

**T.R.
GEBZE TECHNICAL UNIVERSITY
GRADUATE SCHOOL**

**INVESTIGATING THE EFFICIENCY OF ISO 9001
STANDARDS FOR THE CONSTRUCTION OF REINFORCED
CONCRETE BUILDINGS**

GÖZDE ALNİAÇIK KAHYA

**A THESIS OF MASTER OF SCIENCE
DEPARTMENT OF CIVIL ENGINEERING
EARTHQUAKE AND STRUCTURAL
ENGINEERING PROGRAM**

ADVISOR: DOÇ. DR. SEVİLAY DEMİRKESEN ÇAKIR

FEBRUARY 2023

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LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ**

**BETONARME BİNALARIN İNŞAATINDA ISO 9001
STANDARTLARININ ETKİNLİĞİNİN
ARAŞTIRILMASI**

GÖZDE ALNİAÇIK KAHYA

**YÜKSEK LİSANS TEZİ
İNŞAAT MÜHENDİSLİĞİ ANABİLİM DALI
DEPREM VE YAPI MÜHENDİSLİĞİ PROGRAMI**

DANIŞMAN: DOÇ. DR. SEVİLAY DEMİRKESEN ÇAKIR

ŞUBAT 2023



MASTER of SCIENCE JURY APPROVAL FORM

A thesis submitted by G zde ALNIA IK KAHYA defended on 15/02/2024 before the jury formed with the 05/02/2024 date and 2024/10 numbered decision of the GTU Graduate Administration Board, has been accepted as a MASTER of SCIENCE thesis in the Department of Civil Engineering Earthquake and Structural Engineering Program.

JURY

MEMBER

(THESIS ADVISOR) : Do . Dr. Sevilay DEMIRKESEN  AKIR

MEMBER

: Do . Dr. Onur  EKER

MEMBER

: Dr.   r.  yesi Sedat Semih  A LAYAN

APPROVAL

Gebze Technical University Graduate Administration Board
...../...../..... date and/..... numbered decision.

SIGNATURE/SEAL

ABSTRACT

This master's thesis focuses on quality management systems, addressing the implementation of quality management practices in the construction industry. In the introduction section, the background, research problem, research aim and objectives, significance of the study, and scope of the study are detailed. The research methodology is explored, covering data collection, research design, data analysis, and ethical considerations.

The literature review section encompasses concepts related to quality management systems, benefits and barriers of management systems, the ISO 9001 standard, quality management system implementation, total quality management, the PDCA cycle, and quality improvement techniques.

In a section dedicated to quality management in the construction industry, an overview of quality management in construction is presented, along with the adaptation of ISO 9001 in construction.

The comparison of quality management systems section compares traditional systems with Electronic Document Management Systems (EDMS). A detailed analysis of the advantages and disadvantages of a system installed over Google Drive is provided.

The core section titled "A Novel Quality Management System for the Construction Industry" defines a system consisting of components such as processes, forms, lists, schemas, instructions, and appendices.

The case study with examples from system application section illustrates the applicability of the system by detailing SRC.11 and SRC.12 processes.

The findings and discussion section addresses the realization status of the expected advantages from the system, disadvantages expected from the Google Drive system, and unforeseen disadvantages identified during system usage.

The conclusion section summarizes the overall findings of the thesis, provides recommendations, and offers perspectives for future research.

Keywords: Quality, Quality Assurance, Quality Control, Quality Management System (QMS), Project Management, Construction Management.

ÖZET

Bu yüksek lisans tezi, kalite yönetim sistemlerine odaklanarak inşaat endüstrisinde kalite yönetimi uygulamalarının incelenmesini amaçlamaktadır. Giriş bölümünde, arka plan, araştırma problemi, araştırma amaç ve hedefleri, çalışmanın önemi ve kapsamı detaylı bir şekilde ele alınmıştır. Araştırma metodolojisi, veri toplama, araştırma tasarımı, veri analizi ve etik düşünceleri kapsayan unsurları içeren bir şekilde incelenmiştir.

Literatür taraması bölümü, kalite yönetim sistemleri ile ilgili kavramları, yönetim sistemlerinin avantajlarını ve engellerini, ISO 9001 standardını, kalite yönetim sistemlerinin uygulanmasını, toplam kalite yönetimini, PDCA döngüsünü ve kalite iyileştirme tekniklerini içermektedir.

İnşaat endüstrisinde kalite yönetimi bölümünde, inşaat sektöründeki kalite yönetiminin genel bir bakışı sunulmuş ve ISO 9001'in inşaatta uyarlanması ele alınmıştır.

Kalite yönetim sistemlerinin karşılaştırıldığı bölüm, geleneksel sistemleri Elektronik Belge Yönetim Sistemleri (EDMS) ile karşılaştırır. Google Drive üzerinde kurulu bir sistemden beklenen avantajların ve dezavantajların detaylı bir analizi sunulmaktadır.

İnşaat Endüstrisi İçin Yenilikçi Bir Kalite Yönetim Sistemi başlıklı çekirdek bölüm, süreçler, formlar, listeler, şemalar, talimatlar ve ekler gibi bileşenlerden oluşan bir sistem tanımlar.

Sistem uygulamasından örneklerle yapılan vaka çalışması bölümü, SRC.11 ve SRC.12 süreçlerini detaylandırarak sistemin uygulanabilirliğini göstermektedir.

Bulgular ve tartışma bölümü, sistemden beklenen avantajların gerçekleşme durumu, Google Drive sisteminin beklenen dezavantajları ve sistem kullanımı sırasında tespit edilen beklenmeyen dezavantajları ele almaktadır.

Sonuç bölümü, tezin genel bulgularını özetler, öneriler sunar ve gelecekteki araştırmalar için perspektifler sağlar.

Anahtar Kelimeler: Kalite, Kalite Güvencesi, Kalite Kontrolü, Yönetim Sistemi (QMS), Proje Yönetimi, Süreç Yaklaşımı.

ACKNOWLEDGEMENTS

I would like to express my sincere thanks to everyone who supported me in successfully completing this thesis.

I extend my gratitude to my thesis advisor, Associate Professor Sevilay Demirkesen akır, who was with me at every stage of the process with her knowledge and experience. Her patience and guidance provided strength for me to overcome every challenge. I thank her deeply for her support and guidance.

My father, Civil Engineer Osman Alniaık, was my first guide in this profession. My mother, Mediha Alniaık, consistently believed in me and significantly contributed to my determination. My sister, Architect Gamze Alniaık Aksoy, not only provided emotional support but also became an important supporter with her experiences in the field of architecture.

Additionally, my spouse, Civil Engineer Erdi Kahya, supported me throughout the thesis process with his knowledge and expertise. His profound insights and contributions enriched the content of my thesis. The encouragement and guidance provided by all of them played a crucial role in the successful completion of this thesis.

With heartfelt thanks,

Gözde ALNIAIK KAHYA

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LIST OF ABBREVIATIONS

QMS	: Quality Management System.
EDMS	: Electronic Document Management System.
PDCA	: Plan–Do–Check–Act.
QA	: Quality Assurance.
ISO	: International Organization for Standardization.
KPI	: Key Performance Indicators.
TQM	: Total Quality Management.
MR	: Management Review.
NCR	: Non-conformance Report.
METU	: Middle East Technical University.
ITU	: İstanbul Technical University.
GTÜ	: Gebze Technical University.
IMO	: Chamber of Civil Engineers.
SRC	: Processes.
FR	: Form.
SM	: Schema.
TL	: Instructions.
EK	: Appendices.

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1. INTRODUCTION

1.1 Background

Quality management systems (QMS) are critical for companies operating in the construction sector [1],[2].

This system provides a framework and a set of systems that assist an organization in defining its quality objectives, planning its processes to achieve these objectives, implementing these processes, controlling them, and continuously improving them. In the construction sector, given the complexity and variability of projects, establishing, and maintaining an effective quality management system is even more critical [2],[4].

This thesis aims to investigate and compare traditional documentation-based quality management systems with electronically managed quality management systems within the construction industry. The objective is to identify the most suitable quality management system implementation model for companies in this sector.

The construction industry is known for its project-based nature, which often involves extensive documentation and coordination [5],[6]. Traditional quality management systems have historically relied on physical documentation, which can be cumbersome and prone to inefficiencies in this dynamic environment. In contrast, electronic quality management systems offer the potential for real-time data access, collaboration, and streamlined processes.

Through a comparative analysis of these two approaches, this thesis seeks to determine the advantages and disadvantages of each and propose a framework that aligns with the specific needs and challenges of construction projects. The ultimate goal is to provide companies in the construction sector with guidance on adopting the most effective and efficient quality management system model, taking into account their unique requirements and the evolving nature of the industry.

1.2 Research Problem

The research problem revolves around determining the most effective QMS implementation model for companies operating in the construction sector. There exists uncertainty regarding which criteria should be used to understand the differences and advantages between traditional documentation based QMS and electronically managed QMS in the construction industry, and how to develop a framework that better aligns with the complexity of construction projects. Therefore, research is needed to identify and propose the most suitable quality management system approach for firms in the construction sector.

This research problem represents a significant scientific challenge that can assist companies in optimizing their quality management systems in the construction industry. Given the importance of efficiently managing construction projects and maintaining high-quality standards, this topic holds great significance. This thesis aims to examine both traditional documentations based QMS implementation models and electronically managed QMS implementation models, comparing the two approaches and assessing their effectiveness in the construction sector. In this context, the goal is to identify and recommend the most suitable QMS approach that can better align with the specific needs of construction projects and the changing dynamics of the industry.

1.3 Research Aim and Objectives

The main purpose and research topics of this study are summarized as follows.

- To identify the obstacles and challenges encountered during the implementation of QMS in the construction industry and examine strategies for overcoming these obstacles.
- To understand how the ISO 9001 standard is adapted to and implemented within the construction sector.
- To examine exemplary cases of successful QMS implementation in construction companies and analyse the lessons learned from these cases.
- To conduct a comparative analysis between traditional quality management

systems and Electronic Document Management Systems (EDMS) to elucidate their advantages and disadvantages.

- To evaluate the advantages and disadvantages of a document management system implemented on Google Drive.
- To introduce a document management system applied on Google Drive as an alternative to traditional systems and EDMS systems for users.

1.4 Significance of the Study

The significance of this study is emphasized from the following perspectives.

Quality Improvement in the Construction Industry: This thesis holds critical importance in enhancing quality within the construction industry. The evaluation of quality management system implementations in construction projects has the potential to elevate overall quality standards in the industry.

Contribution to the Success of QMS Implementations. The research will contribute to the identification of barriers and the development of strategies to overcome them for the successful implementation of Quality Management Systems. This can aid in more effective management and completion of construction projects.

Adaptation of ISO 9001 Standard in the Construction Sector: Since the study investigates how the ISO 9001 standard is adapted and applied in the construction sector, it can guide professionals seeking to improve quality management practices within this industry.

Informative Comparative Analyses: This thesis, through comparative analyses between traditional quality management systems and EDMS, can guide organizations in making optimal choices regarding their quality management system selections.

Advantages of a Quality Management System Installed on Google Drive. Additionally, this study examines a quality management system installed on platforms like Google Drive, highlighting the advantages it offers. This system combines the benefits of electronic document management with the strengths of traditional systems, providing organizations with a more effective approach to quality management.

Therefore, it is believed that this study contributes significantly to quality management in the construction industry, the implementation of the ISO 9001 standard, and the selection of quality management systems that harness the advantages of both electronic and traditional methods.

1.5 Scope of the Study

This thesis aims to compare the applicability and performance of electronic document management systems and traditional systems in the implementation of quality management systems, identifying their advantages and disadvantages. The objective is to provide companies with a methodology to choose the most suitable quality management system for their structures.

After introducing the system, providing practical examples, and conducting a system evaluation, the aim is to present the quality management system installed on Google Drive as an alternative for companies.

This study is designed to offer guidance to organizations in the selection of quality management systems, enhancing their understanding of the applicability of these systems in different sectors. Additionally, within the scope of this study, a quality management system method prepared via Google Drive will be introduced to combine the advantages of both systems. Examples of the quality management system implementation through Google Drive will be provided, and through these examples, the advantages and disadvantages of this system will be examined and compared with the other two systems.

1.6 Research Methodology

This section outlines the methodology employed in conducting the research, including data collection, analysis, and evaluation processes. The research methodology is structured to address the research objectives and to provide a comprehensive understanding of the topic. The research methods used in the subsections of the **Figure 1.1** are explained in detail.

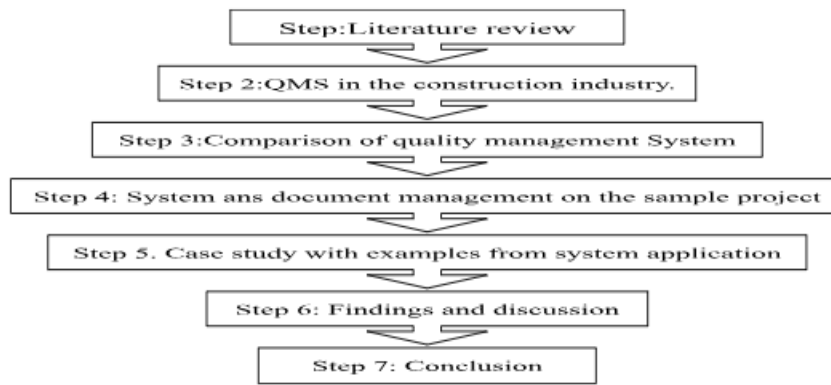


Figure 1.1: Thesis structure flowchart.

Step 1: Literature Review

2.1 Concepts Related to Quality Management System: This section delves into the fundamental concepts associated with quality management systems.

2.2 Benefits and Barriers of Management System: The advantages of quality management systems have been elaborated, and the barriers encountered in establishing management systems have been discussed.

2.3 ISO 9001 Standard: It explores the ISO 9001 standard in detail, covering its scope, normative references, terms, definitions, and key elements such as context of organization, leadership, planning, support, operation, performance evaluation, and improvement.

2.4 Quality Management System Implementation: This part discusses various aspects of quality management system implementation.

2.5 Total Quality Management: Explores the principles and practices of Total Quality Management (TQM).

2.6 PDCA Cycle: Examines the Plan-Do-Check-Act (PDCA) cycle as a systematic approach to continuous improvement.

2.7 Quality Improvement Techniques: Introduces various techniques employed for enhancing quality within an organizational context.

Step 2: QMS in the Construction Industry.

3.1 Overview of Quality Management in Construction: It provides an overview of quality management practices specifically in the construction industry.

3.2 Adaptation of ISO 9001 in Construction: This section examines how ISO 9001 is adapted and applied within the construction sector.

Step 3: Comparison of Quality Management Systems

4.1 Traditional Systems: Examines traditional quality management systems.

4.2 EDMS Systems: Introduces Electronic Document Management Systems (EDMS) and includes market analysis.

4.3 Comparison of Traditional System and EDMS: Compares the traditional system with Electronic Document Management Systems.

4.4 In a System Installed Over Google Drive: This section focuses on a quality management system installed on Google Drive, outlining its expected advantages and disadvantages.

Step 4: A Nover Quality Management System for the Construction Industry

It categorizes various document types, including processes, forms, lists, schemas, instructions, and appendices.

Step 5: Case Study With Examples From System Application

6.1 SRC.11 Project Planning Process

Provides a case study on the Project Planning Process within the proposed system.

6.2 SRC.12 Project Management Process

Offers a case study on the Project Management Process with specific document examples.

Step 6: Findings and Discussion

7.1 Examining the realization status of the expected advantages: This section evaluates the extent to which the expected advantages of the system have been realized.

7.2 Disadvantages Expected from Google Drive System: It discusses the anticipated disadvantages of the Google Drive-based system.

7.3 Additionally, the Disadvantages that were not Foreseen: This part highlights any disadvantages that were not initially anticipated but were identified during the usage of the system.

Step 7: Conclusion

This thesis structure provides a comprehensive framework for understanding and evaluating the various aspects of quality management systems in the context of the construction industry and Google Drive-based implementations.

1.6.1 Data Collection

The data collection process involved gathering information from various sources, including literature reviews, case studies, and practical observations. Primary data was collected through interviews conducted within construction companies and organizations that have implemented QMS, as well as from samples taken from these companies' systems. Secondary data was obtained from relevant academic literature and industry reports.

1.6.2 Research Design

The research design is primarily exploratory and descriptive, aiming to analyse the current state of Quality Management Systems in the construction industry and compare traditional systems with EDMS. Case studies were utilized to examine real-world implementations of QMS in construction companies.

1.6.3 Data Analysis

Data analysis included the qualitative and quantitative assessment of collected data. Qualitative analysis focused on identifying the obstacles and benefits related to the implementation of QMS, while quantitative analysis encompassed records regarding the system's implementation.

A comparative analysis was conducted to evaluate the advantages and disadvantages of traditional QMS, EDMS, and a system installed over Google Drive. This analysis aimed to provide insights into the suitability of each system for quality management in the construction industry.

1.6.4 Ethical Considerations

Ethical considerations were taken into account throughout the research process, ensuring the confidentiality and anonymity of participants in interviews and surveys. All data collection and analysis adhered to ethical research guidelines and principles.



2. LITERATURE REVIEW

In this section, the aim is to provide sufficient knowledge and understanding of concepts such as quality, quality management systems, quality management systems in construction projects, before comparing EDMS and traditional documentation systems to offer the most suitable solution to companies. The goal is to ensure that the thesis is appropriately guided on these subjects before presenting the most appropriate solution to companies by exploring these concepts.

The subheadings provided below have been researched and examined to serve as sources for the thesis and to provide guiding relevance for the thesis.

2.1 Concepts Related to Quality Management System

While quality is an abstract concept without a clear definition, we can say, based on standards, that for quality, "Quality is the degree to which a set of inherent characteristics of an object fulfils requirements."

If we need to provide a more concrete example, we can say that quality, based on the efforts of accomplished leaders, can be achieved through the approaches outlined below.

- Excellence. (Tuchman, 1980).
- Value. (Feigenbaum, 1951).
- Conformance to specifications (Shewhart, 1931; Levitt, 1972).
- Conformance to requirements. (Crosby, 1979).
- Fitness for use. (Juran, 1974; 1988).
- Meeting desired product characteristics. (Leffler, 1982).
- Loss prevention. (Taguchi, 1987).
- Meeting customer expectations (Ryall and Kruithof, 2001; ISO 9000, 2005).

Are some of the approaches to achieving quality based on the work of accomplished leaders [3].

Understanding and implementing quality requires knowledge of the concepts that constitute quality. **Table 2.1** fundamental concepts that form quality are discussed.

Table 2.1: Fundamental concepts constituting quality.

Assurance	Assurance is a positive declaration on a product or service. And by defining the expectations and requirements about that product or service in advance, provides a guarantee which would work without any problem according to expectations and requirements [2]-[10].
Quality Assurance (QA)	Quality Assurance is also known as QA Testing . QA is defined as an activity to ensure that an organization is providing the best product or service to the customers [2]-[10]. Quality assurance is not concerned with the outcome of the product or service. It deals with the production stage and the impact of the management details that affect the production stage on the product or service [2]-[10].
Quality Control	Quality Control determines whether a product or service complies with the specified standards by examining the outcome of a process. A reliable quality control system will prevent products or services that do not meet the required standards from reaching the end of the production process or being delivered to customers [2]-[10].
Customer Satisfaction	The measure of how well a product or service meets or exceeds customer needs and expectations [2]-[10].
Quality Policy	A documented statement of an organization's commitment to quality and its intentions regarding quality objectives [2]-[10].
Quality Objectives	Specific, measurable goals that an organization sets to achieve within its QMS, often aligned with its quality policy [2]-[10].
Process Approach	Viewing the organization as a set of interconnected processes and managing them systematically to achieve desired outcomes [2]-[10].
Continuous Improvement	The ongoing effort to enhance products, services, processes, and the QMS itself to achieve better results and increased efficiency [2]-[10].
Risk-Based Thinking	Identifying, assessing, and managing risks that could impact the achievement of quality objectives and customer satisfaction [5]-[12].

Table 2.1 continue: Fundamental concepts constituting quality.

Documentation	The creation, management, and control of documents and records to ensure that processes are well-documented, standardized, and traceable [2]-[10].
Performance Measurement	The systematic collection and analysis of data to evaluate the performance of processes and the overall QMS, often using key performance indicators (KPIs) [5]-[12].
Supplier Management	Evaluating and managing the performance of suppliers and ensuring the quality of materials and components used in production [5]-[12].
Audit and Review	Conducting internal and external audits to assess compliance with the QMS and identify opportunities for improvement [5]-[12].
Employee Competence	Ensuring that employees have the necessary skills and training to perform their roles effectively and contribute to quality improvement [5]-[12].

2.2 Benefits and Barriers of Management System

Quality management systems are essential tools used by organizations to improve the quality of their products and services, ensure customer satisfaction, and promote continuous improvement. However, during the establishment of quality management systems, certain barriers may be encountered. These barriers include ensuring adequate resources, overcoming staff resistance, addressing change management challenges, implementing complex processes, and sustaining continuous improvement efforts. Overcoming these challenges requires a strategic approach involving careful planning, effective leadership, and staff participation. Successfully navigating these obstacles can help an organization evolve into a more effective, efficient, and customer-centric entity [5], [9]-[15].

Table 2.2 Discusses the advantages of quality management systems and the challenges encountered during the installation of management systems.

Table 2.2: Benefits and barriers of management system.

