Quality Management in improving the performance of engineering projects?*
- *How does the application of TQM affect project outcomes in terms of time, cost, and quality?*
- *What are the factors that contribute to the success or failure of TQM implementation in engineering projects?*
- *How can the application of TQM tools and methods be improved in engineering projects to ensure sustainable success?*

Study Approach.

The descriptive analytical method was used to examine "the role of Total Quality Management in the success of engineering projects."

The limits of the study:

Spatial boundaries: The Arab world.

Time limits:2025-2001

Study plan.

Chapter One: Theoretical Framework and Scientific Concepts

Section One: An Introduction to Understanding Total Quality Management (TQM)

- *First: The concept of Total Quality Management*
- *Second: Tools of Total Quality Management*
- *Third: Characteristics of Total Quality Management*
- *Fourth: Objectives and models of Total Quality Management*
- *Fifth: Key components of Total Quality Management*

Section Two: An Introduction to Understanding Engineering Project Management

- *First: The concept and importance of engineering project management*
- *Second: Strategies of engineering project management*
- *Third: Challenges related to engineering project management*
- *Fourth: Systems and software for scheduling engineering projects*
- *Fifth: Methods of managing human resources in engineering projects*
- *Sixth: Advantages of engineering project management*

Chapter Two: The Impact of Total Quality Management on the Success of Engineering Projects

Section One: The Role of Total Quality Management in Enhancing the Performance of Engineering Projects

- *First: The impact of TQM on cost reduction and efficiency improvement*
- *Second: The role of quality management in reducing errors and achieving excellence in execution*
- *Third: The relationship between TQM implementation and customer satisfaction in engineering projects*

Section Two: Challenges and Opportunities in Implementing TQM in Engineering Projects

- *First: Challenges facing TQM implementation in engineering environments*
- *Second: Opportunities provided by TQM to improve project outcomes*
- *Third: Strategies to overcome challenges and maximize the benefits of TQM application*

Section Three: Tools and Methods for Implementing TQM in Engineering Projects

- *First: Core tools of Total Quality Management*
- *Second: The role of multidisciplinary teams in applying TQM in engineering projects*

Chapter One: Theoretical Framework and Scientific Concepts

Section One: Introduction to Understanding Total Quality Management (TQM)

First: The Concept of Total Quality Management

The term “quality” has been used in various ways to express differing perspectives and opinions, as there is no single, clear-cut definition of it. For instance, to the customer, quality may refer to the value of a product, its ability to meet their needs, or even its price. From the producer's perspective, it often means the product's compliance with pre-established specifications (Boufa, 1995, p. 88). However, from the viewpoint and philosophy of Total Quality Management (TQM), quality refers to delivering a product or service of outstanding excellence that meets or exceeds customer needs and expectations, resulting in satisfaction and delight. This is achieved through predefined standards in production or service delivery, with a focus on excellence.

Quality has become a fundamental factor in the success of business organizations and is considered one of the most crucial elements in local and international market competition. The UK National Economic Development Office defined quality as “a set of factors or characteristics that must be present in a product or service in order to meet market requirements” (Abdel-Mohsen, 2004, p. 29).

The term "quality" may also be used in a broader sense to refer to concepts such as quality of life, air quality, or personality quality. Seminer (1987, p. 70) defined quality as the comprehensive specifications of an entity—

whether a product, individual, or organization—related to its capacity to satisfy actual or anticipated needs.

Regarding Total Quality Management, many authors, researchers, and specialists have addressed it from different perspectives. For instance, Hizer & Renelit (1996, p. 81) described TQM as an organization-wide focus that begins with the supplier and ends with the customer, emphasizing management's commitment to all aspects of products and services that matter to the customer.

Ferganbaum (1983, p. 7) defined TQM as a combination of product or service features related to marketing, engineering, manufacturing, and maintenance, through which customer needs and desires can be fulfilled.

Meanwhile, Noori & Radford (1995, p. 638) referred to TQM as a philosophy based on four fundamental principles: intensive focus on customer satisfaction, accurate activity metrics, continuous improvement of products and processes, and empowering individuals with influence and control.