Benefits of QMS	Barriers of QMS
Improved Product and Service Quality: A QMS helps organizations maintain consistent quality standards, leading to better products and services. This, in turn, enhances customer satisfaction and loyalty [5], [9]-[16].	Lack of Leadership Commitment: If top management does not prioritize or demonstrate sufficient commitment to quality, the successful implementation of a QMS can be challenging [5], [9]-[16].
Increased Efficiency: By defining and streamlining processes, a QMS can improve efficiency and reduce waste. This can result in cost savings and increased profitability [6], [9]-[16].	Employee Resistance: Employees may resist new procedures and changes associated with the QMS, making implementation difficult [5], [9]-[16].
Customer Satisfaction: Consistent quality and meeting customer requirements boost customer satisfaction, increasing the likelihood of repeat business and referrals [9]-[16].	Insufficient Resources: Inadequate budget, staff, or technology resources can hinder the effective implementation of a QMS [9]-[16].
Compliance with Standards and Regulations: Many industries have specific quality standards and regulations that must be met. Implementing a QMS can help ensure compliance with these standards, reducing the risk of fines and legal issues [9]-[16].	Lack of Training and Awareness: Insufficient training or awareness among employees about the requirements and purpose of the QMS can impact successful implementation [9]-[16].
Risk Management: QMS includes risk assessment and mitigation processes. Identifying and addressing risks early can prevent quality issues and reduce the likelihood of costly recalls or product failures [5], [9]-[16].	Documentation Complexity: Overly complex or unnecessary documentation processes can disrupt employees and management and reduce the effectiveness of the QMS [5], [9]-[16].

Table 2.2 continue: Benefits and barriers of management system.

Improved Decision-Making: A QMS provides data and metrics that can be used for informed decision-making. This helps organizations identify areas for improvement and make strategic choices [9]-[16].	Inadequate Monitoring and Measurement: Using insufficient or inappropriate metrics and performance indicators to monitor quality can make it difficult to understand the effectiveness of the process [9]-[16].
Employee Engagement: Clearly defined processes and responsibilities can improve employee understanding of their roles and contributions. Engaged employees are more likely to take ownership of quality [9]-[16].	Poorly Defined Processes: Poorly defined or unorganized business processes can negatively affect the establishment and maintenance of quality processes [9]-[16].
Competitive Advantage: Organizations with a strong commitment to quality often gain a competitive edge in the market. Quality products and services can set a company apart from competitors [9]-[16].	Technical Issues: Technical infrastructure problems or software issues can hinder the efficient use of the QMS [9]-[16].
Continuous Improvement: QMS promotes a culture of continuous improvement, with regular monitoring and assessment of processes. This leads to ongoing refinements and optimizations [9]-[16].	Lack of Employee Engagement: Failure to involve employees in the development or improvement of the QMS can jeopardize its success [9]-[16].
Traceability and Accountability: QMS provides traceability, ensuring that processes and products can be tracked back to their source. This fosters accountability and transparency [9]-[16].	Culture That Doesn't Prioritize Quality: If the organizational culture does not promote quality or continuous improvement, it can make QMS implementation challenging [9]-[16].
Customer Trust: As organizations consistently meet or exceed customer expectations, trust in the brand grows. Trust is a valuable asset that can lead to long-term customer relationships [9]-[16].	Lack of Continuous Improvement: An approach that does not encourage continuous improvement of quality can limit the effectiveness of the QMS [9]-[16].
Global Expansion: For organizations looking to expand globally, a QMS can help ensure consistent quality across different locations and markets [9]-[16].	Communication Gaps: Lack of effective communication can hinder understanding and implementation of quality objectives and requirements among employees [9]-[16].

Table 2.2 continue: Benefits and barriers of management system.

Supplier Relationships: A QMS can improve relationships with suppliers by setting clear quality expectations and standards. This can lead to better cooperation and more reliable supply chains [9]-[16].	External Factors: External factors such as economic, political, or market conditions can influence QMS implementation [9]-[16].
Reduced Costs: By minimizing defects and rework, a QMS can lead to cost reductions. Additionally, it can help avoid costly quality-related issues down the line [9]-[16].	Non-Compliance with Regulations: Difficulty in complying with relevant regulations can hinder the successful implementation of a QMS [9]-[16].
Sustainability: Some QMS frameworks incorporate sustainability principles, helping organizations reduce their environmental impact and contribute to a more sustainable future [9]-[16].	Using the Management System Solely for Documentation: Using the QMS solely for documentation or compliance purposes without seeking real-world process improvements can result in limited benefits [9]-[16].

These factors can impact the implementation of a Quality Management System, and recognizing and overcoming these barriers is essential for successful implementation.

2.3 ISO 9001 Standard

ISO 9001 is an international standard for QMS. The content of ISO 9001 the latest version of the standard, is organized into several sections, each addressing specific aspects of quality management. **Table 2.3** have an overview of the main content of ISO 9001 Standard.

Table 2.3: Main content of ISO 9001 Standard.

Scope	Defines the organization's business processes and the implemented quality management system [26]-[29].
Normative References	Lists reference documents essential for understanding and implementing the ISO 9001 standard [26]-[29].
Terms and Definitions	Provides definitions of terms and concepts used throughout the standard [26]-[29].

Table 2.3 continue: Main content of ISO 9001 Standard.

Context of Organization	Evaluates factors that influence the design of the quality management system by determining the internal and external context of the organization [26]-[29].
Leadership	Defines the leadership requirements for the quality management system and related responsibilities [26]-[29].
Planning	Covers topics such as setting quality objectives, process-based planning, and risk management [26]-[29].
Support	Addresses the management of resources, competencies in human resources, infrastructure, and information [26]-[29].
Operation	Covers operational processes, the planning and control of products and services, among other topics [26]-[29].
Performance Evaluation	Includes the evaluation of the performance of the QMS, audit results, customer satisfaction, and process performance [26]-[29].
Improvement	Encompasses continuous improvement, corrective and preventive actions, and aims to correct nonconformities and prevent their recurrence [26]-[29].

2.4 Quality Management System Implementation

QMS are a structured approach and set of processes that organizations use to enhance the quality of their products or services, ensure customer satisfaction, and continuously improve their operations. One of the most commonly used QMS standards is ISO.

QMS's are frameworks that organizations put in place to manage and control the quality of their processes, products, and services. They provide a systematic and structured way to identify, document, and address quality-related issues and challenges within an organization. **Table 2.4** have an overview of the quality management system key steps.

Table 2.4: Implementing a quality management system key step.

Leadership and Commitment	Top management demonstrates a strong commitment to quality, setting the tone for the organization's commitment to a QMS [8]-[16].
Risk Assessment	Internal and external risks that could impact the achievement of quality objectives are identified and evaluated. Plans are developed to mitigate these risks [8]-[16].
Process Identification	Document all key processes within the organization, including inputs, outputs, and responsibilities [8]-[16].
Training and Awareness	Employees are trained on the QMS, quality policies, and procedures [8]-[16].
Monitoring and Measurement	To measure the effectiveness of the QMS, key performance indicators (KPIs) are defined. These KPIs are regularly monitored and measured [8]-[16].
Continuous Improvement	Performance data is continuously reviewed and analysed to identify improvement opportunities. Corrective actions and preventive measures are implemented when necessary [5],[8]-[16].
Customer Satisfaction	Customer feedback is collected and used to improve products or services [6],[8]-[16].
Internal Auditing	Regular internal audits are conducted to ensure compliance with the QMS and identify improvement areas [8]-[16].
Management Review	The QMS is periodically reviewed to assess its ongoing compliance, adequacy, and effectiveness, and continuous improvement opportunities are evaluated [8]-[16].
Documentation and Records	These are all the documents used to implement the QMS. Processes, forms, policies, instructions, etc. All forms within the scope of the QMS are included [8]-[16].
Certification	Organizations apply to authorized bodies to validate the effectiveness of their quality management systems, and when their competence is confirmed, they become eligible to receive a certificate [8]-[16].

Implementing a QMS can be a complex and ongoing process that requires dedication and commitment from all levels of the organization. It aims to create a culture of

quality and continuous improvement, ultimately leading to increased customer satisfaction and business success.

Compliance with quality management systems requires the adoption of certain key features and it is essential for personnel to understand and implement these features.

Table 2.5 have an overview of key features of quality management systems.

Table 2.5: Key features of quality management systems.

Compliance with Quality Standards	QMS ensures compliance with specific quality standards, typically international standards like ISO 9001, to ensure that product and service quality is maintained at a specified level [5],[8]-[10].
Continuous Improvement	QMS aims to continuously improve quality by regularly reviewing processes and identifying improvement opportunities [5],[8]-[10].
Documentation and Record-Keeping	QMS includes documentation of processes and the maintenance of critical records, allowing the organization to monitor, audit, and take corrective actions when necessary [5],[8]-[10].
Process Focus:	QMS promotes a process-oriented approach to understanding and improving operations. Each process is managed with defined objectives, inputs, and outputs [5],[8]-[10].
Customer Focus:	QMS prioritize enhancing customer satisfaction by understanding and meeting customer requirements [5],[8]-[10].
Prevention of Issues and Corrective Action:	QMS encourages the prevention of errors and the early detection of potential issues. This helps reduce costs and increase customer satisfaction [5],[8]-[10].
Management Involvement:	Successful implementation of QMS requires support and leadership from top management [5],[8]-[10].

2.5 Total Quality Management

Total Quality Management (TQM) is a management approach based on the philosophy of continuously improving business processes and maximizing quality. TQM emphasizes a focus on quality at every level of an organization and encourages all employees to contribute to efforts to ensure and enhance quality. The primary goals are to increase customer satisfaction, improve efficiency, and gain a competitive advantage. TQM is founded on principles such as continuous improvement, customer focus, leadership, and collaboration and can be applied to all of an organization's business processes [4],[6],[9].

Analysing the three words, we have.

- Total—Made up of the whole.
- Quality—Degree of excellence a product or service provides.
- Management—Act, art, or manner of handling, controlling, directing, etc” [4].

The content is described in **Figure 3.1**.



Figure 2.1: Total quality management system approach.

A Quality Management System does not require Total Quality Management, but it is an applicable approach.

In terms of principles such as Quality Focus, Continuous Improvement, Customer Focus, Leadership and Management Involvement, Data and Analysis, Standards and Process-Based Implementation, Training and Awareness, Corrective and Preventive Actions, quality management systems and total quality management method are similar approaches [5],[8].

While quality management systems are defined as a set of rules primarily under the control of management and the Quality Department, based on the ISO 9001 standard, total quality management is a culture that engages every level of the workforce. To effectively implement quality management systems alongside total quality management, it is essential to integrate quality management systems as a cultural aspect within the organization and establish a system in which employees from all levels actively participate.

2.6 PDCA Cycle

The plan-do-check-act (PDCA) cycle is well-known model for continual improvement. It teaches organizations to plan an action, do it, check results and act on what has been learned. In the following articles and **Figure 2.2**, the plan, do, control and act stages of the pdca cycle will be detailed and what will be done at which stage in this study will be explained in detail [5],[8]-[10].



Figure 2.2: PDCA cycle.

Plan: Planning is one of the most significant aspects of QMS (Quality Management System) and begins with understanding the organization's context and the needs of stakeholders interested in the QMS (4.1 and 4.2), which is then used to define the scope of the QMS and QMS processes (4.3 and 4.4). This is followed by the commitment of

leadership in the company to steer the organization towards a customer-centric approach by defining organizational roles and responsibilities and by establishing a quality policy to give the overall QMS a focus (5.1, 5.2, and 5.3). The next level of planning is to identify and address the risks and opportunities of the QMS, including setting and planning for quality objectives and changes to support continual improvement (6.1, 6.2, and 6.3). The final level of planning is to identify and implement the support structure to allow you to carry out your plans. This includes resources (7.1), identifying competence (7.2), awareness (7.3), communication (7.4), and establishing processes for the creation and control of documented information (7.5).

Do: Planning is useless unless the plan is carried out. Controls need to be identified for the QMS operations, product or service requirements need to be identified (8.2), designs developed (8.3), controls placed on externally provided processes, products and services (8.4). The process of producing the product or service needs to be carried out with control of product and service release (8.5 & 8.6), any non-conforming products or services need to be addressed (8.7). In short, the activities of creating and providing products or services to the customers need to be done.

Check: There are several requirements in the standard to check the processes of the Quality Management system to ensure they are functioning properly as they have been planned. There is a need to monitor, measure, analyse and evaluate the products or services to ensure they meet requirements, the processes used are adequate and effective, and customer satisfaction is being met (9.1). Internal Audit (9.2) of the processes is the keyway to assess the effectiveness of the system. Further is the Management Review process (9.3), which reviews and assesses all of the monitored data to make changes and plans to address the issues.

Act: Action in this case involves the actions needed to address any issues found in the check step. Improvement (10.1 & 10.3) is the overall heading for these action steps (10.1) with the activities of addressing nonconformity and Corrective Actions (10.2) to eliminate the causes of actual or potential nonconformities as the first step in acting to improve the system.

2.7 Quality Improvement Techniques

QMS mainly demands a process of continued improvement aimed at reducing variability. An organization wishing to support and develop such a process needs to use quality management tools and techniques. It is prudent to start with the simpler tools and techniques. These are Check-sheet, Check list, Histogram, Pareto Diagram, Cause-and-Effect Diagram (Fishbone Diagram), Scatter Chart and Flowchart [2],[5],[8],[11],[16].

Check-sheet

A control sheet is used to record events or non-events (non-conformances). For example, it can be used to note if there are any defects or errors in a product's production line. This sheet helps you keep track of when and where each event occurred and can also assist in identifying the reasons behind these events. It makes it easier to detect and solve quality issues.

Control sheets are usually prepared in advance, and the people performing the operations or monitoring progress fill them out. This ensures that the work is done in an organized and systematic manner. Most importantly, the value of a control sheet lies in retrospective analysis. The data recorded allows you to review past issues and prevent future errors. Therefore, it plays a crucial role in quality control and continuous improvement processes [2],[5],[8],[11],[16].

Checklist

Checklist is a tool used to organize and facilitate the process of performing or tracking specific tasks, steps, or checks. This list serves as a reminder to users of what needs to be done, making tasks more organized and comprehensive. Checklists find applications in various fields, including quality control, process tracking, error reduction, and process improvement. They help users avoid skipping any steps or tasks and can enhance efficiency [2],[5],[8],[11],[16].

Pareto Analysis

Pareto Analysis is a management tool used by organizations to identify and prioritize problems or areas of concern. Its primary aim is to assist organizations in focusing their attention and resources on the most significant issues. Here are the key components of Pareto Analysis [2],[5],[8],[11],[16].

- Data Collection and Classification: The first step involves identifying and collecting data on the problems or issues faced by the organization. These data are then classified to determine which problems occur most frequently or have the greatest impact [2],[5],[8],[11],[16].
- Creating a Pareto Chart: After classifying the data, a Pareto Chart is created. This chart ranks the problems in order of their magnitude, visually illustrating how significant each problem [2],[5],[8],[11],[16].
- Prioritizing Issues: The Pareto Chart clearly indicates which problems should be addressed as a priority. Typically, based on the "80/20 rule," this analysis identifies approximately 20% of the issues that contribute to about 80% of the total impact. These are the issues that are addressed first [2],[5],[8],[11],[16].
- Solution Focus: Based on the analysis results, organizations concentrate their efforts on solving the most impactful problems. This ensures that resources are used efficiently and enhances the organization's quality and efficiency [2],[5],[8],[11],[16].
- Continuous Improvement: Pareto Analysis is a part of an organization's continuous improvement process. After addressing issues, new data is collected and analysed, allowing for ongoing improvement and better results over time [2],[5],[8],[11],[16].

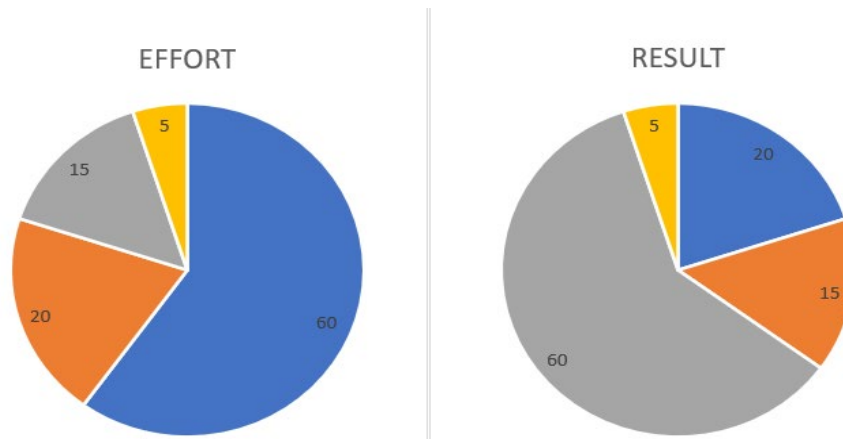


Figure 2.3: Pareto analysis example.

In **Figure 2.3** as an example, it is observed that a business segment where 15% effort is expended contributes to 60% of the outcome. Therefore, this business segment will be prioritized for business development.

In conclusion, Pareto Analysis is a powerful tool used by organizations to identify, prioritize, and address problems effectively. Prioritizing issues helps in the efficient allocation of resources and leads to improvements in quality and efficiency within the organization.

Cause and Effect Diagram (Fishbone Diagram)

Fishbone Diagram, also known as Cause-and-Effect Diagram, is a visual tool used to analyse and understand the root causes and effects of a problem. The name comes from its appearance, which resembles the skeleton of a fish. This diagram is used to gain a better understanding of a problem faced by an organization or a team and to dissect its various components [2],[5],[8],[11],[16].

The key elements of the diagram include:

- Main Problem: The first step is to clearly define the main problem that needs to be resolved. This problem becomes the focal point of the analysis [2],[5],[8],[11],[16].
- Categories: The Fishbone Diagram uses categories or headings to represent major areas of consideration. These categories guide the analysis and typically

include areas such as "People," "Processes," "Materials," "Machines," and "Environment" [2],[5],[8],[11],[16].

- Causes: Under each category, potential causes or factors related to the main problem are listed. These causes represent possible sources or contributors to the problem. [2],[5],[8],[11],[16].
- Root Causes: Causes are further examined in detail, and root causes are investigated. This aims to identify the fundamental sources of the problem [2],[5],[8],[11],[16].
- Visual Representation: The Fishbone Diagram is drawn as a graphical representation, with the main problem at the top and causes connected to categories using branching lines [2],[5],[8],[11],[16].
- Analysis and Solution: Once the Fishbone Diagram is completed, the team or organization evaluates potential causes and root causes. This process aids in developing strategies to address the problem [2],[5],[8],[11],[16].

An example of a fishbone diagram is shared in **Figure 2.4**.

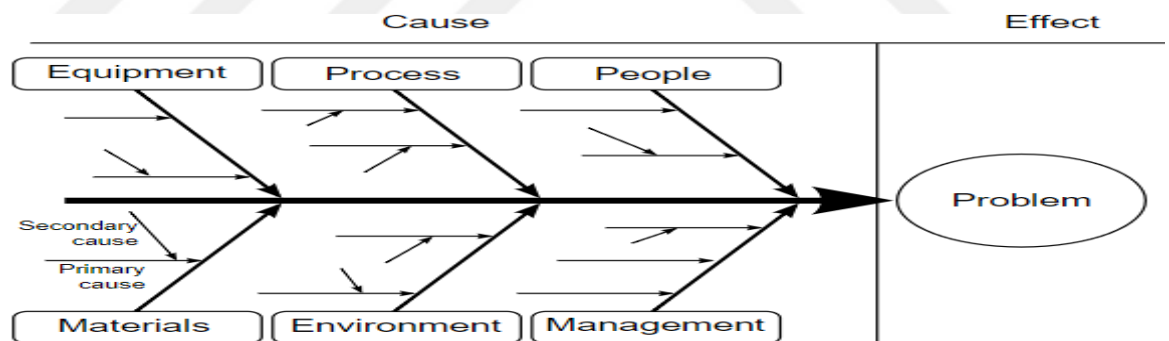


Figure 2.4: Fishbone diagram.

The Fishbone Diagram is a powerful tool for understanding the complexity of problems, identifying root causes, and developing solutions. It is commonly used in various fields, from quality control to continuous improvement initiatives [2],[5],[8],[11],[16].

Scatter Diagram

Scatter diagram is a visual representation method used to examine the relationship between two variables. It has two main components: one variable is represented on the horizontal axis (X-axis), and the other variable is represented on the vertical axis (Y-axis). Each data point is depicted on the graph with its corresponding values on the axes. A scatter diagram helps us visually understand the relationship between variables, especially whether this relationship is linear. These diagrams quickly identify data patterns, correlations, and outliers, making them useful for decision-making and predictions [2],[5],[8],[11],[16]. An example of a scatter diagram shared in **Figure 2.5**.

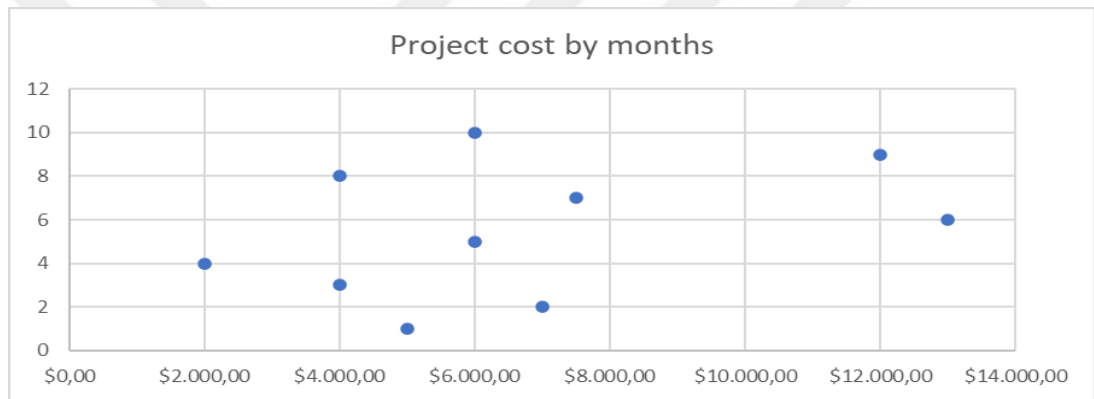


Figure 2.5: Scatter diagram.