Al-Ajez (2008, p. 53) defined TQM as “a contemporary managerial philosophy centered on anticipating customer expectations, aiming for continuous process improvement to meet customer needs and expectations through trained work teams, with quality embedded in all stages of work—from the first step to customer interaction.”

Al-Alam (2010, p. 37) described TQM as “comprehensive quality control, requiring the collaborative effort of all employees, including managers, supervisors, and workers, across all activities (planning, design, resource

procurement, manufacturing, inspection, production, sales, service, financial control, and personnel management).”

Madhoun (2009) characterized TQM as “a culture, behavior, and application—thus, it should be viewed as a new, improved, and evolved management system that is continuous in nature.”

Barakat (2007) defined TQM as a distinctive performance culture that leads to the continuous synergy of efforts to meet beneficiaries' expectations. This is achieved by focusing on performance from the early stages to reach the desired quality in the shortest time and at the lowest cost (Barakat, 2007). It is considered a method for improving overall work effectiveness and flexibility—a comprehensive organizational approach that involves the entire institution, including all departments, activities, and employees at all levels (Al-Quthami, 2013).

Najm (2010) described TQM as a management system within a company that applies tools, technologies, and standard procedures related to defect prevention, process and product improvement, and the establishment of an organizational culture and work ethics aimed at achieving excellence (Najm, 2010).

Barakat (2007) also defined TQM as a philosophy of an integrated intellectual approach that focuses on customer satisfaction as the primary long-term goal of the organization. It emphasizes collective responsibility between management and employees for continuous improvement across all activities and at the organizational level as a whole (Barakat, 2007).

From the perspective of Al-Tamimi and Issa (2013), TQM is one of the modern managerial concepts whose philosophy is based on a set of ideas

and principles. Institutions that aim to achieve performance excellence and customer satisfaction—or even exceed expectations—must adopt these principles. TQM is a modern managerial approach that aims at continuous improvement and development in service quality through the collaboration and synergy of efforts between management and employees within the institution or administrative body. It focuses on performing tasks and activities correctly, with constant attention to the beneficiary by involving them in service design (Al-Tamimi & Issa, 2013).

In light of the above, quality from a TQM perspective implies the following:

- 1. A suitable standard of excellence that must be achieved and measured.*
- 2. Delivering the best the organization can offer to its customers to gain their satisfaction.*
- 3. Paying close attention to all aspects and details equally, aiming for perfection—there is no room for randomness or guessing.*
- 4. Quality is not merely satisfying the customer but bringing them joy.*
- 5. Quality is linked to customer expectations in terms of: precision, craftsmanship, outstanding performance, distinctive specifications, timely delivery, and affordable cost.*
- 6. Quality serves as an indicator of: defect-free output, superior design, comprehensive and effective control, clarity of work, low cost, optimal time investment, efficient use of resources, speed of execution, and minimal waste.*
- 7. Poor quality reflects the organization's responsiveness to customer needs.*

8. *When customer satisfaction and happiness are achieved through the quality of the product or service, it means that Total Quality Management has fulfilled its objectives.*

Second: Total Quality Management Tools

Total Quality Management (TQM) adopts various methods and approaches to identify and solve the problems facing an organization in order to achieve quality in its products or services. The customer, based on their perspective of quality, expectations, and satisfaction with the product or service, acts as the judge. Ishikawa developed seven methods (tools) to improve performance and achieve total quality, as cited in (Bakka, May 25, 2023):

- 1. Control Chart (Shewhart Chart): The control chart is the primary and best tool for monitoring performance and conducting statistical process control. It allows for continuous statistical analysis of changes in the process to monitor and adjust the quality of the product or service and improve the process performance. It is a graphical representation that shows the changes and deviations in the quality characteristics over time. This chart helps distinguish between natural variations due to general causes inherent in the process and variations caused by specific factors. It can be used to determine if the process is under statistical control or if it is influenced by other factors that negatively impact the quality of the product or service.*

2. *Ishikawa Diagram (Fishbone Diagram) (Cause and Effect)*: This diagram, also known as the Fishbone Chart or Ishikawa Diagram (named after the Japanese quality expert Ishikawa), aims to identify the possible causes of a problem and analyze its details. It relies on a simple concept that resembles the alignment of fishbones, where each arrow represents a source of defects or deviations from specifications in production processes, whether it is a primary or secondary cause. The goal is to identify the causes and trace their sub-causes, and so on.