Flowcharts

A flowchart used in quality management systems is a diagram employed to depict a specific process or workflow within a business or organization. This diagram represents the steps, sequence, and relationships of the process using a set of symbols and arrows [5],[9].

The key components include:

- **Symbols:** Flowcharts utilize various symbols to represent different processes and steps. For instance, rectangles denote process steps, oval symbols signify the start or end points, and arrows illustrate the flow between steps [2],[5],[8],[11],[16].

- Process Steps: The diagram provides a detailed representation of the steps within a particular process or workflow. The sequence of these steps and how they are interconnected are clearly defined [2],[5],[8],[11],[16].
- Start and End Points: Oval symbols indicate where the workflow begins and ends, specifying where the process initiates and concludes [2],[5],[8],[11],[16].
- Arrows and Relationships: Arrows are used to illustrate the relationships and flow between the steps. They indicate the sequence and how processes are connected [2],[5],[8],[11],[16].
- Data and Decision Points: Some flowcharts employ specialized symbols to denote data input or decision points at specific steps [2],[5],[8],[11],[16].

Flowcharts visually represent a business process, aiding in its understanding, analysis, and improvement. In the context of quality management systems, these flowcharts help organizations enhance the efficiency and quality of their processes.

Statistical analysis

Statistical analysis is a tool used in quality management systems, and it benefits businesses in the following ways [2],[5],[8],[11],[16].

- Data collection and organization: Businesses collect and organize data related to product quality, process performance, and other factors [2],[5],[8],[11],[16].
- Application of statistical methods: These methods are used to examine and understand the data. For example, methods like mean, standard deviation, and regression analysis can be used to understand the data [2],[5],[8],[11],[16].
- Problem detection: Statistical analysis helps in identifying issues within processes. Abnormal data points or deviations may indicate the presence of problems [2],[5],[8],[11],[16].
- Improvement opportunities: Once problems are identified, businesses can investigate the root causes and find opportunities for process improvement [2],[5],[8],[11],[16].
- Quality control and improvement: Statistical analysis is used for controlling product quality and continuously improving processes [2],[5],[8],[11],[16].

- Data presentation and reporting: Statistical results are presented in an understandable manner to stakeholders and decision-makers [2],[5],[8],[11],[16].

In summary, statistical analysis is an important tool that helps businesses understand data, identify issues, improve processes, and control quality within the framework of quality management systems.

Pilot survey

Pilot survey is a preliminary test or pilot study in which a specific section of a new quality management system or the proposed changes are tested on a small sample before initiating the full-scale implementation. The primary purpose of this technique is to identify and address potential issues before the system is fully implemented. [2],[5],[8],[11],[16].

3. QMS IN THE CONSTRUCTION INDUSTRY

3.1 Overview of Quality Management in Construction

The successful implementation of a QMS involves a meticulously planned and executed process at every stage. Under this heading, we will examine the fundamental steps of QMS implementation: “System Preparation,” “Certification,” “System Maintenance,” and “Continuous Improvement.” These steps constitute the central principles of quality management in the construction industry [5]-[7].

System Preparation

To implement a QMS successfully, fundamental steps must be taken within the organization. At this stage, a team or responsible individuals from within the organization should be appointed. This team or individuals will oversee and guide the implementation of the QMS. It is essential to organize processes, define responsibilities clearly, and establish quality control procedures. Quality policies and objectives are also determined at this stage, and the organization’s commitment to the QMS is established [5]-[7].

Certification

Certification involves the evaluation and approval of the QMS by an independent organization. Selecting the right certification authority is of paramount importance for establishing and maintaining the QMS. Obtaining certification from a recognized certification body can enhance the credibility of the company’s quality processes and provide a competitive advantage. The certification process typically includes documenting compliance with quality standards [5]-[7].

System Maintenance

After the QMS is established, ensuring its effective operation is critical. At this stage, the system is regularly reviewed and improved. Audits and inspections are utilized to assess the system’s performance and compliance. Feedback is considered to identify areas for improvement and to maintain continuous compliance with quality standards [5]-[7].

Continuous Improvement

Focusing on continuous improvement is project success of a QMS. Feedback from customers and internal stakeholders contributes to the enhancement of processes and products. This feedback is used to rectify errors, enhance efficiency, and surpass quality standards.

In summary, the successful implementation of a quality management system in the construction industry requires careful planning, adherence to quality standards, effective communication among stakeholders, and a commitment to continuous improvement. Meeting customer needs and delivering quality products are central objectives in the construction sector. Quality management in the construction industry aims to effectively identify customer needs and provide cost-effective solutions, such as buildings, facilities, or structures. This necessitates the successful implementation of a QMS [5]-[7].

3.2 Adaptation of ISO 9001 in Construction

In construction projects, there are three distinct roles customer, designer, and contractor. During the design phase, the designer plans according to the customer's needs. The contractor then implements these plans. After the Project is completed, the customer takes over the building and becomes responsible for its use and maintenance [6],[9],[10]. The roles and responsibilities in the construction project are described in Figure 3.1.

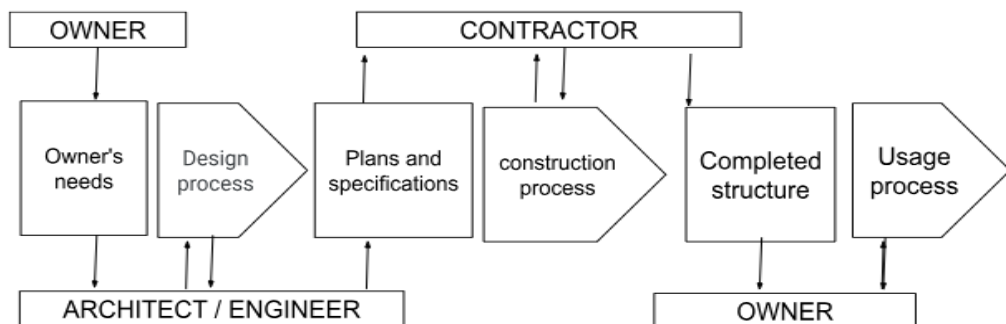


Figure 3.1: A Typical construction project flow diagram [5].

In the construction industry, the product is the structure. The concept of quality construction can be obtained by examining these 8 dimensions defined by Garvin for quality: Performance, Features, Reliability, Conformance, Durability, Serviceability, Aesthetic, Perceived Quality.

Performance

This dimension primarily concerns the question, "Does the construction work satisfy the client-specified performance standards; does it meet the aesthetic and quality specified in the Design and Contract?" [5],[8],[10],[17].

Features

Companies must describe the performance characteristics and features explicitly and the intended processes to achieve high quality in implementing their projects. Furthermore, for many clients, better quality is less about the availability of specific features and more about the overall aesthetic appearance of the building [5],[8],[10],[17].

Reliability

Reliability is inextricably linked to performance and is a significant driver of a company's image and organizational reputation. The underlying question remains, "Will companies continue to meet standard quality specifications?" This dimension represents the likelihood of a product or service failure or degradation of the technology over a specific period. The mean time to the first failure, the time between failures, and the failure rate per unit time are among the most frequently used dependability metrics." Additionally, clients want reliability more as mechanical problems and management costs increase [5],[8],[10],[17].

Conformance

Garvin defines quality conformance as the degree to which a product's design and operating characteristics meet established standards. The central question under this dimension is, "Does the construction work conform to the design specifications in the design and contract model?" When the workmanship quality meets the specified performance specifications, it is said to have conformed with the quality standards set in the design model [5],[8],[10],[17].

Durability

Garvin defined durability as “The lifespan of a product,” which has economic and technological implications. Durability is a technical term that measures the duration of use that a thing may withstand before deteriorating. Clients often evaluate the anticipated operating and maintenance costs against the initial investment cost in economic terms and personal discomfort. Thus, this dimension covers the critical question of how long the building can withstand the adverse effect of weather and other environmental hazards. As a result, it is intertwined with the principle of contractual terms. More significantly, clients frequently incorporate quality durability criteria in procurement contracts. Garvin states that “the durability dimension has two direct implications. Firstly, it implies that “durability and reliability” are inextricably related. Second, it implies that details relating to durability must be evaluated critically through new technological tools like BIM. The quality of workmanship can be improved by using more quality materials. [5],[8],[10],[17].

Serviceability

This dimension is concerned with the serviceability and maintainability of the building. According to Garvin and Kenyon, “Clients are worried not just about the issues of rework, defects, but also about the quality of workmanship, the regularity of future maintenance work and other quality issues. The quality of construction projects significantly impacts the economy, the environment, and the public’s safety [5],[8],[10],[17].

Aesthetics

This dimension, which refers to the final appearance of the building, is centred on the viewer’s opinion of whether the building is precisely the same as in the design model and pertains to the structure’s construction precision. Additionally, it is concerned with the aesthetic qualities of the building and its relationship to the company’s overall corporate image and quality adherence reputation. Thus, this is one of the primaries focuses of this research. Clients here are more concerned with the extent to which the physical aesthetics conforms to the design model and the overall appearance of the building [5],[8],[10],[17].

Perceived Quality

Perceived service quality evaluation is done at the end of the project to rate the client's satisfaction. The perceived quality is obtained from customer satisfaction feedback based on the quality inspector's evaluation after completing the project. Garvin succinctly summarizes the link between reputation and perceived quality when he states, "Reputation is the primary stuff of perceived quality." More precisely, reputation relates to how the quality of service is perceived. Its strength stems from an implicit "analogy: that the quality of products today was like yesterday's products, or the quality of goods in a new product line is similar to the quality of a company's established products. "Thus, the basic premise remains that perception is reality. Using high-quality materials in construction work is not just the element that impacts the overall quality reputation of the construction project. Because a project may be labelled low-quality due to poor workmanship or poor construction service even though the materials used are qualitative. If the building is not correctly constructed and fails to meet the aesthetic appearance, the failure is frequently attributed to service quality rather than material quality. Therefore, quality should be embedded in the construction process, decision-making, design, maintenance, and operation." [5],[8],[10],[17].

4. COMPARISON OF QUALITY MANAGEMENT SYSTEMS

Management systems have been preferred by companies for many years to carry out their operations in an organized manner in accordance with established standards. This is especially crucial in today's business environment, where [4]-[12].

- Maintaining business integrity while managing large teams is a challenge.
- Ensuring maximum time savings is imperative due to the competitive market.
- Preventing the cost of prolonged or repetitive work resulting from a lack of systematization is essential for many companies.

For large-scale companies, management systems have become a necessity in the competitive market. Even small and medium-sized companies are opting for management systems because of the advantages that systematic management offers, enhancing their reputation in the market [4]-[12].

Systems where all documents are manually prepared, controlled, and archived without the use of computer technology can be considered the most primitive form of quality management systems. Today, computer systems have advanced to the point where even the smallest businesses can utilize them. This means that encountering entirely manual systems is rare, except in extreme cases.

Effective document management is crucial for an efficient quality management system. Today's document systems can be categorized into traditional systems and EDMS systems.

4.1 Traditional Systems

In systems that we can define as traditional systems, companies transfer manually filled documents to simple files prepared in the computer environment with Word Programs.

There is no management system software infrastructure. Data collected manually is processed and stored in data sources, typically located on local servers or in public areas. The results of the processed data are gathered, and a plan for improving the quality management system is developed through necessary evaluations.[18]-[20].

4.2 EDMS Systems

The concept of EDMS (Electronic Document management System) refers to commercial software that encompasses all business units (sales, after-sales service, maintenance, repair, design, human resources, etc.) across all sectors. It ensures that processes and units operate in harmony with each other and facilitates the integration of all ongoing information flow within companies. In addition to all of these functions, EDMS Systems eliminate manual processes and enable automation [9]-[12].

EDMS systems compile a comprehensive dataset from processed data, customize it to meet business needs, and facilitate the generation of necessary reports. In EDRMS systems, data collection and evaluation are automated through software-based systems. Users log in with a username and password to access profiles specifically defined for them and perform data processing and display operations within the program. Furthermore, the required data evaluation criteria are incorporated into the programs using company-specific formulas, and data evaluation is carried out through the program.

4.2.1 EDMS Market Analysis

Firms operating in various sectors, including trade, industry, and services, are increasingly turning to EDMS systems with the aim of utilizing information systems more effectively and adding value to their operations. The adoption of EDMS applications in Turkey has gained significant momentum, especially in the last decade. Until recently, information systems were primarily employed by large-scale enterprises in our country. However, more recently, it has become evident that even SMEs (Small and Medium-sized Enterprises) are embracing information systems. This shift can be attributed to increased global competition and its impact on the domestic market. [18]-[25].

Some of the manufacturers offering corporate software solutions through EDMS packages include SAP, Oracle, PeopleSoft, IAS, Logo, Netsis, IFS, and Uyumsoft [18]-[25].

4.2.2 The Basic Features EDMS

Below table has been prepared to describe the key features of EDMS.

Table 4.1: The basic features of electronic document management systems.

Document Storage and Organization	EDMS provides a central platform to store and organize electronic documents. You can categorize, label, and archive documents [18]-[25].
Document Scanner	It offers the capability to scan physical documents and convert them into electronic formats. [18]-[25].
Access Control	It can limit access to documents and control who can share them, specifying permissions for individual users or groups [18]-[25].
Document Search	Provides the ability to search documents by attributes such as keywords, dates, Decals, etc. [18]-[25].
Version Control	Manages document versions, enabling tracking and rollback of each update [18]-[25].
Document Sharing	Facilitates document sharing and collaboration, allowing you share and edit documents with permissions [18]-[25].
Security	Ensures document security through encryption, authentication, and other security measures [18]-[25].
Workflow Management	Automates document workflows, tracks approval processes, and manages document movements [18]-[25].
Reporting and Analysis	Allows for report generation and data analysis related to documents, enhancing process understanding [18]-[25].

EDMS helps improve businesses' document management processes, ensuring organized and secure data storage, and facilitating collaboration. The features and capabilities of EDMS may vary depending on the specific needs and scale of your business.

4.3 Comparison of Traditional System and EDMS

As can be seen, the advantages of traditional systems such as budget and ease of understanding are disadvantages for EDMS Systems, while the systemic integrity, online data recording, ease of connection etc. provided by EDMS systems are the advantages of EDMS Systems, while they remain disadvantages for primitive systems.

On **Table 4.2** aim of this study is to establish a system that combines the advantages of traditional systems and EDMS systems and at the same time eliminates the disadvantages, is affordable, easy to implement and at the same time offers online data recording, integrity is ensured, and connections are defined.

Table 4.2: Comparison of traditional system and EDMS.

Traditional Systems	EDMS Systems
Traditional System Advantages	EDMS Systems Disadvantages;
Cost-Effective: Manually implemented quality management systems are often less costly than automated systems. Equipment and training expenses can be lower [18]-[25].	Initial Costs: Implementing an Electronic Document Management System can involve significant upfront costs for software, hardware, and training [18]-[25].
Simplicity: Manual systems do not require complex software or technology. This can be particularly attractive to small businesses [18]-[25].	Learning Curve: Employees may need time to adapt to the new system, potentially impacting productivity during the transition period [18]-[25].
Flexibility: Manual systems can easily adapt to the specific needs of a business. Creating customized workflows and procedures is more straightforward [18]-[25].	Customization Complexity: Customizing an EDMS to fit specific organizational needs can be complex and time-consuming [18]-[25].

Table 4.2 continue: Comparison of traditional system and EDMS.

Training and Awareness: Manual systems help employees gain a better understanding of document management and quality procedures. This encourages staff training and participation [18]-[25].	Training and Awareness: EDMS [Electronic Document Management System) does not provide an infrastructure for employees to directly create documents or improve processes. Employees are in a user rather than a developer role, which can be a disadvantage in terms of training and participation [18]-[25].
Technology Independence: Manual systems are not affected System crash or system outage. They are advantageous for ensuring continuity [18]-[25].	Dependence on Technology: EDMS relies on technology, making it vulnerable to technological failures like power outages or software crashes [18]-[25].
Internet independence: Not affected by internet disruptions or offline environments [18]-[25].	Limited Access without Internet: Access to electronic documents may be restricted without an internet connection, which can be inconvenient in remote or offline situations [18]-[25].
Independence from cyber threats: Cyber threats are not a concern as there is no electronic environment or internet involved [18]-[25].	Security Concerns: Electronic documents are vulnerable to cyber threats and data breaches, requiring robust cybersecurity measures [18]-[25].
Independence from vendors: The organization can operate its system independently from external vendors as it is not required to purchase any programs or services [18]-[25].	Dependence on Vendor: Organizations rely on the EDMS vendor for ongoing support, updates, and maintenance [18]-[25].
	Privacy and Compliance: Compliance with data privacy regulations is critical, and EDMS systems must ensure data protection and compliance, which can be challenging [18]-[25].
Integration Ease: Being on paper removes electronic constraints, providing an advantage in integrating new processes [18]-[25].	Integration Challenges: Integrating EDMS with existing systems can be challenging, potentially leading to compatibility issues [18]-[25].
	Data Migration: Transferring existing manual records to an EDMS can be a cumbersome process [18]-[25].

Table 4.2 continue: Comparison of traditional system and EDMS.

Traditional System Disadvantages	EDMS Systems Advantages
Extra Costs: Printing, distribution and storage costs and Shipping costs for distant recipients [18]-[25].	Cost Savings: Although initial setup costs can be involved, in the long run, EDMS can lead to cost savings. Reduced labour costs, less paper usage, and lower resource requirements contribute to financial benefits [18]-[25].
Increased Human Errors: Manual processes often result in more human errors. Data entry, document management, and record-keeping processes are prone to mistakes and omissions [18]-[25].	Reduced Human Errors: Electronic Document Management Systems (EDMS) significantly reduce the likelihood of human errors. Automation minimizes data entry mistakes, ensuring accuracy in document management and record-keeping [18]-[25].
Slower and Inefficient: Manual processes are generally slower and less efficient compared to automation. Managing documents manually, including approval and updates, can be time-consuming [18]-[25].	Efficiency and Speed: EDMS streamlines processes, making them faster and more efficient than manual methods. Handling documents electronically, including approvals and updates, saves time [18]-[25].
Documentation Intensity: Manual systems typically require more time and resources for document management. Organizing, storing, and updating physical files can be complex [18]-[25].	Effortless Document Management: EDMS simplifies document management, reducing the time and resources required. Digital files are organized, easily accessible, and updates can be made seamlessly [18]-[25].
Faulty Record Keeping: Errors can occur in manual record-keeping processes, leading to inaccuracies or missing records. This can compromise the reliability of quality documentation [18]-[25].	Accurate Record Keeping: Electronic record-keeping minimizes errors and omissions. It ensures that all records are complete and up to date, enhancing the reliability of quality documentation [18]-[25].
High Labor Costs: Manual processes often rely on human labour, increasing labour costs. Managing documents manually and conducting manual checks can consume employee time [18]-[25].	Low Labor Costs: Shifting labour-intensive tasks to electronic platforms reduces labour costs [18]-[25].

Table 4.2 continue: Comparison of traditional system and EDMS.

Limited Traceability: Tracking, updating, and auditing documents can be more challenging in manual systems. This can create difficulties in responding quickly or meeting traceability requirements [18]-[25].	Enhanced Traceability: EDMS provides a traceable history of document changes and approvals. This ensures that all actions are tracked, making it easier to comply with regulations and standards [18]-[25].
Reporting and Data Analysis Challenges: Manual systems may face difficulties in data collection and analysis. Manually entering data can complicate analysis efforts [18]-[25].	Advanced Reporting and Analysis: EDMS facilitates data collection, analysis, and reporting. Customized reports can be generated quickly, aiding in identifying improvement opportunities [18]-[25].
Accessibility Issues: Accessing physical documents may pose challenges, as they may be stored in various locations. This can hinder quick access to essential information [18]-[25].	Accessibility and Availability: Electronic documents are easily accessible from anywhere with an internet connection. This ensures rapid access to critical information [18]-[25].
Update Problems: Keeping track of updates and revisions in manual systems can be challenging. This may result in the use of outdated or invalid documents [18]-[25].	Effortless Updates: EDMS tracks document revisions effortlessly. Users are always working with the most current versions, reducing the risk of outdated or invalid documents [18]-[25].
Environmental Impact: Manual document management can contribute to excessive paper usage, impacting the environment. [18]-[25]	Environmental Benefits: EDMS significantly reduces paper usage, contributing to environmental sustainability by minimizing waste and resource consumption. [18]-[25]
Effective Risk Management: EDMS enhances risk management capabilities. It ensures better control over document security and reduces the risk of data breaches [18]-[25].	Effective Risk Management: EDMS enhances risk management capabilities. It ensures better control over document security and reduces the risk of data breaches [18]-[25].
Multiple Resource Needs: Due to the difficulties in tracking and sharing resources, the same resource can be purchased multiple times for different regions and workplaces [18]-[25].	Shared Use of Resources: It ensures the joint and efficient use of production and distribution resources such as materials, labour, machinery-equipment and information between regions and/or workplaces [18]-[25].

Table 4.2 continue: Comparison of traditional system and EDMS.

Difficulty in Instant Access to Information: When data collected manually is desired to be used or evaluated, accessing information instantly is challenging [18]-[25].	Real-time information: Information is available in real time and end users can easily access the information they need [18]-[25].
Storage Space Requirement: Additional storage space [cabinets, archives, etc.) is needed for paper-filled documents and prepared folders [18]-[25].	No need for storage space: Since documents are filled out and stored in the system, there is no need for additional storage space [18]-[25].
Storage Risk: There is a possibility of documents being lost or damaged [due to factors like humidity, pests, etc.) within the storage area [18]-[25].	No storage risk: Since documents are stored within the system, there is no risk [humidity, pests, etc.) of loss or damage [18]-[25].
Manuel review and approval: Review and approval can only be done manually [18]-[25].	Automated review and approval: Automatic review and control settings can be made in accordance with the companies' own management systems [18]-[25].
Risk of duplicate documents on different places: The inability to control documents instantly and from a single central point creates a risk of duplication [18]-[25].	One document in only one place: Managing documents in real-time through the system prevents the risk of generating multiple duplicate documents [18]-[25].
	Document recovery ability: It provides the opportunity to recover documents that are accidentally deleted or altered without proper control [18]-[25].
	Customer Satisfaction: It improves customer satisfaction [18]-[25].
	Electronic signature: It allow official approvals to happen quickly and smoothly [18]-[25].

4.4 Google Drive-Based Management System

The aim is to eliminate the mentioned disadvantages and provide all the specified advantages in a system established on Google Drive.

Within the scope of this study, the effects of the Google Drive system, which is prepared with the aim of providing both the ease of in-house intervention without high setup costs like a manual system and the opportunity to establish automatic and easily traceable processes in an electronic environment, will be examined.

When the advantages of both systems are combined, it is anticipated that the following benefits will be realized.

4.4.1 Advantages Expected from Google Drive System

Table 4.3 describes the total advantages expected from the system.

Table 4.3: Advantages expected from Google Drive System.

Cost Efficiency	The systems implemented in Google Drive do not involve significant upfront costs for software, hardware, and training, as in the case of EDMS systems. Additionally, in the long run, reduced labour costs, less paper usage, and lower resource requirements contribute to financial benefits [18]-[25].
Simplicity	The systems implemented in Google Drive do not require complex software or technology. Since they are built on office infrastructure, employees using office programs can easily adapt. This can be particularly attractive to small businesses [18]-[25].
Customization and Integration	The Google Drive system is customizable and can be integrated with other business systems, making it easy to adapt to the specific needs of the business. Creating customized workflows and procedures is more straightforward [18]-[25].
Training and Awareness	It provides employees with the opportunity to create documents and improve processes. It helps employees gain a better understanding of document management and quality procedures. This encourages staff training and participation [18]-[25].

Table 4.3 continue: Advantages expected from Google Drive System.

Independence	Because they are based on Google Drive, they are not affected by system crashes or system outages, just like any specialized software. They have an advantage in ensuring continuity [18]-[25].
Reduced Human Errors	This system significantly reduces the likelihood of human errors. It minimizes data entry mistakes and ensures accuracy in document management and record-keeping [18]-[25].
Efficiency and Speed	EDMS streamlines processes, making them faster and more efficient than manual methods. Handling documents electronically, including approvals and updates, saves time [18]-[25].
Reduced Documentation Intensity	Google Drive simplifies document management, reducing documentation intensity, while allowing the advantages of manual processes to remain robust and secure [18]-[25].
Accurate Record Keeping	Data validation and data selection methods minimize record-keeping errors and omissions, enhancing the reliability of documents [18]-[25].
Low Labor Costs	Shifting labour-intensive tasks to electronic platforms reduces labour costs [18]-[25].
Data Analysis and Reporting	Google Drive provides access to data for more in-depth analysis and the creation of customized reports [18]-[25].
Accessibility and Availability	System documents are easily accessible from anywhere with an internet connection. This ensures rapid access to critical information [18]-[25].
Facilitating Document Revisions/Update	Google Drive makes it easy to track and apply document revisions and updates, ensuring that you maintain current and valid documents [18]-[25].
Environmental Sensitivity	Reducing paper usage by using Google Drive contributes to environmental sustainability, minimizing waste and resource consumption [18]-[25].
Risk Management	Google Drive enhances document security and reduces the risk of data breaches while preserving the independence and flexibility advantages of manual processes [18]-[25].

Table 4.3 continue: Advantages expected from Google Drive System.

Shared Use of Resources	It ensures the joint and efficient use of production and distribution resources such as materials, labour, machinery-equipment, and information between regions and/or workplaces [18]-[25].
Real time analysis	It provides real-time profit-loss and cost analysis [18]-[25].
Real-time information	Information is available in real time and end users can easily access the information they need [18]-[25].
No storage risk	Since documents are stored within the system, there is no risk [humidity, pests, etc.) of loss or damage [18]-[25].
Customer Satisfaction	It improves customer service levels and increases customer satisfaction [18]-[25].
Limited Internet Access Sustainability	Because manual systems have an adaptable infrastructure, forms filled out by hand can be easily adapted during an internet outage [18]-[25].
Independence on Vendor	Since there is no need for a software company supplier for the system, there is also no vendor dependency [18]-[25].

4.4.2 Disadvantages Expected from Google Drive System

A solution cannot be foreseen for the disadvantages provided **Table 4.4**.

Table 4.4: Disadvantages expected from Google Drive System.

Security Concerns	Electronic documents are vulnerable to cyber threats and data breaches, requiring robust cybersecurity measures [18]-[25].
Integration Challenges	Integrating Google Drive System with existing systems can be challenging, potentially leading to compatibility issues [18]-[25].
Data Migration	Transferring existing manual records to a Google Drive can be a cumbersome process [18]-[25].

For all purposes and in accordance with these criteria, a quality management system will be established over Google Drive in accordance with ISO 9001 standard for

Kahyalar İnşaat, which was chosen as an example for the thesis, all stages will be followed with examples, it will be checked whether the specified advantages are provided or not. In case of encountering a disadvantage, these issues will also be reported separately.



5. A NOVEL QUALITY MANAGEMENT SYSTEM FOR THE CONSTRUCTION INDUSTRY

In this section of the study, we will exemplify the planning, implementation, control, and improvement phases of a reinforced concrete construction project in alignment with the ISO 9001 standard. This will be done using the QMS Infrastructure established on Google Drive.

The system was meticulously developed by identifying the requirements of ISO 9001, considering the organizational structure, and addressing the specific needs of the company. It comprises a comprehensive set of documents related to six key components: processes (SRC), forms (FR), lists (LST), schematics (SM), instructions (TL), and appendices (EK). Together, these components form a quality system designed to ensure adherence to quality standards throughout the project lifecycle.

The system has been set up to be implemented via Google Drive. Information will be presented through this document, the necessary information flow will be managed, data will be collected, and the collected data will be evaluated. Necessary system documents and formats have been prepared to present information. Links between documents have been established for information flow. Necessary macros have been assigned to collect data and record it in relevant formats. To evaluate data, special formulas have been assigned to documents containing data, such as form data and lists, to guide performance evaluation.

The system has been prepared on a process-based basis. All the operation that the standard requires and that the company needs are explained with the processes. Other supporting documents such as forms, lists, diagrams, instructions, and attachments are defined as inputs or outputs within the relevant processes. A direct link is defined by assigning a link to all documents such as forms, lists, diagrams, instructions, annexes within the processes.

The definition of these components and their function in the system are described below.

5.1 Process (SRC)

The techniques used.

Flowchart technique: All processes are prepared using flowchart symbols. Documents have been employed to identify the necessary resources and responsible individuals, defining the tasks, workflow, and required connections in operational, administrative, or support issues.

Processes can be described in procedures, flowcharts can be utilized, or an alternative method determined by the organization can be applied. The crucial aspect is that it meets the process criteria specified in Article 4.4 of the standard.

For processes.

- Its inputs and expected outputs should be determined.

In this study, all inputs and outputs are given in the relevant step of the process, by writing the name of the document with green arrows. In addition, each process step can be called the output of the previous step and the input of the next step.

- It should determine the order and their interaction with each other.

The processes were prepared sequentially using the flowchart technique and by defining connections. Additionally, a process interaction chart has been created to describe the interactions between processes.

- Control methods should be identified and implemented.

Processes explaining control methods such as Corrective Action Process, Internal Audit Process, Supplier Evaluation Process, and Calibration Process have been established, detailing the requirements, and evaluating the outcomes.

- Required resources must be identified and obtained.

Necessary resources are explained in the processes and existence ensured with controls.

- Authorities and responsibilities should be determined.

Responsible job descriptions or departments are also specified under each process step.

- Risks and opportunities for processes should be identified.

Risk and opportunity tables covering all processes have been prepared according to the criteria specified in ISO 9001. All processes are prepared taking into account their own risks and opportunities, and necessary revisions are made in a planned manner if needed.

- Processes should be monitored and controlled; necessary changes should be made in a planned manner.

The monitoring and measurement method is explained by preparing the process. Documents needed to collect evidence are given in the process as input or output.

- For continuous improvement:

For continuous improvement, actions are planned in line with factors such as tracking risks and opportunities, checking the status of targets, planning corrective action for nonconformities, collecting customer requests and complaints, evaluating process performance results, and reviewing internal audit results and YGG decisions.

- Documented information describing the porcelain and providing evidence that it was ingested should be retained.

All records are recorded and evaluated through the system prepared on google drive.

The process names used in this study are as follows.

- Process Creation and Implementation
- Change Management Process
- Customer Happiness Evaluation Process
- Purchasing Process
- Corrective Action Process
- Creating a Document and Update Process
- Internal Audit Process
- Education Process

- Measurement and Evaluation Process
- MR Meeting Process
- Project Planning Process
- Project Management Process

For all documents defined as input or output in the processes, the page opening code is defined on the relevant symbol mentioned in the process. Thus, if you click on the relevant symbol in the process, you can directly access the document such as form, list, diagram, instruction, and annex.

```
function FR2A () {
  var spreadsheet = SpreadsheetApp.getActive();
  spreadsheet.setActiveSheet(spreadsheet.getSheetByName('FR.2'), true); };
```

5.2 Form (FR)

The techniques used.

Check-sheet: This technique is used in forms where specific questions are checked. For example, orientation forms, training activity evaluation forms.

Cause and Effect Diagram (Fishbone Diagram): This method is used in forms where the cause-and-effect relationship is evaluated. (For example, non-conformance reports).

Statistical analysis: This method is used for evaluating data collected from forms. All responses collected in the data table of the forms are interpreted and evaluated.

These are the documents in which the requirements or controls are recorded in order for the processes to function correctly and adequately. Forms are not permanent documents they are recorded instantly. And for every new need, a new form is used.

The forms names used in this study are as follows.

- Customer Satisfaction Survey
- Change Request
- NCR Form

- Internal Audit Report
- Training Evaluation Survey
- Meeting Report
- Project Preliminary Evaluation Report
- Project Daily Report
- End Of Project Report

Every form must be associated with a process. The data collected from these forms serves as a source for assessing process performance, crucial for devising improvement plans within the quality management system.

In this study, forms are organized systematically within the Google Drive file dedicated to the research topic, identified by the FR abbreviation and the corresponding form number. Each form comprises two tabs. The initial tab labelled FR."Form number" (e.g., FR.2) contains the form itself, designed to solicit information essential to the respective process. When no other option is available, information is requested in standalone text. However, where feasible, alternatives such as multiple-choice answers, confirmation boxes, or specific formats for monetary and date entries have been incorporated. This aids in standardizing responses and streamlining the evaluation process.

Within the forms, cells requiring data entry are the only ones left accessible; all other cells are locked and can only be modified by authorized personnel. This precaution is taken to prevent incorrect or erroneous completion of the forms.

Users input information on the initial tab. Should the user wish to start anew, clicking the "clear" button, located at the bottom right and designated for resetting, will restore the form to its cleared state. Once confident that the form has been correctly and adequately filled, users can simply press the "save" button in the lower right corner, assigned the saving code.

Upon clicking the Save button, the information from the form will be sequentially transferred to the data tab identified as FR"form number" (e.g., exampleFR2).

Save button data example for FR2 form.

```
function FR2() {
var ss      = SpreadsheetApp.getActiveSpreadsheet();
var formSS   = ss.getSheetByName("FR.2"); //Form Sheet
var datasheet = ss.getSheetByName("FR2"); //Data Sheet //Input Values
var values = [[formSS.getRange("B6").getValue(),//Değişiklik Adı
              formSS.getRange("B7").getValue(),//Geliş Kanalı
              formSS.getRange("B8").getValue(),// Talep Açıklaması
              formSS.getRange("B9").getValue(),//Değişiklik İsteği Yapan
              formSS.getRange("B10").getValue(),//Eğitim İhtiyacı
              formSS.getRange("G7").getValue(),//DF Kaynaklı mı?
              formSS.getRange("G8").getValue(),//Değişiklik Tipi
              formSS.getRange("G9").getValue(),//Geliş Tarihi
              formSS.getRange("G10").getValue(),//Doküman İhtiyacı
              formSS.getRange("B12").getValue(),//Analiz
              formSS.getRange("B13").getValue(),//Değişikliğin Etkisi
              formSS.getRange("B14").getValue(),//Etkilenecek Müşteri Sayısı
              formSS.getRange("B15").getValue(),//Talep Bilgileri...]];
datasheet.getRange(datasheet.getLastRow()+1, 2, 1, 33).setValues(values);};
Delete button data example for FR2 form
```

```
function FR2C() {
var ss      = SpreadsheetApp.getActiveSpreadsheet();
var formSS   = ss.getSheetByName("FR.2"); //Form Sheet
var datasheet = ss.getSheetByName("FR2"); //Data Sheet //Input Values
formSS.getRange("B6").setValue(""),//Değişiklik Adı
formSS.getRange("B7").setValue(""),//Geliş Kanalı
formSS.getRange("B8").setValue(""),// Talep Açıklaması
formSS.getRange("B9").setValue(""),//Değişiklik İsteği Yapan
formSS.getRange("B10").setValue(""),//Eğitim İhtiyacı
formSS.getRange("G7").setValue(""),//DF Kaynaklı mı?
formSS.getRange("G8").setValue(""),//Değişiklik Tipi
formSS.getRange("G9").setValue(""),//Geliş Tarihi
formSS.getRange("G10").setValue(""),//Doküman İhtiyacı
formSS.getRange("B12").setValue(""),//Analiz
```

```
formSS.getRange("B13").setValue(""),//Değişikliğin Etkisi  
formSS.getRange("B14").setValue(""),//Etkilenecek Müşteri Sayısı  
formSS.getRange("B15").setValue(""),//Talep Bilgileri ...}
```

While the information collected in the data tab can be evaluated later, in order to facilitate follow-up and evaluation, where possible, a formula can be defined in the data follow-up lists, and instant follow-up can be made through the list.

Since it is not possible to assign formulas to text answers, answers in text format are usually examined and analysed by the relevant administrator at certain intervals. In fields where multiple selection, checkbox or fixed format are used, formulas can be directly assigned to the tag list where the data is saved, and these lists can also be used for simultaneous analysis.

For example, if we take the FR.1 Customer Satisfaction evaluation survey, in the FR.1 Data section, answers are received with multiple choices from 1 to 5. When the answers received were transferred to the FR1 data section, the answers were conditionally formatted to mean 1 to 5. This allows us to check how the same subjects are evaluated in different tests.

In addition, special formulas can be defined at this stage for specific reminder notes that will facilitate the system. For example, when the customer satisfaction is below 4, give a red warning on the relevant tab and ask to contact the customer to inquire about the dissatisfaction.

In special cases, such as the absence of an internet connection, the manually filled out form data can be manually transferred to the next number in the data tab by competent personnel. Since the formula is assigned to transfer data to the first blank line, the next automatic records will continue without any problems.

The processes are documents prepared for informational purposes, since the process itself does not have a data collection function, no code has been used to collect data or interpret data in the processes, except for the routing code above.

5.3 List (LST)

The techniques used.

Checklist: All lists maintain their continuous relevance in terms of the subjects they track.

Pareto Analysis: Lists are followed by ranking issues, such as risks, opportunities, or goals, in order to take the most rapid and effective action on the highest-rated issue.

Statistical analysis: Data from previous statistics can be used as a reference for the assessments and rankings made in the lists (for example, risk assessments, target completion date).

They are the follow-up documents directed by the processes. These documents are only one sample for each list number and are periodic documents. The information is updated on the same document and followed continuously.

The list names used in this study are as follows.

- Document Following List
- QMS Targets
- Related Parties Requirements and Expectations
- Risk Analysis
- Opportunity Analysis
- Calibration Plan
- Approved Supplier List
- Internal Audit Program
- Process Performance Evaluation Table
- Training Schedule
- Job Description

Lists are documents available for multiple use. Its continuity continues even if it is used at different times and by different competent persons. In addition, since there are follow-up lists, they contain a lot of data for process performance evaluations and are

data sources that contain the information needed for the continuous improvement of the quality management system.

Formulas assigned to lists make follow-ups meaningful and easier. For example, the degree of risk is determined according to the value obtained by multiplying the effect and probability with the formulas assigned to the risk tables, and the measure is planned for the risk according to the degree class.

5.4 Schema (SM)

The techniques used.

In the logic of a flowchart, connections are defined by specifying the necessary links between job descriptions from top management to the lowest level unit. The information is updated on the same document and followed continuously.

The list schemas used in this study are, Organization Chart, Process Interaction Schema. Responsible persons in the processes must be in harmony with the position of that personnel in the organization chart and the duties/responsibilities defined for the personnel.

5.5 Instructions (TL)

The techniques used.

Documents that define and provide control over step-by-step descriptions of tasks to be performed in advance are informative documents. These documents describe the methods of handling technical-based specific topics within operational processes.

The instructions names used in this study are as follows.

- Concrete Instructions
- Reinforcement Instructions
- Isolation Instructions
- Brick Instructions
- Scaffolding Instructions

5.6 Appendices (EK)

Documents prepared with the purpose of providing information, independent of any specific technique. They are system-based information documents, excluding the other documents specified, prepared for the requirements of the ISO 9001 standard. These are documents that can be updated as needed through the same document for each document code. Guidance for the relevant documents is made from the handbook and processes.

The appendices names used in this study are as follows.

- QMS Manuel
- Internal and External Issues
- Scope
- Methods to Provide QMS Activity
- Policy
- MR Meeting Reports

6. CASE STUDY WITH EXAMPLES FROM SYSTEM APPLICATION

In this section, we aim to comprehend the practical application of quality management systems in the construction sector by examining two critical processes named SRC.11 and SRC.12. SRC.11 encompasses the Project Planning Process, and among the documents utilized in this process are the FR.8 Project Preliminary Evaluation Report, LST.3 Risk Analysis, and LST.4 Opportunity Analysis. On the other hand, SRC.12 focuses on the Project Management Process, and the documents employed in this process include the Project Plan, Daily Report, Change Request, NCR (Non-Conformance Report), Internal Audit Report, and Process Performance Report.

These examples aim to illustrate how a quality management system in the construction sector is implemented on Google Drive, showcasing its impact on process management, reporting, and performance evaluation. The detailed analysis of each example will highlight the advantages and challenges of the system, providing insights into the role of this innovative approach in shaping quality management in the construction industry. An example is shared in the **Figure 6.1**.

Figure 6.1: Document following list.

Since this study involves the quality management system of a construction company, examples of the system content will be made through construction processes and relevant annexes.

In the examples,

- Which document was prepared for which need of the system?
- How data was collected,
- How were the collected data evaluated?
- Which links and which formulas were used in the Google Drive system will be explained.

Process flow charts prepared in accordance with the standard were examined for both processes mentioned. The resources connected to the schemes are explained which resource, why, how it was prepared and how it is evaluated, and the application phase is detailed by giving an example for all resources. The meanings of the process symbols are described in the **Figure 6.2**.



Figure 6.2: The symbols used in the process flow chart.

6.1 SRC.11 Project Planning Process

Which clauses of ISO 9001 Standard does it comply with?

4.1 Understanding and Controlling the Context

The project planning process begins by understanding the organization's objectives, context, and relevant stakeholders. The project should be planned in alignment with the organization's overall goals [26]-[29].

4.2 Understanding the Needs of Interested Parties:

The project is planned while considering the requirements and expectations of relevant stakeholders. This is crucial for the successful completion of the Project [26]-[29].

6.1 Identification of Risks and Opportunities:

The project planning process identifies the specific risks and opportunities associated with the project. This is important to ensure successful project management [26]-[29].

6.2 Quality Objectives and Planning:

Project planning establishes the quality objectives of the project and includes the necessary plans to achieve these objectives [26]-[29].

7.1.6 Control of Organizational Knowledge and Documents:

Project plans and documents are managed in accordance with ISO 9001 requirements. Recorded information is preserved as organizational knowledge [26]-[29].

8.1 Operational Planning and Control:

The project plan is used to plan and control the operational stages of the project. This is important to ensure the project is completed on time and within budget [26]-[29].

9.1 Monitoring, Measurement, Analysis, and Evaluation:

Establishing appropriate processes and criteria to monitor, measure, analyse, and evaluate the progress of the project is a critical step in project management [26]-[29].

These provisions represent the key points to consider when preparing the project planning process in accordance with ISO 9001 requirements. Depending on the needs

of the organization and the complexity of the project, there may be variations in the implementation of these provisions.

The Project Planning Process is created taking into account the factors listed below, from receiving the project request to completing the project work plan. Once the project planning stage is completed, the project implementation process begins.

Project Initiation and Definition: The planning process begins with a clear understanding of the project's purpose, objectives, and scope. In this stage, a preliminary project evaluation is conducted. The preliminary evaluation includes necessary resources, project goals, expected outcomes, and overall assessments related to them.

Project Team Formation: A project team is assembled, consisting of key personnel such as project managers, architects, engineers, contractors, subcontractors, and other relevant stakeholders. Each team member has specific roles and responsibilities. At each step of the processes, the responsible person or team name is noted during team formation.

Site Assessment and Feasibility Study: A detailed site assessment is carried out to evaluate the project's location, soil conditions, environmental impact, and regulatory requirements. A feasibility study is also conducted to determine whether the project is feasible.

Design Development: Based on the project's goals and scope, the design phase begins. Electrical, mechanical, static, architectural, landscape/acoustic projects are completed.

Budgeting and Cost Estimation: Within the project plan, a detailed budget is prepared, including estimates for labour, materials, equipment, permits, and contingencies. Cost estimation involves itemizing expenses and creating a cost breakdown structure.

Schedule Development: Within the project plan, all stages of work are defined, including their durations and dependencies. The estimated project start and end dates are provided.

Risk Assessment and Management: Potential risks and uncertainties are identified and analysed.

Procurement and Contracting: The procurement strategy is determined, and negotiations and contracts are carried out with suppliers, subcontractors, and vendors. Contracts specify the terms, conditions, and responsibilities of each party.