The cause-and-effect diagram serves as a document or map for the problem being studied within the industrial or service organization. It originates from ideas of workers, engineers, and managers to identify the problem's causes, which are often classified into:

- *Problems related to human factors (workers) – Men.*
- *Problems related to methods – Methods.*
- *Problems related to materials – Materials.*
- *Problems related to machines and equipment – Machines.*

For this reason, this diagram is referred to as the **4M Diagram**. The Ishikawa diagram is one of the most valuable quality control tools

due to its usefulness at various managerial levels and work positions, from workers to quality circle teams and maintenance teams within the industrial or service organization.

Cause and Effect Diagram with Addition Cards (CEDAC). In Japanese factories, the Cause and Effect Diagram is used along with CEDAC cards (Cause and Effect Diagram with Addition Cards). This tool is used by factory workers to collect their opinions and ideas about the process by attaching these opinions to cards during working hours. These ideas then feed into the cause-and-effect diagram in the factory, enabling continuous improvements to be made.

Chapter Two: The Impact of Total Quality Management on the Success of Engineering Projects

Section One: The Role of Total Quality Management in Improving the Performance of Engineering Projects

First: The Impact of Total Quality Management on Reducing Costs and Increasing Efficiency

The impact of applying Total Quality Management (TQM) on reducing costs and increasing efficiency is one of the key factors that contribute to improving the performance of engineering projects. The fundamental concept of total quality is to improve all aspects of the project, starting from planning, through execution, and up to the final delivery. Achieving this improvement is not limited to the quality of the products and services provided, but also extends to enhancing the processes that lead to achieving these results. Therefore, applying quality management methods is one of the most effective tools for reducing excessive costs and increasing the efficiency of resources used in engineering projects.

Initially, the application of total quality management leads to improvements in engineering processes by focusing on reducing waste and minimizing errors. When processes that repeatedly experience errors

or resource waste are identified and analyzed, companies can implement more effective working methods that help save time and reduce costs associated with errors. For example, if procurement and supply processes within a project are improved using TQM methods such as root cause analysis of errors, the project can reduce additional costs arising from mistakes in these processes.

By implementing continuous improvement concepts such as the "PDCA" (Plan, Do, Check, Act) cycle, the ability of engineering teams to execute projects more efficiently is enhanced. This includes conducting periodic analyses to ensure that processes align with required standards, which reduces the need for rework or error correction at later stages of the project. In the context of engineering projects, these process improvements are essential for reducing project costs, whether those costs relate to time, wasted resources, or the cost of fixing mistakes.

Furthermore, cost reduction through total quality management is closely related to minimizing the need for additional resources due to errors and repetition. When quality practices are effectively adopted, resources can be used more efficiently, whether they are human or material resources. For example, when TQM is applied during the engineering design phase, modifications that would need to be made in later stages of the project are

reduced, which saves the resources that would have been allocated to these modifications and contributes to lowering the project costs.

Additionally, increasing efficiency in execution is one of the major benefits of applying total quality management. When engineering teams are trained in quality management methods, processes become more organized, which boosts the speed and quality of work. This improvement in efficiency is not limited to the workers alone but extends to coordination among the different teams within the project, enhancing the smooth flow of work with lower costs. Faster execution and higher quality reduce delays that might occur due to rework or error correction, which, in turn, leads to lower costs.

Although applying total quality management requires an initial investment in training and providing the necessary tools and resources, the long-term sustainable returns in the form of reduced costs and increased efficiency far outweigh this investment. Many studies have indicated that companies that invested in training their employees to apply TQM concepts experienced significant improvements in project costs and quality. Companies that focus on total quality management avoid many of the problems that may arise due to neglecting quality at

the early stages of a project, which positively impacts the overall reduction in costs.