Municipal Approvals: Approvals are obtained from the municipality for completed projects, and after ground surveys and projects receive approval, a permit is obtained from the municipality to commence construction.

Resource Allocation: Resources, including labour, materials, and equipment, are allocated based on the project schedule and budget. Resource levelling ensures efficient resource utilization.

Monitoring and Control: During the construction phase, project progress is monitored, and performance is measured against the project plan. Adjustments and corrective actions are taken when necessary.

Closeout and Handover: Upon completion of construction, the closeout process begins, which includes final inspections, commissioning, and the handover of the project to the owner or operator.

The identified advantages of using the Google Drive system.

Page opening macros have been assigned to the relevant resources (list, form, diagram, instructions, etc.) indicated in the flowcharts, enabling direct access to the respective resource documents. This allows for direct access to the relevant resource documents when reviewing the process.

Users can directly access the process by clicking on the links established in the document list and handbook from the point where the documents mention them. The use of flowcharts has freed us from lengthy and tedious procedures. With the meanings assigned to symbols and the established connections, processes are presented to the user in a simpler and clearer manner.

The identified disadvantages of using the Google Drive system.

There is no option for copying or replicating for recurring symbols. Each symbol that makes up the flowchart needs to be created from scratch. This results in both a workload and time loss disadvantage. It also jeopardizes consistency and aesthetics in the presentation. An example is shared in the **Figure 6.3**.

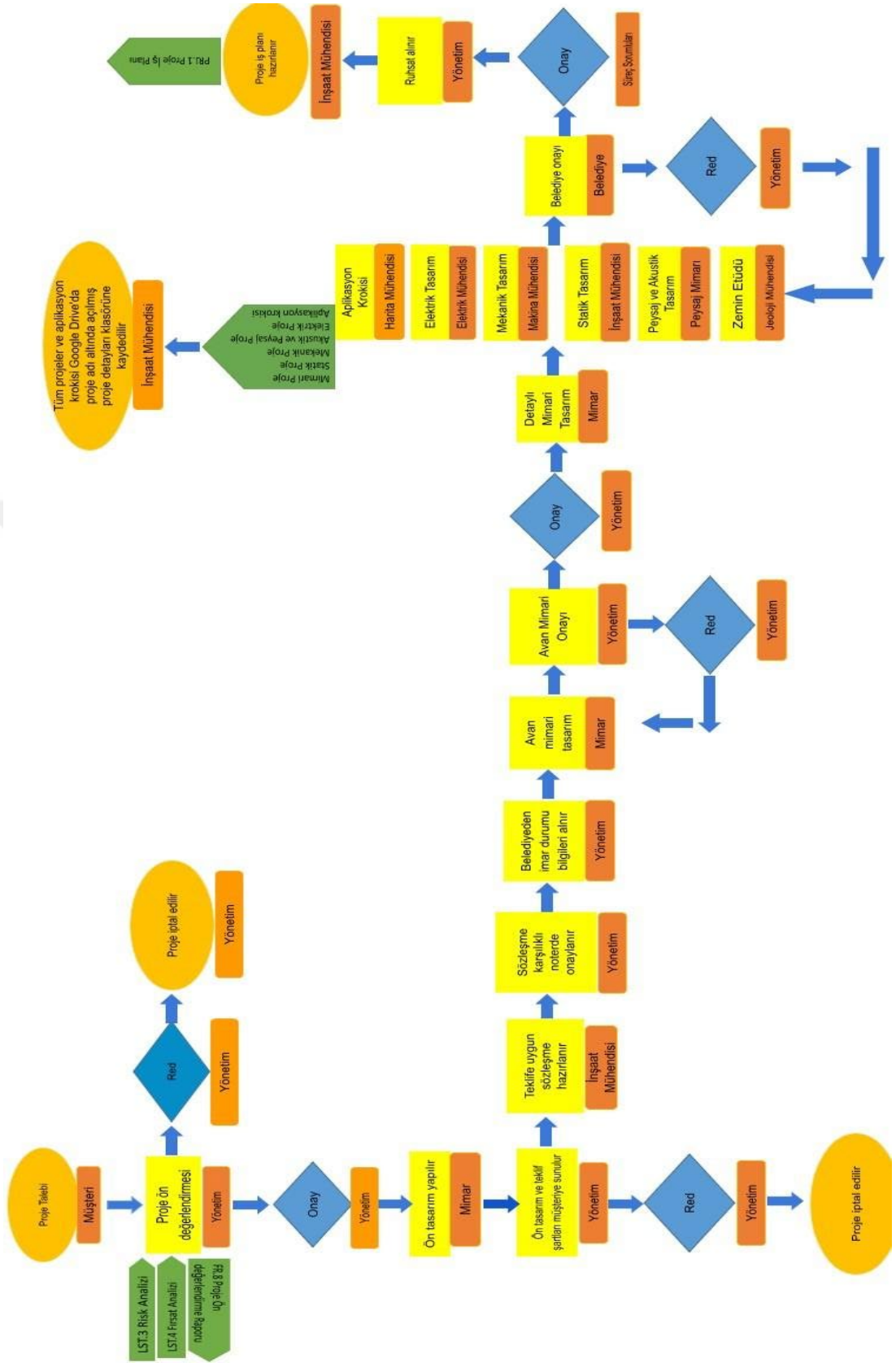


Figure 6.3: Project planning process.

6.1.1 FR.8 Project Preliminary Evaluation Report

Which clauses of ISO 9001 Standard does it comply with?

4.2 Understanding the Needs of Interested Parties:

Project planning is carried out to respond to these requirements by taking into account the needs and expectations of relevant parties [26]-[29].

6.1 Identification of Risks and Opportunities:

Plans are made to manage these risks and opportunities by identifying the unique risks and opportunities of the project [26]-[29].

6.2 Quality Objectives and Planning:

Projects that support the company's quality objectives and, if necessary, bring new objectives are preferred [26]-[29].

7.1 Resource Control:

The necessary infrastructure resources, human resources, and document resources for the project should be specified [26]-[29].

8.1 Operational Planning and Control:

The report should emphasize that the operational stages of the project are planned and controlled [26]-[29].

9.1 Monitoring, Measurement, Analysis, and Evaluation:

Preliminary assessments of the project are made, and reference information for planning is shared [26]-[29].

The purpose of the project preliminary evaluation is to decide whether the project will be carried out or not by comparing the positive and negative aspects of the project and investigating the feasibility of the project.

Before starting the project planning, the possible risks and opportunities of the project are determined. The human resources, machinery and equipment resources and infrastructure resources required for the project are determined. It is determined which of these resources the company owns, and which should be outsourced. Estimated

expenses are calculated and an approximate project cost is determined. The estimated project cost is determined. A general project evaluation is made by taking all these data into consideration. If it is decided to implement the project, the plan will continue.

After filling out the form, pressing the save button will transfer the form information to the data tab. No formula or macro was used in the form other than the record and delete button. However, by defining a link to the risk and opportunity sections, a directive has been made to the company's general risk and general opportunity tables. This will help us identify risks and opportunities that may affect the project, taking into account the data in the relevant lists.

Date format was used for the date section of the form. The remaining sections are selected as plain text.

For this study, a sample preliminary evaluation form for the Nurten Kara Apartment project is shared below. A general project evaluation was made based on the risk, opportunity, resource and estimated project cost data in the form, and as a result of this positive evaluation, the project plan was continued.

When the Save button is pressed, all data here is transferred to the FR8 data tab. The data of all saved forms are available in the FR.8 Data tab. This provides the opportunity to compare projects over time and control the entire list.

The identified advantages of using the Google Drive system.

- Automatic recording.
- Format fixing (date, text, currency, number, etc.).
- Ease of direct access from the process, document list, and handbook.
- Ease of data control in the data section and the advantage of formula assignment.

The identified disadvantages of using the Google Drive system.

- No disadvantages have been reported for this document.

An example is shared in the **Figure 6.4**.

	PROJE ÖN DEĞERLENDİRME RAPORU		Dokuman No	FR.8
			Yayın Tarihi	08.11.2022
	PROJECT PRELIMINARY EVALUATION REPORT		Revizyon Tarihi:	03.03.2023
			Revizyon No	2
Proje Adı / Project Name: NURTEN KARA APARTMANI				
Müşteri Adı / Customer Name: NURTEN KARA				
Projenin Riskleri: Risk of Project:				
Unforeseen increase in construction materials and labor costs during the project period due to inflation. Financial losses and loss of time that may occur as a result of the withdrawal of agreed suppliers from the market The project does not meet the design as a result of working with unqualified teams Adverse weather conditions disrupt the business plan				
Projenin Fırsatları: Benefits of Project				
Ease of sales as it is a popular region Sales from land due to the trust provided by previous projects Fixing the price by purchasing materials and labor with the proceeds from land sales According to AFAD data, working in the area less affected by the earthquake Ease of access to construction materials as it is close to Istanbul Due to the fear of the great Istanbul earthquake and the increase in living costs in Istanbul, the region's immigration from Istanbul has increased the need for housing.				
Proje için gerekli olan kaynaklar: Necessary resources for the project:				
Şirketin sahip olduğu kaynaklar: Company resources		Dışarıdan temin edilmesi gerekli olan kaynaklar; Resources to be obtained from outside;		
Project Manager Design Engineer Technical Office Engineer Field Engineer Field Architect Generator Vibrator Company Car		Survey Engineer Architect Electrical Engineer Mechanical Engineer Landscape Architect Formwork Team Reinforcement Team Concrete team Insulation team Brick team Scaffolding team Electrical & Plumbing team Plaster team Forklift Manitu Excavator Truck Mobile Crane		
Tahmini proje maliyeti : Estimated project cost:		M2/10.000 TL		
Genel proje değerlendirmesi: General evaluation of project:		The project will take place in an appreciated and in-demand area of the city.It is a project consisting of 2 units of 2+0 on the ground floor and 12 units of 1+1 on the normal floors.The region has both social environment and ground advantages. With the influence of the trust gained in the market, a plan can be prepared in which the project can largely finance itself.		
Değerlendirmeyi yapan; Evaluated by:				
İsim- Soyisim Name-Surname		Tarih Signature		
ERDİ KAHYA		16.12.2022		

Figure 6.4: Project preliminary evaluation report.

6.1.2 LST.3 Risk Analysis

Which clauses of ISO 9001 Standard does it comply with?

Risk analysis is based on several different clauses of ISO 9001 standard, especially the 2015 version. ISO 9001 adopts a risk-based thinking approach and recommends risk management processes. Therefore, risk analysis is based on the following standard clauses:

4.1 Understanding the Context:

Risk analysis is associated with the need to understand and analyse the organization's internal and external context [26]-[29].

4.2 Understanding the Needs and Expectations of Interested Parties:

Risk analysis involves considering the requirements and expectations of the organization's interested parties [26]-[29].

5.1.2 Top Management Commitment:

Top management should commit to addressing risk management and opportunities for continuous improvement [26]-[29].

6.1.1 Risk and Opportunity Assessment:

This clause requires organizations to assess risks and opportunities, which are used for determining processes and establishing objectives [26]-[29].

6.1.2 Planning:

Risk analysis guides the organization's processes during the planning phase. Plans are created for how risks and opportunities will be addressed [26]-[29].

8.1 Monitoring, Measurement, Analysis, and Evaluation:

This clause requires monitoring and measuring the risk management [26]-[29].

Risk analysis is a process that helps organizations identify, assess, and develop measures to mitigate potential risks and capitalize on opportunities. The ISO 9001:2015 standard encourages the implementation of this process in line with the general principles and requirements of the standard.

Before starting a project, it is necessary to determine the risks of the project.

While determining the risks of the project, the risk table is opened to check whether there are risks that may affect this project. If any new risk arising from the project is detected, this risk is also added to the table.

The risk table includes risks that affect the company in general or projects. Risks are defined on a process basis. The risks of this process are defined as SRC.11 Project Planning Risks.

Risks are defined by specifying their sources, possible consequences and risk classes. All risks are rated considering their impact and probability on **Table 6.1**.

The impact of the risk is explained in **Table 6.2**.

Table 6.1: Probability values used in qualitative risk calculation.

Frequency	Probability	Probability Value
Once a year	Very low	1
Quarterly	Low	2
Once in a month	Middle	3
Once a week	High	4
Every day	Very high	5

Table 6.2: Severity values used in qualitative risk calculation.

Fact	Severity of risk	Severity value
One staff member per year or less	Very low	1
Several times a year, several staff	Low	2
At least once a month, many staff	Middle	3
At least weekly, most staff	High	4
Almost every day, all staff	Very high	5

Note: The assessment of risk severities has been modified from the current study to comply with the quality management system.

Table 6.3: 5x5 Risk assessment table.

RISK LEVEL	Severty				
Probability	Very High 5	High 4	Middle 3	Low 2	Very Low 1
Very High 5	High 25	High 20	High 15	Middle 10	Low 5
High 4	High 20	High 16	Middle 12	Middle 8	Low 4
Middle 3	High 15	Middle 12	Middle 9	Low 6	Low 3
Low 2	Middle 10	Middle 8	Low 6	Low 4	Low 2
Very Low 1	Low 5	Low 4	Low 3	Low 2	Low 1

In the risk calculation table, probability and severity values are assigned according to the criteria given **Table 6.3**. The risk degree is automatically calculated with the assigned multiplication formula.

Conditional formatting has been defined for risk values to correspond to the colour given for the values given above. These colours have both stimulating and guiding qualities. If the risk is in red, corresponding to values between 15-25, urgent preventive action is planned and, if necessary, that step of the process is held until the planned action is completed. If there is a medium level risk between 8-12, preventive action is planned, but at this stage the process can continue in a controlled manner. There is no obligation to plan action for low-level risks with a score below 8. My action planning is optional, it is enough to follow the risk. If the risk in question exceeds 8, it will switch to medium risk and action planning will be mandatory.

While identifying the risks for this project, experiences derived from past projects were evaluated. Simultaneously, earthquake reports prepared by authorized institutions such as METU, ITU, GTÜ, and IMO based on field and resource investigations for the earthquake that occurred in Kahramanmaraş on February 6 were examined (On February 6, 2023, at 04:17 and 13:24 Turkish time, two earthquakes with magnitudes

of Mw 7.7 and Mw 7.6 occurred, with the epicentre in Pazarcık (Kahramanmaraş) and Elbistan (Kahramanmaraş). The earthquake with a magnitude of 7.7 occurred at a depth of 8.6 km, while the earthquake with a magnitude of 7.6 occurred at a depth of 7 km). General effects negatively impacting the structural integrity of the building, such as faulty static project design, material impact, faulty workmanship, improper foundation selection, insufficient ground improvement, lack of understanding of the project by implementers, and errors in workmanship, were identified and reflected in the table as risks [30]-[34].

In the risk table, risks are determined on a process basis. By defining the risk, what will happen as a result and also the class and severity of the risk are determined. An action plan is made for the risks whose characteristics are determined and an action manager is assigned. And finally, the risk is re-evaluated after the action. By making impact and probability evaluations again, the risk is rated again and the risk class is determined.

The identified advantages of using the Google Drive system

- Risk classes can be determined with checkboxes.
- Risks can be filtered by various headings such as process, resource, risk class, etc.
- Risks and their statuses can be monitored in real-time.
- Risks can be graded, and necessary alerts can be assigned based on risk levels.
- Alert conditions can be defined for risks with approaching action dates and overdue planned action dates.

An example is shared in the **Figure 6.5**.

LOGO

Güncelleme tarihi
Update

RISK ANALİZİ
RISK ANALYSIS

Dokuman No
Yayın Tarihi
Revizyon Tarihi
Revizyon No

LST-3
08.11.2022
01.02.2023
1

Sıra No	Süreç Process	Kaynak Source	Risk Tanımı Description of Risk	Risk Sonucu Consequence of Risk	Risk Smith Control Matrix										Aktarılan Önce Riskin Derecesi Transferred Before Risk Level		Planlanan Aksiyonlar Planned Actions		Sorumluluk Responsibility	Etki Impact	Mevcut Durum Current Status				
					F	P	D	F	M	P	C	T	O	N	H	A	B	Etki Impact	Olasılık Probability	Hesaplan an Risk Calculated Risk Level (1-25)		Olasılık Probability Y			
					F	P	D	F	M	P	C	T	O	N	H	A	B								
1	SRC.1 Process Creation and Implementation	Corporate information	Lack of coordination, Disruptions that may occur as a result of not clearly defining who will do what and how and not establishing the necessary connection.	Poor quality Delay Loss of reputation Economic damage	☐	☒	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	3	3	9	A procedure has also been prepared to explain the planning and implementation phase of the work in detail. Instructions will be prepared for all technical expertise issues included in the application details and the rules and details of the work will be clearly described. Legal requirements will be described regularly and changes will be checked at the end of each month. In case of a change that needs to be reflected in the application, change management will be implemented by preparing a change request form.	Quality Manager	3	2	6
2	SRC.2 Change Management	1305-1326; IMO Magazine	Disruptions that may occur as a result of legal implementation	Delay Economic damage	☐	☐	☐	☐	☒	☐	☐	☐	☐	☒	☐	☐	☐	3	2	6	Technical Office Engineer	3	1	3	
3	SRC.3 Change Management	1305-1326; IMO Magazine	Disruptions that may be caused by natural / disasters or epidemics	Delay Economic damage	☐	☐	☐	☐	☐	☒	☐	☐	☐	☒	☐	☐	☐	3	3	9	Change management will be implemented by evaluating the effects of the type of natural disaster and epidemic.	Quality Manager	3	2	6
4	SRC.4 Change Management	1305-1326; IMO Magazine	Extended duration of work due to adverse weather conditions	Delay	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	2	4	8	Weather conditions will be taken into account when preparing the business plan.	Technical Office Engineer	2	4	8
5	SRC.4 Change Management	1305-1326; IMO Magazine	Time and financial losses that may arise from a construction technique tried for the first time	Delay Economic damage	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	3	4	12	Necessary planning is made in accordance with change management standards and changes are reflected in the system in a planned manner.	Quality Manager	3	2	6
6	SRC.3 Customer Happiness Evaluation	Corporate information	Not following customer complaints, repeating the same problem without being aware of the problem that it is the subject of its architect.	Poor quality Loss of reputation	☐	☐	☐	☐	☒	☐	☐	☐	☒	☐	☐	☐	☐	3	3	9	All customer complaints are followed through a survey at the end of each project. Thus, customer complaints are also obtained through a survey at the end of each project.	Sales and marketing	3	1	3
7	SRC.3 Customer Happiness Evaluation	Corporate information	Failure to respond to customer complaints in a timely and adequate manner	Loss of reputation	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	3	3	9	Complaints received are evaluated and corrective actions are initiated. As a result of the completion of the corrective action, the customer is informed about what has been done. Criteria for suppliers were determined and an approved supplier list was prepared. We continue to work with suppliers that are on the list and have high scores whenever possible.	Sales and marketing	3	1	3
8	SRC.4 Purchasing	Corporate information	Failure to deliver purchased materials on time	Delay Economic damage	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	4	2	8	Purchased materials are stored in a pre-planned, clean, safe and moisture-free warehouse area.	Purchasing	4	2	8
9	SRC.4 Purchasing	Corporate information	Quality loss of the material after purchase due to the conditions under its influence	Delay Economic damage	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	4	2	8	Regular field checks are carried out and daily activities in the field are recorded with daily reports. Corrective action is taken by opening a NCR for detected nonconformities.	Purchasing	4	1	4
10	SRC.5 Corrective Action	1305-1326; IMO Magazine	The production had to be redone because it was not of the desired quality.	Economic damage	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	4	2	8	For the detected problems, the root cause is determined by opening NCR and the root cause is eliminated to prevent recurring errors.	Site Chief	4	1	4
11	SRC.5 Corrective Action	Corporate information	Repetitive application errors	Poor quality Delay	☐	☐	☐	☐	☒	☐	☐	☐	☒	☐	☐	☐	☐	3	3	9	Before the static calculation phase, dimension checks and necessary corrections are done and a new revision is requested from the architecture according to the current situation.	Quality Manager	3	2	6
12	SRC.7 Internal Audit	Corporate information	Incorrect design details, such as incorrectly sized profiles shown in the architect's drawings,	Delay Economic damage	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	4	1	4	In internal audits, personnel awareness is measured by sampling and field controls. In cases where deficiencies are detected regarding personnel awareness, corrective action is planned by opening a NCR.	Technical Office Engineer	4	1	4
13	SRC.7 Internal Audit	1305-1326; IMO Magazine	Damage to materials and equipment	Delay Economic damage	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	4	3	12	In internal audits, personnel awareness is measured by sampling and field controls. In cases where deficiencies are detected regarding personnel awareness, corrective action is planned by opening a NCR.	Site Chief	4	2	8
14	SRC.8 Education	1305-1326; IMO Magazine	Gross construction errors caused by staff ignorance	Collapse or damage Loss of reputation Economic damage	☐	☐	☐	☐	☒	☐	☐	☐	☒	☐	☐	☐	☐	5	3	15	We work with competent personnel and the personnel are trained on instructions regarding their duties.	Site Chief	5	1	5
15	SRC.8 Education	1305-1326; IMO Magazine	Fine structure errors caused by personnel ignorance	Poor quality	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	3	3	9	We work with competent personnel and the personnel are trained on instructions regarding their duties.	Site Chief	3	2	6

Figure 6.5: Risk analysis.

16	SRC-9 Assessment and Evaluation	ODTU Earthquake Report	Ground Liquefaction	Collapse or damage	☒	☐	☐	☐	☐	☐	☐	☐	5	4	20	Ground surveys are carried out before the project by competent engineering companies. Necessary improvements are made according to the ground condition. As a result of the decision taken by the management, dependence on credit has been restricted. Developing a plan to ensure business continuity with the current budget and sales opportunities.	Design engineer	5	1	5
17	SRC-10 MR Meeting	1305-1326, IMO Magazine	Unforeseen increases in credit costs	Economic damage	☐	☐	☐	☐	☐	☐	☐	☐	4	4	16	As a result of the decision taken by the management, dependence on credit has been restricted. Developing a plan to ensure business continuity with the current budget and sales opportunities.	Management	4	2	8
18	SRC-10 MR Meeting	1305-1326, IMO Magazine	Not getting paid on time	Delay	☐	☐	☐	☐	☐	☐	☐	☐	4	4	16	Sales conditions are guaranteed by contract.	Management	4	3	12
19	SRC-10 MR Meeting	1305-1326, IMO Magazine	Cost and overhead increases and delay penalties arising from not completing the work on time	Delay	☐	☐	☐	☐	☐	☐	☐	☐	3	2	6	Before starting the work, day-by-day schedule were prepared, in which the necessary connections were also defined. This schedule is updated in accordance with any changes that may occur during the process.	Management	3	2	6
20	SRC-10 MR Meeting	1305-1326, IMO Magazine	Theft	Economic damage	☐	☐	☐	☐	☐	☐	☐	☐	3	2	6	No materials are left at the work site outside working hours, the materials are transported to the warehouse.	Site Chief	3	2	6
21	SRC-11 Project Planning	1305-1326, IMO Magazine	Actual expenditures due to inflation are more than planned expenditures	Economic damage	☐	☐	☐	☐	☐	☐	☐	☐	4	3	12	Until the purchase of materials and labor is completed, the money inside or coming in is evaluated through pre-purchases.	Management	4	2	8
22	SRC-11 Project Planning	ODTU Earthquake Report	Using hollow block flooring as a diaphragm	Collapse or damage	☐	☒	☐	☐	☐	☐	☐	☐	4	2	8	In case of hollow block flooring, shear walls are designed to absorb at least 75% of the overturning moment in both directions.	Design engineer	4	1	4
23	SRC-11 Project Planning	ODTU Earthquake Report	Failure to properly distribute horizontal and earthquake loads to vertical load-bearing elements due to unconscious use of building design software (inadequate engineering design)	Collapse or damage	☐	☒	☐	☐	☐	☐	☐	☐	5	3	15	The Design Engineer checks the building earthquake regulations during the design phase.	Design engineer	5	1	5
24	SRC-11 Project Planning	GTU Earthquake Report	Settlement is defined as a significant decrease in the shear strength and effects of saturated, cohesionless or low cohesion soils under earthquake shaking, parallel to the increase in pore water pressure.	Collapse or damage	☒	☐	☐	☐	☐	☐	☐	☐	5	3	15	In areas where there is a risk of ground liquefaction, necessary infrastructure works are carried out, water is drained and the ground is dried. Reinforcement works are carried out on the ground in accordance with the ground.	Design engineer	5	1	5
25	SRC-11 Project Planning	IMO Earthquake Report	Inadequate ground conditions	Collapse or damage	☐	☐	☐	☐	☐	☐	☐	☐	4	4	16	Reinforcement works are carried out on the ground in accordance with the ground.	Design engineer	4	1	4
26	SRC-11 Project Planning	Building Earthquake Regulation	Uneven distribution of stiffness	Collapse or damage	☐	☒	☐	☐	☐	☐	☐	☐	5	3	15	Columns and shear walls will be designed so that the center of rigidity of the structure meets the center of gravity.	Design engineer	5	1	5
27	SRC-11 Project Planning	Building Earthquake Regulation	Short column effect	Collapse or damage	☐	☒	☐	☐	☐	☐	☐	☐	5	3	15	Designs that create the short column effect are not done	Design engineer	5	1	5
28	SRC-11 Project Planning	GTU Earthquake Report	Presence of insufficient longitudinal reinforcement in column sections	Collapse or damage	☐	☒	☐	☐	☐	☐	☐	☐	5	3	15	During the design phase, the placement of the reinforcement will be checked in the program to ensure that they are applicable designs during the application phase.	Design engineer	5	1	5
29	SRC-11 Project Planning	GTU Earthquake Report	Collision of adjacent buildings under the influence of strong ground motion due to insufficient expansion joints	Collapse or damage	☐	☒	☐	☐	☐	☐	☐	☐	5	3	15	If there is insufficient dilatation, the two buildings are designed to operate at the same frequency.	Design engineer	5	1	5
30	SRC-11 Project Planning	GTU Earthquake Report	Strong beam weak column	Collapse or damage	☐	☒	☐	☐	☐	☐	☐	☐	5	3	15	Strong column weak beam design	Design engineer	5	1	5
31	SRC-11 Project Planning	GTU Earthquake Report	Soft floor effect	Collapse or damage	☐	☒	☐	☐	☐	☐	☐	☐	4	4	16	There is no deviation allowed in buildings with shops underneath or higher than 7 floors.	Design engineer	4	1	4
32	SRC-11 Project Planning	1305-1326, IMO Magazine	Designing the entrance floors relatively high or Removal of existing grill walls in the project	Collapse or damage	☐	☐	☐	☐	☐	☐	☐	☐	4	3	12	Ground surveys are carried out before the project by competent engineering companies. Necessary improvements are made according to the ground condition. Ground and foundation details are checked.	Design engineer	4	1	4
33	SRC-12 Project Management	ODTU Earthquake Report	Uncertain ground conditions	Collapse or damage	☐	☐	☐	☐	☐	☐	☐	☐	3	4	12	Possible errors are prevented with daily construction site checks.	Site Chief	3	1	3
34	SRC-12 Project Management	IMO Earthquake Report	Possible reinforcement detailing errors at the building site	Collapse or damage	☐	☒	☐	☐	☐	☐	☐	☐	4	2	8	Possible errors are prevented with daily construction site checks.	Site Chief	4	1	4
35	SRC-12 Project Management	IMO Earthquake Report	Spans strapping loading	Collapse or damage	☐	☒	☐	☐	☐	☐	☐	☐	4	2	8	Possible errors are prevented with daily construction site checks.	Site Chief	4	1	4

Figure 6.5 continue: Risk analysis.

6.1.3 LST.4 Opportunity Analysis

The opportunity table is prepared with the same logic and the same mathematical formulas as the risk table. The equivalent of taking precautions against risks in the risk table is to develop opportunities in the opportunity table. An example is shared in the **Figure 6.6**.

FIRSAT ANALIZI

OPPORTUNITY ANALYSIS

Genel Yönetici

1

Sıra 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Figure 6.6: Opportunity analysis.

6.2 SRC.12 Project Management Process

Which clauses of ISO 9001 Standard does it comply with?

4.2 - Understanding of Interested Parties:

Projects are based on the process of understanding the needs and expectations of customers, stakeholders, and other relevant parties [26]-[29].

5.1.1 - Commitment and Leadership:

Project management requires leadership and commitment from project leaders and managers [26]-[29].

6.1 - Internal Processes within the Organization:

Projects can affect the internal processes, resources, and communication within the organization and, therefore, should align with internal processes [26]-[29].

7.1 - Resource Management:

Project management necessitates effective management of human resources, infrastructure, and other resources [26]-[29].

8.1 - Monitoring, Measurement, Analysis, and Evaluation:

Projects require monitoring and measurement activities, and the data from these activities are used to evaluate performance [26]-[29].

8.2 - Internal Audit:

Projects are audited and improvement opportunities are identified through internal audits and reviews [26]-[29].

The project implementation process starts from the construction site installation and ends with the receipt of occupancy. All kinds of ground improvement works, foundation installation, rough construction works and fine construction works are included in this stage.

The stages of this process are carried out taking into account certain rules and criteria. All stages are carried out by professional teams under the control of the site manager. The instructions below are written for process steps that are complex and must comply

with certain specifications. These instructions must be followed while performing these steps, TL.1 Concrete Instruction, TL.2 Reinforcement Instruction, TL.3 Formwork Instruction, TL.4 Isolation Instruction, TL.5 Brick Instruction, TL.6 Scaffolding Instruction.

These instructions both help the teams as a guide and set rules regarding the of the job. In the planning process, it is necessary to fill out the documents with their explanations in the middle of the process in order to manage and control throughout the process.

These documents consist of the following three groups according to their type:

- Constantly updated documents (PRJ.1 Project Work Plan).
- Documents filled regularly at certain periods (FR.9 Project Daily Report, FR.4 Internal Audit Report, LST.8 Process Performance Evaluation Table).
- Documents filled out when needed (FR.2 Change Management Form, DÖF Form).

These documents, which are filled out for the purpose of managing and controlling the process, are saved by number under the folders opened for the project in Google Drive after being delivered to the relevant people by e-mail. This also ensures that project information is stored while implementing quality management systems in the project. The acquired knowledge and experience are transferred to subsequent projects.

The process is a document prepared to provide information and does not have the nature of collecting data. For this reason, only page opening macros that direct to resources were used as formulas in the processes.

The identified advantages of using the Google Drive system.

The same advantages have been identified for the project planning process.

The identified disadvantages of using the Google Drive system.

The same disadvantages have been identified for the project planning process. Furthermore, it is necessary to separately identify resources that may be required continuously or at specific intervals, such as daily reports, NCR forms, schedules, which do not have a single-step input or output. An example is shared in the **Figure 6.7**.

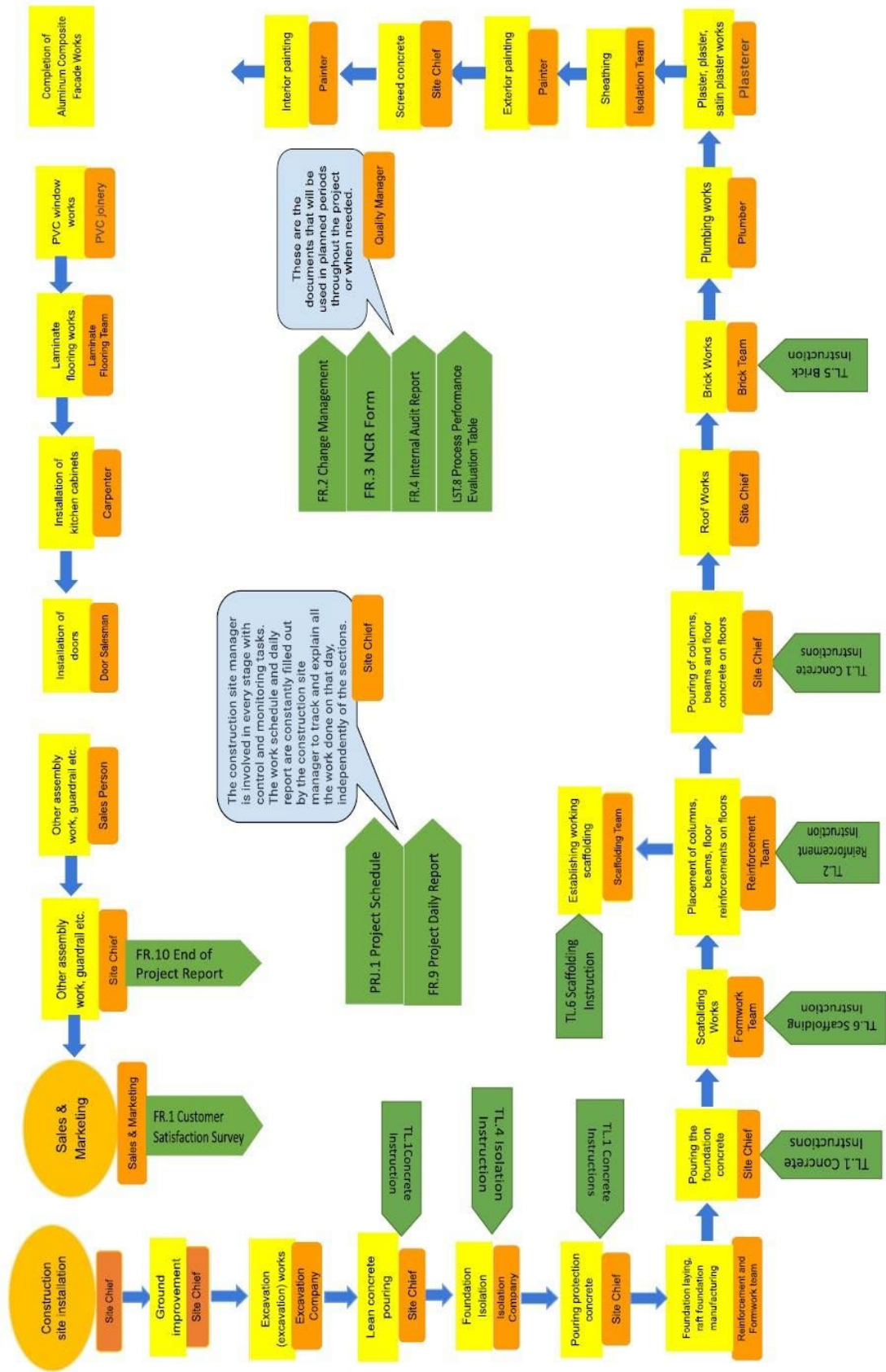


Figure 6.7: Project management process.

6.2.1 Project Plan

Which clauses of ISO 9001 Standard does it comply with?

4.3 - Implementation and Control of Processes:

The project plan explains how project processes will be implemented [26]-[29].

6.1 - Internal Processes within the Organization:

The project plan should align with internal organizational processes and resources [26]-[29].

7.1 - Resource Management:

The project plan includes plans for effectively managing human resources, infrastructure, and other resources [26]-[29].

8.1 - Monitoring, Measurement, Analysis, and Evaluation:

The project plan includes methods for project monitoring, measurement, analysis, and performance evaluation [26]-[29].

All work to be done in the schedule is divided into the following four groups:

- License and project Works.
- Rough construction manufacturing.
- 1st Group fine manufacturing.
- 2nd Group fine manufacturing.

According to this plan, rough structure manufacturing does not start before the license and project works are completed, and fine structure manufacturing does not start before the rough structure manufacturing is completed. Although the 1st group manufacturing is generally planned to take place before the 2nd group manufacturing, if the connections between the steps allow, the 2nd group manufacturing can also be planned to take place before the 1st group fine manufacturing in order to save time. For each step in the project, a start/end date and project duration in days are defined.

The start date and end date cells are formatted in date format. The project duration is formatted in number format.

The only value entered manually in the schedule is the Likhap Document start date, which is considered the start of the project. End dates for all steps were automatically obtained from the “start date + duration” formula.

Connections between steps are also formulated in such a way that the start date of that step takes into account the end date of the step to which it is connected.

Example1: Static project design will start with the completion of the ground survey. For this reason, =G14 was assigned as the end date of the ground survey for the static project start date.

Example 2: The building inspection process will commence after the completion of all stages, including static project, mechanical project, electrical project, and mapping project. Therefore, the final completion date for the specified projects has been assigned as the start date for the building inspection, indicated by =MAK(G15;G16;G17;G18).

With this method, each step has been formulated specifically for its connection to the respective step. This means that in case of any delay or extension in any step, the entire timeline can be adjusted without the need to individually check and correct all affected dates. This allows for reaching the updated work plan by simply modifying the affected or extended process in the table.

Percent completion is given for each step. These steps are filled in manually based on data received from the field. For each step, conditional formatting is defined that will colour that cell red to warn if the completion percentage continues to be 0% after the start date and if the completion percentage is not 100% after the end date. Depending on this warning, either the job completion percentage will be updated, or the required number of days will be calculated, and the time given for the job will be updated depending on this value. By updating this value, the start and end dates of all steps connected to this stage will also be updated.

In the Project tab, a project calendar in month/day format is placed to the right of the general project information to monitor the project progress. The calendar cells for each step are conditionally formatted to be orange from start to end date.

This provides the advantage that all stages and connections for the project can be easily understood on the calendar.

Additionally, the calendar cells for each step are conditionally formatted as dark blue paint if the date is today. This allows you to see what has been done in the project as of today and what is planned to be done next.

The identified advantages of using the Google Drive system.

- A project work plan is prepared in a sequential and grouped manner.
- The work plan can be continuously updated.
- Real-time access to up-to-date information is available.
- With linked formulas assigned between dates, when the date of a step changes or the duration of a task is extended, only that step needs to be updated, and all related steps are automatically updated.
- Intermediate steps can be easily added, removed, or modified.
- Alerts are defined for tasks that do not start or finish on time by assigning conditions to start and completion dates.
- Time periods in which tasks occur are filled in on the calendar to provide a holistic view of the work.
- Responsible personnel can be assigned for each stage through the work plan.
- Budget tracking can be done for each stage through the work plan.
- All relevant personnel can use it collectively.

The identified disadvantages of using the Google Drive system.

Nothing.

6.2.2 Daily Report

Which clauses of ISO 9001 Standard does it comply with?

The Project Daily Tracking Report can address various clauses of the ISO 9001 standard, but it can be prepared specifically to comply with the following clauses:

7.1 - Resource Management:

It aims to track how human resources are utilized, the distribution of workforce, and how resources are effectively managed [26]-[29].

8.1 - Monitoring, Measurement, Analysis, and Evaluation:

It is used to monitor, measure, and analyse the progress of the project [26]-[29].

8.2 - Internal Audit:

It can assist in examining the project's performance during internal audits [26]-[29].

9.3 - Management Review:

It provides information about the status and performance of the project during management reviews [26]-[29].

According to ISO 9001 standards, a daily report is prepared in the format specified below to track the following factors on a daily basis. The reports are sent to the relevant individuals via email at the end of the day. Furthermore, since they serve as evidence and contain corporate information, the reports are regularly archived in a Google Drive folder created for the respective project.

Tracking Progress: Daily reports document how much progress is made on a construction project each day. This helps record any delays or advancements. Time is crucial in construction projects, and daily reports show project managers whether the project schedule is being followed on time.

Material and Resource Management: Reports track the consumption of materials and stock levels. This ensures timely material orders and also shows how resources (such as labour) are being utilized.

Worker and Team Performance: Daily reports assist in evaluating the performance of workers and subcontractors. Information such as who completed which tasks in how much time, the number of workers, and working hours is monitored with these reports.

Monitoring Job Safety: Daily reports keep track of safety measures. Worker safety violations, accidents, or hazardous situations are reported. This information shows that safety standards are being properly applied and improved.

Change Management: Any changes or additional work requests are recorded in daily reports. This helps determine how frequently the project scope changes and whether additional costs or schedule changes are necessary.

Evidence and Documentation: Daily reports can be used as evidence for future disputes or legal issues. For example, they provide documentation in matters such as contract breaches, delays, or changes.

In conclusion, daily reports are crucial tools used to manage and document the daily administration, progress, budget, safety, and quality of construction projects. These reports are essential to ensure the successful completion of the project and provide data for future improvements.

If any non-conformance is detected in the project daily report during the day, a NCR is also opened. The daily report format is shared with the example below.

The identified advantages of using the Google Drive system.

It encompasses the same advantages as the project preliminary evaluation form and, at the same time, allows for real-time data processing and access to up-to-date information anytime and anywhere.

The identified disadvantages of using the Google Drive system.

Nothing.

An example is shared in the **Figure 6.10**.

	PROJE GÜNLÜK RAPORU		Dokuman No	FR.9
	PROJECT DAILY REPORT		Yayın Tarihi	08.11.2022
			Revizyon Tarihi	03.03.2023
			Revizyon No	2
Proje Adı Project Name:	Nurten KARA Apartment			
Müşteri Adı Customer Name:	Nurten KARA			
Rapor tarihi Report name	02.08.2023			
Çalışma saatleri Working hours	09.00-18.00			
Çalışma alanı Working Area	On Site			
Günlük yapılan işler Daily work				
2nd floor formwork completed. The reinforcement team completed the manufacturing of all 2nd floor columns Column manufacturing and formwork were checked on site by the site manager.				
Uygulanan yöntemler: Applied methods				
On-site application by qualified personnel and on-site control by the construction site manager				
Çalışan personeller ve görevleri: Employees and their duties:				
Yağız KAHYA / Site Manager- Architect				
Kullanılan kaynak ve ekipmanlar Resources and equipment used				
Formwork Team Reinforcement Team Architect				
Raporla birlikte sunulacak ekler Attachments to be submitted with the report				
Nothing				
Gün içinde alınan notlar ve belirlenen uygunsuzluklar Notes taken during the day and identified non-compliances				
Nothing				
Hazırlayan Prepared		Approved Onaylayan		
İsim- Soyisim: Name-Surname:	Yağız KAHYA	İsim- Soyisim: Name-Surname:		
Tarih Date	02.08.2023	Tarih Date	02.08.2023	
İmza: Signature:		İmza: Signature:		

Figure 6.10: Daily report.

6.2.3 Change Request

Which clauses of ISO 9001 Standard does it comply with?

It is prepared to comply with the standard's Clause 6.3 Planning of Changes [26]-[29].

A change management form in quality management systems typically includes the following components and should be filled out as follows:

Description of Change: Clearly state what the change is. Which document or procedure is being updated, and what kind of change is being made?

Reason: What are the reasons for the change? Explain why this change is needed and what problems it aims to address.

Proposer: The name and position of the person proposing the change. This is important to identify the person responsible for the change.

Change Details: Provide details of the change. Which sections or clauses are being altered? Explain the differences between the old and new text.

Affected Areas: Specify which areas or departments the change affects. Who will be impacted by this change?

Approval and Monitoring: Define the approval process for the change. Who should approve the change, and how does the approval process work?

Implementation Date: Specify when the change will take effect.

Change Monitoring: Specify the metrics or performance indicators that will be used to monitor the effectiveness of the change.

Approvals and Signatures: Obtain the names and signatures of individuals who approve the change.

Attachments: Include any additional documents or references related to the change.

After the form is completed, it is important to present the change proposal to management or relevant individuals for approval. Once the change is approved, it is essential to revise the updated document or procedure and document this revision.

The identified advantages of using the Google Drive system.

It encompasses the same advantages as the project preliminary evaluation form.

An example is shared in the **Figure 6.11**.