In conclusion, the impact of Total Quality Management (TQM) on the continuous reduction of costs and the increase in efficiency is a fundamental pillar in the success of engineering projects. By improving processes, minimizing errors, and enhancing resource utilization efficiency, TQM contributes to delivering a final project that is cost-effective and meets the specified standards within the set timeframe. Therefore, the application of TQM is not limited to improving the quality of products or services, but extends to enhancing the economic aspects of the project, ultimately leading to added value for the organization and society as a whole.

Secondly: The Role of Quality Management in Reducing Errors and Achieving Excellence in Execution.

Total Quality Management (TQM) is a strategic approach aimed at improving processes and elevating performance in engineering projects, playing a pivotal role in reducing errors and ensuring excellence in execution. Achieving quality is not just a temporary goal in engineering projects; it is an ongoing process in which principles and methods are applied to enhance all aspects of the project, from planning to final delivery. In this context, TQM contributes to reducing errors and achieving excellence in execution through various tools and techniques that ensure quality control at every stage.

Firstly, TQM contributes to reducing errors by implementing precise methodologies that aim to identify problems and challenges before they occur, a concept known as proactive quality management. Through tools like root cause analysis, errors that may arise in any phase of the project, whether related to design, execution, or procurement, can be analyzed. Once the primary cause of any fault is identified, corrective actions can be applied to prevent the recurrence of similar mistakes in the future. For example, in engineering projects, errors might result from flaws in designs or raw materials used. By applying TQM methodologies, the

source of these errors can be pinpointed accurately, and preventive actions can be taken to avoid them in the future.

Moreover, TQM contributes to error reduction through continuous improvement, which is one of the core principles of quality. The concept of continuous improvement requires periodic performance assessments and identification of gaps that could lead to errors. This ongoing evaluation helps engineering and management teams adjust strategies and processes regularly to keep up with changes and new requirements in the project. For instance, in large projects like construction, changes in technical specifications or execution techniques might occur during the course of the project. By applying the principle of continuous improvement, processes are constantly fine-tuned to minimize the likelihood of errors arising from these changes.

In addition, ongoing training and quality awareness are essential factors in reducing errors. By ensuring that all project teams—whether design teams or execution teams—are sufficiently knowledgeable about TQM principles, achieving excellence in work and minimizing errors becomes easier. Continuous training involves teaching employees how to identify problems early on and handle them efficiently. Employees who are well-versed in basic quality principles are better able to spot errors at early

stages of the project, allowing them to take corrective actions before these issues escalate into major problems.

On the other hand, TQM helps achieve excellence in execution by improving coordination between the various teams involved in the project. Engineering project management requires high levels of coordination among many parties, including architects, contractors, suppliers, and workers. Through TQM implementation, it is ensured that all these teams work according to unified standards and follow the same procedures to ensure work is executed with precision. In this context, collaboration between multidisciplinary teams is vital to minimize errors and achieve excellence in execution. For example, regular meetings can be used to exchange information, review work progress, and ensure that all parties are adhering to the required standards.

As for excellence in execution, Total Quality Management (TQM) helps achieve this excellence by applying high standards in quality control. Continuous monitoring of all aspects of the project, from design quality to the quality of work execution, is essential to ensuring excellence. When each phase of the project is executed according to high-quality standards, it ensures that the project stays on the right track and there are no defects that could affect quality in later stages. Effective quality control helps

prevent errors and identify problems before they escalate, which enhances the overall quality level of the project.

TQM is not only focused on reducing errors and achieving excellence in executing engineering projects but also enhances the organization's ability to innovate and adapt to changes. It helps foster a culture of quality within the organization, which in turn leads to greater excellence at every stage of the project, from design to execution. Moreover, innovation in using modern technological methods within the quality management process enhances the ability of engineering teams to execute projects at the highest levels of performance and quality.

In conclusion, through these tools and methods, TQM contributes to achieving excellence in executing engineering projects and reducing potential errors, significantly contributing to the success of the project and customer satisfaction. This proves that quality is not just a tactical goal, but an integral part of the engineering project strategy, working to ensure continuous delivery of high-quality results.

Conclusion.