	DEĞİŞİKLİK YÖNETİMİ		Doküman No	FR.2
	CHANGE REQUEST		Yayın Tarihi	08.11.2022
			Revizyon Tarihi	01.02.2023
			Revizyon No	1
Talep Bilgileri Request Information				
Değişiklik Adı Change Name	Reflecting the Amendment of the Zoning Regulation on 12 May 2023 to the System			
Geliş Kanalı Arrival Channel	Management	DF Kaynaklı mı? Sourced from NCR?	No	
Talep Açıklaması Request Description	The changes regarding the closed exit will be examined	Değişiklik Tipi Change Type	Law / Regulation	
Değişiklik İsteği Yapan Requested for Change	Erdi KAHYA	Geliş Tarihi The arrival date	12.05.2023	
Eğitim İhtiyacı Training Needs	No	Doküman İhtiyacı Document Requirement	Yes	
Kuruluş Değişiklik Kurulu Değerlendirme Alanı Organization Change Board Evaluation Area				
Analiz Analysis	The change in question is valid for buildings whose ground floors are designed as commercial premises and which will be built			
Değişikliğin Etkisi Effect of Change	Major			
Etkilenecek Müşteri Sayısı Number of Customers	50+			
Talep Bilgileri Request Information	Conditions of amendment to the zoning law published on 12.05.2023			
Değişiklik Sorumlusu Change Officer	Management			
Yapılacak Aksiyon Planı Action Plan to be Done	In case of no closed overhang, the specified carrier system should be used in building applications without a closed overhang, consisting only of columns and/or curtains (including the sections that continue under the ground up to the foundation), with a maximum of 1 m overflow into the backyard, provided that the distance to the backyard does not fall below 2 m. The area it surrounds is not considered a violation of garden distance and floor area. If the precedent rights are not fully used even in this way, the same application is allowed, with a maximum of 1 m overflow into the front garden, provided that it does not come closer than 4 m to the road boundaries of the parcel. No edge of this area is closed with a wall or any material and the garden quality is not removed.			
Maliyet Cost	Kuruluş Maliyeti Establishment Cost	-	Tedarikçi Maliyeti Supplier Cost	-
Bitirme Tarihleri Completion Dates	Planlanan Planned	12.05.2023	Gerçekleşen Happening	19.05.2023
Bitirme Tarihi Gecikme Nedeni Completion Date Delay Reason	Açıklama Explanation	-	İlgili Taraf related part	Council
Riskler Risks	There is a loss of M2 in the floors above the ground due to the lack of closed exits. Since the increase in the ground floor M2 reduces the garden M2, the area for parking decreases, which may result in not having enough space for the car park and also resulting in a parking fee.			
Alınan Önlemler Precautions Taken	During the preliminary design phase, the budget will be designed in accordance with the current changes.			
Sözleşme Değişikliği Gerektiriyor mu? Does the contract require a change?	Yes			
Açıklama Explanation	Relevant changes have been saved in the system. For proposals, a design suitable for changes will be made starting from the			
*Aşağıdaki bilgiler "Cihaz Ekipman Değişikliği, Proses Değişikliği, Çalışma Alanları Değişikliği Olması Halinde Doldurulacaktır. *The following information will be filled in case of "Device Equipment Change, Process Change, Work Area Change.				
İlave Araç/Gereç/Donanım İhtiyacı Additional Tools / Equipment / Hardware Requirement	No			
İlave Çalışan İhtiyacı Additional Employee Needs	0	Kişi/Person	Maliyet Cost	0,00 TRY
Değişiklik Kurulu Değerlendirme Change Board Evaluation				
Kurul Tarafından Onaylandı mı? Is It Approved By The Board?	Yes			
Değişiklik Sorumlusu Talep Durumu Değerlendirme Change Officer Demand Status Evaluation				
Statü Status	Closed			
Kapanış Tarihi Closing date	20.05.2023			
Eğitim Verildi mi? Has Training Been Provided?	Yes	Kılavuz Hazırlandı mı? Guideline Prepared?	No	

Figure 6.11: Change request.

6.2.4 NCR

Which clauses of ISO 9001 Standard does it comply with?

10.2 - Verification and Evaluation:

It is used to document non-conformities arising in the verification and evaluation processes of products or services [26]-[29].

9.1.1 - Review Requirement:

Non-conformities can be addressed as part of the review processes, and the NCR form can be used in these reviews [26]-[29].

10.1 - Monitoring, Measurement, Analysis, and Evaluation:

It is used to record non-conformities identified during the monitoring, measurement, analysis, and evaluation processes of products or services [26]-[29].

8.7 - Improvement:

The NCR form is used as part of the organization's continuous improvement efforts to help resolve and enhance non-conformities [26]-[29].

The NCR is used for the management of quality issue resolution and quality improvement processes. It is employed to meet the requirements of quality management standards such as ISO 9001 and to assist the organization in continuously enhancing quality.

A typical NCR includes the following information:

Problem Description: Explain what quality issue has arisen or been identified. Clearly state what the problem is.

Source of the Problem: Specify where the problem originated, or in which process it occurred. Understanding the root cause of the problem is important.

Solution Proposals: Describe how you intend to resolve the problem and what the quality improvement measures are.

Responsible Person: Specify who will carry out the corrective or preventive actions. This helps define responsibilities clearly.

Dates: Record important dates such as the date of identification of the problem, start and completion dates of the solution, etc.

Action Plan: Detail the steps to be taken for resolving the problem. Specify what actions will be taken, who is responsible, and the dates to be followed.

Approvals and Signatures: Obtain the names and signatures of individuals who approve the NCR. This provides a record that the activities have been carried out.

The NCR aims to facilitate the quick resolution of quality issues and the prevention of similar issues in the future. Therefore, organizations regularly use NCRs to improve their quality management systems. Additionally, in audits and certification processes, they fill out NCRs to comply with the requirements of ISO 9001 or similar quality management standards. This document helps the organization continuously improve quality and ensure customer satisfaction.

The identified advantages of using the Google Drive system.

It encompasses the same advantages as the project preliminary evaluation form.

The identified disadvantages of using the Google Drive system.

Nothing.

The basic stages of corrective action are given in the **Figure 6.12** respectively.

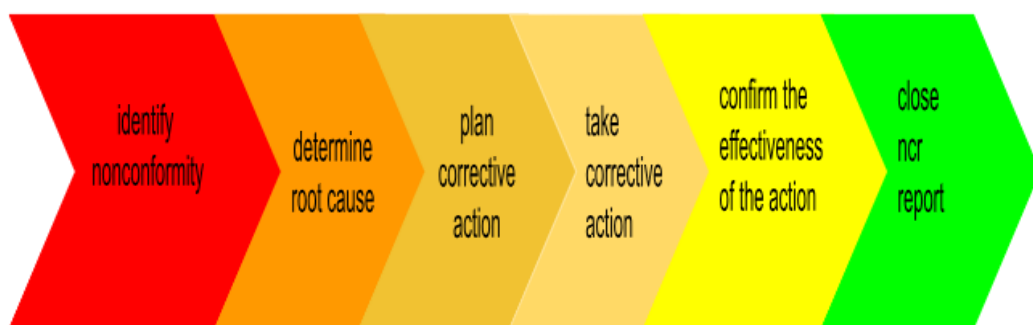


Figure 6.12: Corrective action steps.

An example is shared in the **Figure 6.13**.

	DÖF FORM				Dokuman No	FR.3
	NCR FORM				Yayın Tarihi	08.11.2022
					Revizyon Tarihi	01.02.2023
					Revizyon No	1
Uyumsuzluğun Tespit Edildiği Bölüm: Department where the non-compliance is detected:			Design		DÖF NO / NCR NO: 1	
Talep Nedeni / Reason for Demand:	Müşteri Şikâyeti Customer complaint	☐	İç Tetkik Internal Audit	☐	Proses İyileştirme Process Improvement	☒
Talep Edilen Faaliyet Requested Activity	Düzeltilici ve önleyici Corrective and preventive	☒	Önleyici Preventive	☐		
Uyumsuzluk Tanımı: Description of non-compliance						
A difference in location was detected in the architectural drawing and static drawing of PB23 and PB24 columns.						
Bildirenin Adı/Soyadı: Name / Surname of Reporter:	Gökberk MEŞELİ	İmza: Signature	İlgili Standart Maddesi veya Prosedür Related Standard Clause or Procedure			
Görevi / Title	Architect		SRC.11 Project Planning Process			
Uyumsuzluğun Kök Nedeni: The root cause of non-compliance:		PB23 and PB24 columns were added later by the design engineer during the static design. It has been determined that incorrect internal measurements were taken in the corridor area where the columns are located and the relevant columns were placed with this internal measurement as reference.				
Uyumsuzluğun Tekrarını Önleyecek Düzeltici / Önleyici Faaliyet: Corrective / Preventive Action to Prevent Recurrence of Non-Compliance:		Correct the relevant dimension line and recheck all dimension lines			Planlanan Tarih: Planned Date:	16.04.2023
Analizi yapan Analysis done by		İmza Signature	Tarih Date		15.04.2023	
Adı Soyadı Name-surname	Gözde ALNIAÇIK KAHYA					
Görevi/Title	Design engineer					
Gerçekleşen Düzeltici / Önleyici Faaliyet: Corrective / Preventive Action:		The relevant dimension line has been corrected and all dimension lines have been checked again				
Faaliyeti Gerçekleştiren Activity done by		İmza Signature	Tarih Date		16.04.2023	
Ad Soyad Name-surname	Gözde ALNIAÇIK KAHYA					
Görevi/Title	Design engineer					
Düzeltici Önleyici Faaliyetin Kapatılması / Closing of Corrective and Preventive Action:						
Düzeltilici önleyici faaliyet etkin bir şekilde kapatılmıştır. Saha/doküman kontrolleri yapılmıştır. Corrective and preventive action has been effectively closed. Field / document checks have been done					☒	
Düzeltilici önleyici faaliyetin gerçekleştirilmesi için ek süre verilmiştir. Additional time has been given to carry out corrective and preventive action.					☐	
Açıklama/Explanation						
Değerlendiren Evaluated by		İmza Signature	Tarih Date		16.04.2023	
Adı Soyadı Name-surname	Erdi KAHYA					
Görevi/Title	Project Manager					

Figure 6.13: NCR Form.

6.2.5 Internal Audit Report

Which clauses of ISO 9001 Standard does it comply with?

9.2 - Internal Audits:

The internal audit report is used to document the organization's own quality management system review and evaluation processes [26]-[29].

4.4 - Process Approach:

Internal audits support the process approach by examining the organization's processes and how they function [26]-[29].

9.1.3 - Improvement:

Internal audits are used to assess the organization's continual improvement objectives and activities [26]-[29].

9.3 - Management Review:

The internal audit report can be used to evaluate the organization's performance and compliance levels during management reviews [26]-[29].

In accordance with article 9.2 of the standard, internal audits are carried out at planned intervals, at least once a year, to check that the processes are implemented as planned. Internal audits are planned in advance, announced to process managers, and carried out by competent and objective auditors.

An Internal Audit Form is used in quality management systems as part of the internal audit process carried out by an organization to assess and improve its own quality management system. This form scans the organization's quality processes, procedures, and compliance, aiming to identify deficiencies and improvement opportunities while ensuring the continuous updating of quality management systems. Internal audit forms help monitor and enhance compliance with ISO 9001 standard and provide evidence.

Completing an internal audit form involves the following steps:

Audit Date and Location: Specify the dates and departments/areas.

Auditor Information: Include the auditor's name, position.

Audit Scope: Explain which procedures, processes, or documents were covered.

Audit Objectives: State the objectives of the internal audit. These objectives may include compliance verification, process effectiveness evaluation, identification of improvement opportunities, or other defined goals.

Audit Findings: Record the findings from the internal audit. These findings may include positive or negative results.

Approvals and Signatures: Auditors approval and signature.

The Importance of Internal Audits.

Internal audits provide an opportunity for organizations to review their quality management systems and identify continuous improvement opportunities. This helps organizations operate more effectively and efficiently, enhance quality, and ensure customer satisfaction. Internal audits also serve to monitor compliance with quality management standards and prepare for external audits. They are crucial to maintaining the relevance and suitability of a quality management system.

The internal audit result is recorded in the format given below. If a non-conformity is detected during internal audits, NCR is also opened.

The identified advantages of using the Google Drive system.

It encompasses the same advantages as the project preliminary evaluation form.

The identified disadvantages of using the Google Drive system.

Nothing.

The main factors of internal audit are given in the **Figure 6.14**.



Figure 6.14: Five main steps of internal audit.

An example is shared in the **Figure 6.15**.

	İÇ TETKİK RAPORU		Dokuman No	FR.4
	INTERNAL AUDIT REPORT		Yayın Tarihi	08.11.2022
			Revizyon Tarihi	01.02.2023
			Revizyon No	1
Tetkik Tarihi / Audit Date		01.06.2023		
Tetkik Kapsamı / Audit Scope		SRC.11 Project Planning Process		
Tetkikçiler / Auditor		Gözde ALNIAÇIK KAHYA		
Tetkik Edilen Bölüm Investigated Section		Design and Planning		
İlgili Kısımları Related Sections		Proposal, Design, Planning		
Tetkikte Görüşülen Kişiler ve Unvanları Persons and Titles Interviewed in the Audit		Erdi Kahya		
Tetkikte Tespit Edilen Olumlu Yönler / Positive Aspects Identified in the Inspection:				
Proposal, design and planning details are detailed in SRC.11 Project Planning Process. Preparing the process schematically on Google Drive, accessible to all personnel, eliminates the risk of accessing outdated copies and ensures an easily accessible and understandable process. Inputs and outputs are defined with connections throughout the process, providing direct guidance. In this way, ease of implementation is ensured for the process and document continuity is ensured.				
İyileştirmeye Açık Alanlar Areas Open to Improvement:				
At the bid and design specifications stage, the criteria that determine the bid conditions can be given as input. Standard contract format can be given as an attachment during the contracting phase.				
Tetkikte Tespit Edilen Uygunsuzluklar / Nonconformities Detected in the Inspection:				
When the N.Kara apartment folder was checked, it was determined that the static calculations, static drawings and project work plan were up-to-date, but the architectural drawing of the project was not up-to-date. Since the preservation phase of the approved project information was not explained in detail during the process, it was determined that the last revised drawings were not added to the relevant project folder because the project information preservation phase was overlooked in the final revisions of the architectural drawings.				
Baş tetkikçi Lead Auditor		Yardımcı Tetkikçi Assistant Auditor		
Adı Soyadı Name Surname	Gözde ALNIAÇIK KAHYA	Adı Soyadı Name Surname		
Tarih Date	01.06.2023	Tarih Date	01.06.2023	
İmza Signature		İmza Signature		

Figure 6.15: Internal audit report.

6.2.6 Process Performance Report

Which clauses of ISO 9001 Standard does it comply with?

4.4 - Process Approach:

The Process Performance Evaluation Report supports the process approach by explaining how the organization manages its processes and measures the performance of these processes [26]-[29].

9.1.3 - Improvement:

The report is used to assess the organization's continual improvement objectives and activities [26]-[29].

9.3 - Management Review:

The Process Performance Evaluation Report can be used to evaluate the organization's process performance and quality management system during management reviews [26]-[29].

10.2 - Verification and Evaluation:

The report can document the conformity of processes during verification and evaluation processes [26]-[29].

In accordance with Article 9.1.3 of the standard, process performance must be determined. For process performance evaluation, the performance outputs of that process are compared every year with the performance targets determined at the beginning of the year. Comments are made about process performance at the end of the year.

The identified advantages of using the Google Drive system.

It encompasses the same advantages as the project preliminary evaluation form.

The identified disadvantages of using the Google Drive system.

Nothing.

An example is shared in the **Figure 6.16**.

LOCO		PROSES PERFORMANS DEĞERLENDİRME TABLOSU						Document No	LSER	
								Revizyon Tarihi	08.11.2022	
								Revizyon Tarihi	01.02.2023	
								Revizyon No	5	
PROCESS PERFORMANCE EVALUATION TABLE										
SÜREÇLER PROCESS		Standart Adı	İlgili Doküman	Proses Gözetici	Proses Gözetici	Performans Gözetici	Yüksek Performans Beklentisi	Yüksek Performans Talepleri	Tarih	Notlar
SÜREÇ YÖNETİMİ VE YÖNETİMİ	PROSES YÖNETİMİ VE YÖNETİMİ		DO.01 Grubu DO.01 MS Manual EK.2 Kapsam EK.2 Scope EK.3 Politika EK.3 Policy SM.1 Organizasyon Şeması SM.1 Organization Chart LST.3 Risk Analizi LST.3 Risk Analysis LST.4 Fırsat Analizi LST.4 Opportunity Analysis LST.10 Görev Tanımları LST.10 Job Description SM.2 Proses İnteraksiyon Şeması SM.2 Process Interaction Scheme	DO.01 Grubu DO.01 MS Manual EK.2 Kapsam EK.2 Scope EK.3 Politika EK.3 Policy SM.1 Organizasyon Şeması SM.1 Organization Chart LST.3 Risk Analizi LST.3 Risk Analysis LST.4 Fırsat Analizi LST.4 Opportunity Analysis LST.10 Görev Tanımları LST.10 Job Description SM.2 Proses İnteraksiyon Şeması SM.2 Process Interaction Scheme	LST.3 Risk Analizi LST.3 Risk Analysis LST.4 Fırsat Analizi LST.4 Opportunity Analysis	Performance evaluations for all processes annually	100%	100%	08.09.2023	Performance evaluation was made in accordance with the criteria for 12 processes.
			FL.2 Değişiklik Yönetimi Formu FL.2 Change Management Form LST.3 Risk Analizi LST.3 Risk Analysis LST.4 Fırsat Analizi LST.4 Opportunity Analysis	FL.2 Değişiklik Yönetimi Formu FL.2 Change Management Form LST.3 Risk Analizi LST.3 Risk Analysis LST.4 Fırsat Analizi LST.4 Opportunity Analysis	Risk analysis for changes	100%	100%	08.09.2023	When planning change management, possible risks for all changes are evaluated from the beginning.	
			FL.1 Müşteri Memnuniyeti Anketi FL.1 Customer Satisfaction Form	FL.1 Müşteri Memnuniyeti Anketi FL.1 Customer Satisfaction Form	Satisfaction evaluation survey from customers Average of results from surveys	10%	38%	08.09.2023	During the year, feedback was received from 3 out of 10.	
			LST.8 Oranlar Tedarikçi Listesi LST.8 Approved Supplier List	LST.8 Oranlar Tedarikçi Listesi LST.8 Approved Supplier List	Average of supplier ratings Number of suppliers with a total score below 60 points	80	77	08.09.2023		
			FL.3 DÖF Formu FL.3 NCR Form	FL.3 DÖF Formu FL.3 NCR Form	NCRs close on scheduled date	100%	89%	08.09.2023	For 2 NCRs that could not be closed at the planned time.	
			LST.7 İç Tetkik Programı LST.7 Internal Audit Program FL.3 DÖF Formu FL.3 NCR Form	LST.7 İç Tetkik Programı LST.7 Internal Audit Program FL.3 DÖF Formu FL.3 NCR Form	Carrying out audits for all processes in accordance with the internal audit program	100%	89%	08.09.2023	The internal inspection could not be carried out in August as the fire work did not reach the level to be inspected. Inspection was carried out in the remaining 8 areas at the planned time.	
			FL.5 Eğitim Değerlendirme Anketi FL.5 Training Evaluation Survey FL.6 Katılımcı Değerlendirme Formu FL.6 Participant Evaluation Survey FL.7 Oryantasyon Formu FL.7 Orientation Form LST.9 Eğitim Planı LST.9 Training Schedule	FL.5 Eğitim Değerlendirme Anketi FL.5 Training Evaluation Survey FL.6 Katılımcı Değerlendirme Formu FL.6 Participant Evaluation Survey FL.7 Oryantasyon Formu FL.7 Orientation Form LST.9 Eğitim Planı LST.9 Training Schedule	Score result of training activity evaluations Successful completion rate of participants Successful completion rate of orientations Carrying out training according to plan	75	79	08.09.2023		
			FL.8 Proses Performans Değerlendirme Tablosu FL.8 Process Performance FL.9 Gözetim Değerlendirme Anketi FL.9 Training Evaluation Survey FL.6 Katılımcı Değerlendirme Formu FL.6 Participant Evaluation Survey FL.7 Oryantasyon Formu FL.7 Orientation Form LST.9 Eğitim Planı LST.9 Training Schedule	FL.8 Proses Performans Değerlendirme Tablosu FL.8 Process Performance FL.9 Gözetim Değerlendirme Anketi FL.9 Training Evaluation Survey FL.6 Katılımcı Değerlendirme Formu FL.6 Participant Evaluation Survey FL.7 Oryantasyon Formu FL.7 Orientation Form LST.9 Eğitim Planı LST.9 Training Schedule	Successful completion rate of participants Successful completion rate of orientations Carrying out training according to plan	100%	100%	08.09.2023		
			FL.10 Proses Performans Değerlendirme Tablosu FL.10 Process Performance FL.3 DÖF Formu FL.3 NCR Form FL.4 İç Tetkik Raporu FL.4 Internal Audit Program	FL.10 Proses Performans Değerlendirme Tablosu FL.10 Process Performance FL.3 DÖF Formu FL.3 NCR Form FL.4 İç Tetkik Raporu FL.4 Internal Audit Program	Filling in all items in the VGS report	100%	100%	08.09.2023		
			FL.11 Proje İş Planı FL.11 Project Schedule FL.8 Proje On Değerlendirme Raporu FL.8 Project Preliminary Evaluation Form	FL.11 Proje İş Planı FL.11 Project Schedule FL.8 Proje On Değerlendirme Raporu FL.8 Project Preliminary Evaluation Form	Starting projects on the planned date Number of projects designed in a year (statistical/mechanical/electrical/mechanical)	100%	100%	08.09.2023		
SÜREÇ YÖNETİMİ VE YÖNETİMİ	PROJE PLANLAMA SÜRECİ		FL.11 Proje İş Planı FL.11 Project Schedule FL.9 Proje Gönüllü Raporu FL.9 Project Daily Report FL.10 Proje Sonuç Raporu FL.10 End of Project Report TL.1 Beton Talimatı TL.1 Concrete Instructions TL.2 Donatı Talimatı TL.2 Reinforcement Instructions TL.3 Kırık Talimatı TL.3 Formwork Instructions TL.4 Isılatma Talimatı TL.4 Isolation Instructions TL.5 Yalıtım Talimatı TL.5 Brick Instructions TL.6 Nakle Talimatı TL.6 Scaffolding Instructions	FL.11 Proje İş Planı FL.11 Project Schedule FL.9 Proje Gönüllü Raporu FL.9 Project Daily Report FL.10 Proje Sonuç Raporu FL.10 End of Project Report TL.1 Beton Talimatı TL.1 Concrete Instructions TL.2 Donatı Talimatı TL.2 Reinforcement Instructions TL.3 Kırık Talimatı TL.3 Formwork Instructions TL.4 Isılatma Talimatı TL.4 Isolation Instructions TL.5 Yalıtım Talimatı TL.5 Brick Instructions TL.6 Nakle Talimatı TL.6 Scaffolding Instructions	Completing projects on schedule Completing projects with the planned team Completing projects with planned equipment Completing projects within the completed budget	100%	100%	08.09.2023		
			FL.11 Proje İş Planı FL.11 Project Schedule FL.9 Proje Gönüllü Raporu FL.9 Project Daily Report FL.10 Proje Sonuç Raporu FL.10 End of Project Report TL.1 Beton Talimatı TL.1 Concrete Instructions TL.2 Donatı Talimatı TL.2 Reinforcement Instructions TL.3 Kırık Talimatı TL.3 Formwork Instructions TL.4 Isılatma Talimatı TL.4 Isolation Instructions TL.5 Yalıtım Talimatı TL.5 Brick Instructions TL.6 Nakle Talimatı TL.6 Scaffolding Instructions	FL.11 Proje İş Planı FL.11 Project Schedule FL.9 Proje Gönüllü Raporu FL.9 Project Daily Report FL.10 Proje Sonuç Raporu FL.10 End of Project Report TL.1 Beton Talimatı TL.1 Concrete Instructions TL.2 Donatı Talimatı TL.2 Reinforcement Instructions TL.3 Kırık Talimatı TL.3 Formwork Instructions TL.4 Isılatma Talimatı TL.4 Isolation Instructions TL.5 Yalıtım Talimatı TL.5 Brick Instructions TL.6 Nakle Talimatı TL.6 Scaffolding Instructions	Completing projects on schedule Completing projects with the planned team Completing projects with planned equipment Completing projects within the completed budget	100%	100%	08.09.2023		
			FL.11 Proje İş Planı FL.11 Project Schedule FL.9 Proje Gönüllü Raporu FL.9 Project Daily Report FL.10 Proje Sonuç Raporu FL.10 End of Project Report TL.1 Beton Talimatı TL.1 Concrete Instructions TL.2 Donatı Talimatı TL.2 Reinforcement Instructions TL.3 Kırık Talimatı TL.3 Formwork Instructions TL.4 Isılatma Talimatı TL.4 Isolation Instructions TL.5 Yalıtım Talimatı TL.5 Brick Instructions TL.6 Nakle Talimatı TL.6 Scaffolding Instructions	FL.11 Proje İş Planı FL.11 Project Schedule FL.9 Proje Gönüllü Raporu FL.9 Project Daily Report FL.10 Proje Sonuç Raporu FL.10 End of Project Report TL.1 Beton Talimatı TL.1 Concrete Instructions TL.2 Donatı Talimatı TL.2 Reinforcement Instructions TL.3 Kırık Talimatı TL.3 Formwork Instructions TL.4 Isılatma Talimatı TL.4 Isolation Instructions TL.5 Yalıtım Talimatı TL.5 Brick Instructions TL.6 Nakle Talimatı TL.6 Scaffolding Instructions	Completing projects on schedule Completing projects with the planned team Completing projects with planned equipment Completing projects within the completed budget	100%	100%	08.09.2023		
			FL.11 Proje İş Planı FL.11 Project Schedule FL.9 Proje Gönüllü Raporu FL.9 Project Daily Report FL.10 Proje Sonuç Raporu FL.10 End of Project Report TL.1 Beton Talimatı TL.1 Concrete Instructions TL.2 Donatı Talimatı TL.2 Reinforcement Instructions TL.3 Kırık Talimatı TL.3 Formwork Instructions TL.4 Isılatma Talimatı TL.4 Isolation Instructions TL.5 Yalıtım Talimatı TL.5 Brick Instructions TL.6 Nakle Talimatı TL.6 Scaffolding Instructions	FL.11 Proje İş Planı FL.11 Project Schedule FL.9 Proje Gönüllü Raporu FL.9 Project Daily Report FL.10 Proje Sonuç Raporu FL.10 End of Project Report TL.1 Beton Talimatı TL.1 Concrete Instructions TL.2 Donatı Talimatı TL.2 Reinforcement Instructions TL.3 Kırık Talimatı TL.3 Formwork Instructions TL.4 Isılatma Talimatı TL.4 Isolation Instructions TL.5 Yalıtım Talimatı TL.5 Brick Instructions TL.6 Nakle Talimatı TL.6 Scaffolding Instructions	Completing projects on schedule Completing projects with the planned team Completing projects with planned equipment Completing projects within the completed budget	100%	100%	08.09.2023		
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Figure 6.16: Process performance report.

6.2.7 Customer Evaluation Report

Which clauses of ISO 9001 Standard does it comply with?

9.1.2 -Customer Feedback

This clause requires the collection and analysis of customer feedback to assess customer satisfaction. Customer satisfaction surveys can be used as part of the process of gathering and analysing customer feedback [26]-[29].

9.3.2 Monitoring and Measuring Process Performance

This clause specifies the requirements for monitoring and measuring the performance of processes within the organization. Customer satisfaction surveys can be utilized to evaluate the effectiveness of processes and customer satisfaction [26]-[29].

10.2.1 Customer Satisfaction

This clause mandates the organization to monitor, measure, and improve customer satisfaction. It can be used to meet these requirements [26]-[29].

Customer satisfaction surveys can be an effective tool to support the customer-focused approach of ISO 9001 and contribute to the organization's continuous improvement efforts. However, it is important to design, implement, and analyse surveys properly. Additionally, creating action plans based on survey results to provide the organization with the appropriate level of information and guide improvement activities is essential.

A customer satisfaction survey serves as a tool to measure and understand the level of satisfaction of a business or organization's customers. Such surveys are typically used for the following purposes:

Measuring Customer Satisfaction: Surveys are used to determine the thoughts and satisfaction levels of existing customers regarding your products or services.

Gathering Customer Feedback: Surveys help in collecting customers' opinions, expectations, and suggestions related to your products or services.

Identifying Issues and Complaints: Customer satisfaction surveys are used to identify customer complaints and potential problems early on, allowing for quick intervention.

Identifying Improvement Opportunities: Survey results can help identify deficiencies or opportunities for improvement in your products or services.

Enhancing Customer Loyalty: Improving customer satisfaction is essential to increasing customer loyalty and encouraging repeat sales. Surveys can contribute to this.

Competitive Analysis: Customer satisfaction surveys can help you compare your performance with competing businesses and understand how you fare against industry standards.

Contributing to Decision-Making Processes: Survey results can be used to shape business strategies, product development, and marketing campaigns.

Customer satisfaction surveys help businesses adopt a customer-centric approach and enable them to provide better services by evaluating customer feedback.

In this study, the customer satisfaction assessment survey provided below has been used. This form, prepared in the Google Drive system, serves the following purposes:

- Gathering customer information in specific formats.
Measuring customer satisfaction in specific areas using predefined questions under specific headings, both quantitatively and qualitatively.
- Determining how and why customers reached out to the company with checkboxes.
- Obtaining general comments and feedback from customers about the company through a comment section.

The identified advantages of using the Google Drive system.

- Assisting in Customer Data Entry with Predefined Formats: Google Drive assists in customer data entry by providing predefined formats such as text, date, phone number, and email, thereby preventing erroneous data entry.
- Guiding Customers to Numeric Selections from 1 to 5 during the Evaluation Stage: This ensures the collection of accurate and complete numerical data. The obtained numerical data can be instantly rated in the data stage after recording.

- Analysing Customer Preferences Based on Restricted Data Using Checkbox:
General evaluations can be made based on restricted data using checkboxes, allowing for the analysis of customer preferences.

The system cannot be directly shared with customers; therefore, the form can only be shared with customers in Excel or PDF format. The form filled out by the customer does not go directly into the system; it needs to be transferred by a staff member. This can be noted as a disadvantage of the system.

The identified disadvantages of using the Google Drive system.

Nothing.

An example is shared in the **Figure 6.17**.

MÜŞTERİ MEMNUNİYET ANKETİ		Dokuman : FR.1	
CUSTOMER SATISFACTION SURVEY		Yayın Tarihi: 08.11.2022	
		Revizyon T: 01.02.2023	
		Revizyon N: 1	
Anket tarihi: 16.07.2023			
Firma: -			
Ad-Soyad: -		Görev: -	Arsa Sahibi
Adres: -			
Telefon: -		E-mail: -	
5: ÇOK İYİ VERY GOOD	4: İYİ GOOD	3: ORTA STANDARD	2: YETERSİZ INSUFFICIENT
		1: KÖTÜ BAD	
İLETİŞİM CONTACT		DEĞERLENDİRMENİZ EVALUATION	
1. Yetkililerine ulaşabilme kolaylığı / Ease of access to the authorities		5	
2. Personelinin tutum ve ilgisi / Attitude and attention of staff		5	
3. Zamanında ve yeterli bilgi verilmesi / Providing timely and sufficient information		4	
ÜRÜN / HİZMET PRODUCT / SERVICE			
4. Ürün/hizmet Entegresi / Product / service Intagrement		4	
5. Ürün/hizmet fiyatı / Product / service price		4	
6. Zamanında teslim / Timely delivery		4	
7. Projeye uygunluk / Eligibility to the project		5	
TESLİMAT SONRASI HİZMET SERVICE AFTER DELIVERY			
8. Satış sonrası problem ve şikayetleri iletebilme imkanı / Possibility to convey problems and		5	
9. Problem ve şikayetlere cevap alma hızı / Speed of response to problems and complaints		5	
10. Şikayet ve problemlerin ortadan kaldırılması / Elimination of complaints and problems		4	
GENEL GENARAL			
11. Şirketimizden memnun kaldınız mı? / Are you satisfied with our company?		5	
12. Şirketimizle yeniden çalışmayı düşünür müsünüz? / Would you consider working with our company		5	
Şirketimize nasıl ulaştınız? / How did you reach our company?		Şirketimize nasıl ulaştınız	
1. Web Sitesi Website ☐	2. Referanslar Reference ☒	3. Basın Media ☐	4. Fuar Organizati ☐
Şirketimizle çalışmanıza aşağıdakilerden hangisi ya da hangileri etkili olmuştur / Which or which ones have been effective on your work with our company?			
1. Kalite Quality ☐	2. Referans Reference ☒	3. Güven Confidence ☒	4. Fiyat Price ☐
		5. AR-GE R-D ☐	
Anketimize katıldığınız için teşekkür ederiz. Görüş ve düşünceleriniz bizim için değerlidir ve size daha iyi hizmet verebilmek için değerlendirilecektir. Anket haricinde bize iletmek istediğiniz düşünceler varsa lütfen aşağıda sizin için ayrılan anket harici notlar bölümünü doldurunuz. Thank you for taking our survey. Your opinions and thoughts are valuable to us and will be evaluated to serve you better. If there are any thoughts you would like to convey to us other than the survey, please fill out the survey external notes section below.			
Anket harici notlar : Other notes			

TEMİZLE
CLEAR

KAYDET
SAVE

Figure 6.17: Customer evaluation report.

7. FINDINGS AND DISCUSSION

Within this thesis, the Quality Management System prepared on Google Drive has been examined, and it has been assessed whether the expected advantages are met and whether the identified disadvantages have been eliminated.

Firstly, the advantages foreseen in section 5 will be evaluated, and it will be assessed whether these advantages have been achieved. If they have been achieved, how they were achieved will be discussed. If they have not been achieved, the reasons for not achieving them will be analysed with examples.

Foreseen disadvantages will also be evaluated, and an assessment will be conducted to understand why these disadvantages could not be mitigated.

7.1 Examining the Realization Status of the Expected Advantages from the System.

The expected result, Cost Efficiency

Result: In the short term, when looking at the system established through Google Drive, there are no software or hardware costs. Furthermore, since no custom software is installed, and the system infrastructure relies on office programs, providing in-house training for program usage is sufficient. Additionally, it does not generate consultancy or external training fees. When examined in the long term, automatic record-keeping, shared electronic system usage, document linking, rule creation within documents, and data evaluation formula assignment reduce labour, paper usage, and resource costs in the long run. Ali et al. (2013) also mentioned that cost efficiency is a critical parameter for QMS [18]-[25].

For example, taking the issue of tracking current documents, in a manual system, it is necessary to track the validity of every updated document, including the processes involved. Updating document information must be recorded in the document tracking list, outdated documents must be withdrawn from use, and new documents must be published. In a manual system, monitoring all these steps requires staffing and can also lead to paper consumption. In this system, tracking electronically reduces paper

consumption, and automatic tracking and updates eliminate the need for personnel to perform these tasks.

The expected result, Simplicity:

Result: Since the system is established through Google Drive, there has been no need for additional software or hardware. The existing staff, being proficient in office programs, did not face any difficulties in adapting to this system. In-house training provided by the company has been sufficient for system usage [18]-[25].

The expected result, Customization and Integration

Result: All processes, forms, lists, diagrams, attachments, instructions, etc., related to the system have been custom prepared for the company's needs on Google Drive. Any necessary changes can easily be reflected in the system when identified [18]-[25].

The expected result, Training and Awareness:

Result: Since no software is purchased, there is no reliance on an external company for system setup and updates. Revisions within the system are carried out by competent personnel within the company. Therefore, when it comes to system updates, competent personnel can directly engage with the system, and other personnel can also contribute actively by conveying their ideas to the competent personnel regarding document and process creation. Additionally, the direct involvement of personnel in the system leads to more efficient training and increased awareness [18]-[25].

The expected result, Independence:

Result: There is no dependency on a specific software system, so there is no issue with losing access to the system due to a service provider's system failure. System-related problems would only occur if there were a global issue with Google's services [18]-[25].

The expected result, Reduced Human Errors:

Result: Regarding data entry, only the cells where data should be entered are left open, while the rest of the cells are protected to prevent erroneous data entry. Additionally, the cells where data entry is required have been formatted according to the type of data

(text format, date format, numeric format, etc.). This way, the system will not allow personnel to enter data in an incorrect format [18]-[25].

Furthermore, in cells with limited alternatives for data entry, entries have been designated as multiple-choice. This ensures both standardization and prevents incorrect data from being entered.

For example, when considering the NCR form: Cells for items like approval date and closing date are formatted in date format. Thus, even if personnel attempt to enter incorrect data other than dates in these cells, the system does not allow it.

Moreover, in the section where non-conformities are detected, independent data entry is not allowed. Instead, a dropdown list includes department names for selection. This prevents issues such as different naming conventions for the department. When all NCR owned by a department need to be reviewed, filtering this department is sufficient; additional searches for expressions representing the department are not required.

The expected result, Efficiency and Speed:

Result: Inter-document links, automatic data recording, and automatic data evaluations obtained through assigned formulas improve speed and efficiency [18]-[25].

The expected result, Reduced Documentation Intensity:

Result: Google Drive has simplified document management, reducing document intensity, while allowing the advantages of manual processes to remain robust and secure [18]-[25].

The expected result, Accurate Record Keeping

Result: Data validation and data selection methods have minimized record-keeping errors and omissions [18]-[25].

The expected result, Low Labor Costs

Result: Since data is directly filled and recorded in electronic format, there is no need for additional labour for data transfer [18]-[25].

The expected result, Enhanced Traceability / Facilitating Document Revisions and Updates:

Result: All documents' most up-to-date information is directly transferred to the LST.0 document tracking list. Additionally, as a feature of Google Drive, when activity information on a file is reviewed, it is possible to track when and by whom updates were made to the file [18]-[25].

The expected result, Data Analysis and Reporting Capabilities:

Result: Google Drive provides access to data for more in-depth analysis and the creation of customized reports [18]-[25].

The expected result, Accessibility and Availability:

Result: The system can be easily accessed from anywhere with an internet connection [18]-[25].

The expected result, Environmental Sensitivity:

Result: Using Google Drive has reduced paper consumption, contributing to environmental sustainability by minimizing waste and resource consumption [18]-[25].

The expected result, Shared Use of Resources:

Result: The advantage of multi-use and accessibility from anywhere with an internet connection enables the collaborative and efficient utilization of production and distribution resources such as materials, labour, machinery-equipment, and information between different regions and workplaces. For example, since the access work plan is accessible to all relevant personnel, if it is suitable according to access plans, the same equipment can be used by different projects [18]-[25].

The expected result, Real time analysis / information:

Result: Since data is up-to-date and instantly accessible, real-time data analysis is possible [18]-[25].

The expected result, No need for storage space:

Result: Since data is stored electronically, there is no need for physical storage space. Because physical storage is not involved, there is no risk of loss or damage due to physical storage conditions (humidity, pests, etc.) [18]-[25].

The expected result, Customer Satisfaction:

Result: Systematic structure, speed, ease of data access, and advanced data evaluation methods increase customer satisfaction [18]-[25].

The expected result, Limited Internet Access Sustainability:

Result: In cases such as internet outages, manually filled forms can be adapted to the system [18]-[25].

The expected result, Independence on Vendor:

Result: Since there is no need for a software company supplier for the system, there is also no vendor dependency [18]-[25].

7.2 Disadvantages Expected from Google Drive System

Security Concerns: Electronic documents are vulnerable to cyber threats and data breaches, requiring robust cybersecurity measures [18]-[25].

Integration Challenges: Integrating Google Drive System with existing systems can be challenging, potentially leading to compatibility issues [18]-[25].

Data Migration: Transferring existing manual records to Google Drive can be a cumbersome process [18]-[25].

When the mentioned disadvantages are examined, it is observed that the system was unable to overcome these disadvantages.

7.3 Additionally, the Disadvantages that were not Foreseen but Identified During System Usage are as Follows.

The lack of automatic management of the approval workflow: In this system, unlike EDMS, the approval workflow does not proceed sequentially to the relevant personnel as it is approved. The relevant personnel are required to continue with the

information filled out by the previous respondent. The inability to automate this routing makes organization and information forwarding processes more challenging.

Time-consuming selection and arrangement of flow symbols: When creating processes, the symbols that make up the processes need to be individually selected, their contents prepared, and their arrangements made manually. This extends the process creation time compared to EDMS and makes the process creation process more challenging.



8. CONCLUSION

The Google Drive-based Quality Management System examined in this thesis provides an organization with effective management of its quality processes through various advantages and disadvantages.

Firstly, the realization status of the expected advantages from the system has been assessed. In terms of cost efficiency, in the short term, there are no software or hardware costs, while in the long term, advantages in automatic record-keeping, shared electronic system usage, and document management have contributed to cost efficiency by reducing labour, paper usage, and resource costs.

The simplicity experienced in system setup, owing to it being conducted through Google Drive and requiring no additional software or hardware, coupled with the expertise of the staff in office programs, facilitated the adaptation process. Regarding customization and integration, all processes in the system have been pre-prepared to meet the company's needs, allowing for easy reflection of changes in the system.

In terms of training and awareness, the absence of software purchase and revisions being conducted by competent personnel within the company have provided independence and more effective training opportunities. The lack of dependency on a specific software system has eliminated the issue of access loss due to system failure.

To reduce human errors, protection measures for data entry and standardization in cells with limited alternatives have minimized incorrect data entry. However, despite these advantages, solutions to the security concerns, integration challenges, and data migration disadvantages mentioned in the thesis have not been provided. Additionally, unforeseen disadvantages such as the "lack of automatic management of the approval workflow" and "time-consuming selection and arrangement of flow symbols" have been observed.

In conclusion, the Google Drive-based Quality Management System stands out with advantages such as cost efficiency, simplicity, customization, training, independence, and error reduction. However, careful evaluation and improvement processes are required, especially in areas like security, integration, and data migration.

Organizations should consider both the advantages and disadvantages when choosing this system and make improvements when necessary.



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BIOGRAPHY

Gözde ALNIAÇIK KAHYA started her undergraduate studies in 2009 at Yıldız Technical University, Faculty of Civil Engineering, Department of Civil Engineering, and successfully graduated in 2014. In 2017, she started her graduate studies at Gebze Technical University, Institute of Science and Technology, Department of Civil Engineering. Since 2014. She has been working as a Quality Engineer and Quality Manager in the field of Quality Control and Quality Assurance. Since 2023, she has been continuing her career as a Lead Auditor in this field. Additionally, she has been working as a Structural Project Engineer since 2023. In this section author should include the full Name and Surname, graduation year for B.Sc. and M.Sc. (if exists). Other information's such as high school education, professional experiences, rewards, scholarships, patents etc. can be given optionally.



PUBLICATIONS AND PRESENTATIONS FROM THE THESIS

Gözde ALNIAÇIK KAHYA (Yüksek Lisans Öğrencisi) Gebze Teknik Üniversitesi, Fen Bilimleri Fakültesi, Deprem ve Yapı Mühendisliği Bölümü, Gebze, Kocaeli Doç. SEVİLAY DEMİRKESEN Gebze Teknik Üniversitesi, Fen Bilimleri Fakültesi, Deprem ve Yapı Mühendisliği Bölümü, Gebze, Kocaeli, January 13-14, 2024 Mersin -Türkiye 5. INTERNATIONAL MEDITERRANEAN CONGRESS INVESTIGATING THE EFFICIENCY OF ISO 9001 STANDARDS FOR THE CONSTRUCTION OF REINFORCED CONCRETE BUILDINGS