In conclusion, the importance of implementing Total Quality Management (TQM) in engineering projects is clear, as it serves as a comprehensive approach that effectively contributes to improving performance, increasing efficiency, and enhancing effectiveness throughout all phases of the project, from design to execution and final delivery. This study has discussed the role of various quality tools, such as flow charts, statistical analysis, and quality inspection, in ensuring the efficient application of these standards. It also highlighted the impact of multidisciplinary teams in strengthening the implementation of total quality by fostering collaboration and coordination across different disciplines to ensure that all aspects of the project align with the highest quality standards.

Throughout this study, it was emphasized that the challenges faced in applying quality management in the engineering environment can be overcome through well-thought-out strategies that capitalize on the opportunities provided by effective quality management. By leveraging modern tools and a structured approach, continuous improvement and innovation can be achieved in engineering projects, thereby enhancing

the competitiveness of organizations and improving customer satisfaction.

However, the successful implementation of TQM in engineering projects requires commitment from all stakeholders involved in the process, from work teams to project management. This application necessitates continuous training, the use of appropriate tools, and the presence of a corporate culture that fully supports quality. Additionally, continuous improvement and careful performance monitoring are essential pillars to ensuring the sustainability of any engineering project's success.

Ultimately, this study highlights the importance of innovation and interdisciplinary collaboration as the foundation for achieving sustainable quality in engineering projects. Improving processes and applying quality standards require active participation from all project stakeholders, ensuring that efforts are not limited to technical aspects but also encompass organizational and administrative dimensions. This, in turn, contributes to ensuring the continued success and achievement of excellence in engineering projects.

Results.

- *The study showed that the application of Total Quality Management (TQM) in engineering projects leads to significant improvements in operational efficiency by reducing costs and improving resource utilization. The results also indicated that implementing TQM principles helps reduce errors and risks in execution, enhancing the final quality of the projects.*
- *Through the analysis, it was evident that the core tools of TQM, such as flow charts, statistical analysis, and quality inspection, play a key role in identifying inefficiencies in processes and continuously improving them. Using these tools, engineering teams were able to monitor performance and analyze data accurately, which contributed to making well-informed decisions for quality improvement.*
- *The study revealed the crucial role of multidisciplinary teams in ensuring the application of TQM principles in engineering projects. Collaboration between different disciplines enhances communication and coordination between various teams, helping to solve complex problems and ensuring integration across all aspects of the project, ultimately guaranteeing the delivery of a final product that meets the required standards.*

- *The study emphasized that continuous improvement is one of the most important principles of TQM that should be prioritized in engineering projects. Continuous improvement helps address problems more quickly and enhances performance effectiveness, which ultimately leads to executing engineering projects according to the highest global standards.*
- *The results also showed that implementing TQM directly contributes to increasing customer satisfaction. The study indicated that focusing on the quality of the final product and adhering to strict standards throughout all phases of the project enhances customer trust in the executing company, which increases the chances of sustainable success in the competitive market.*
- *The study demonstrated that following well-thought-out strategies such as continuous training, collaboration among different parties, and reliance on data is crucial for improving the application of TQM. Moreover, leveraging modern technologies can significantly contribute to accelerating and improving the implementation of quality in engineering projects.*

Recommendations:

- *Enhancing continuous training for participants in engineering projects on Total Quality Management (TQM) tools.*
- *Encouraging the implementation of multidisciplinary teams to ensure effective coordination between different technical and managerial aspects.*
- *Adopting analytical tools and techniques such as statistical analysis and flowcharts to monitor and improve quality throughout all phases of the project.*
- *Developing an organizational culture that supports TQM and integrates it into all project processes.*
- *Improving communication among all project stakeholders to ensure alignment of objectives and requirements.*
- *Implementing integrated information systems that assist in collecting and analyzing quality-related data.*
- *Applying principles of continuous improvement through periodic performance reviews and identifying opportunities for improvement.*
- *Focusing on clear definition of responsibilities for individuals and teams within the project to avoid overlap and ensure optimal coordination.*

- *Utilizing modern technologies and innovation to enhance engineering project outcomes and ensure quality.*
- *Increasing collaboration between contractors, suppliers, and consultants to ensure adherence to established quality standards.*

The reviewer:

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