

**PROCESS ANALYSIS AND IMPROVEMENT IN QUALITY  
MANAGEMENT SYSTEMS**  
**(A CASE STUDY IN AN ALUMINUM PRODUCTION COMPANY)**

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**ABSTRACT**

Today, the ability of enterprises operating in the manufacturing sector to achieve sustainable competitive advantage is directly related not only to production capacity but also to the degree of effectiveness with which they implement quality management systems. Rising customer expectations, intensified global competition, and technological developments have directed enterprises toward more systematic, traceable, and continuously improvable management models. In this regard, the Quality Management System (QMS) has become a strategic management approach for standardizing processes, reducing error rates, increasing customer satisfaction, and improving operational efficiency.

The aluminum production sector is of critical importance in terms of quality management, as it supplies products to high-precision fields such as automotive, defense, energy, aerospace, and machinery manufacturing. Dimensional errors, surface defects, or process irregularities that may occur during production directly affect not only product performance but also customer confidence and the competitive strength of the enterprise.

This study examines quality management system practices implemented in a sample aluminum production enterprise, evaluating documentation standardization, establishment of quality control points, and 5S practices. Additionally, the current structure of the organization was analyzed through SWOT analysis, root cause analyses, and performance evaluations.

As a result of the work carried out, it was determined that processes became more

systematic, quality control activities were strengthened, and a significant increase in operational efficiency was achieved. Notable improvements in quality performance were obtained, particularly through workplace organization practices, digital record systems, standard work instructions, and 5S applications. As seen in the figures/graphs, non-conformance rates decreased, while 5S performance scores showed a significant increase.

**Keywords:** Sustainable competitive advantage, Quality Management System (QMS), Aluminum production, Process standardization, Quality control points, 5S practices, Documentation standardization, Operational efficiency, Non-conformance rates, Customer satisfaction, SWOT analysis, Root cause analysis.

## INTRODUCTION

Globalization, digitalization, and increasing customer expectations have significantly changed the understanding of quality in the manufacturing sector. Today, quality is no longer merely a matter of inspection activities carried out at the end of production; it is regarded as a strategic approach requiring all processes of an enterprise to be managed in a planned, standardized, and sustainable manner.

Quality management becomes particularly more critical in the aluminum production sector. This is because non-conformities occurring in production processes can directly affect product quality, delivery performance, and customer satisfaction. Furthermore, disorganized workplace structures, inadequate traceability systems, and non-standard practices reduce operational efficiency. Therefore, production processes need to be managed systematically and quality control mechanisms strengthened.

The Quality Management System (QMS) transforms quality from an element inspected only during final control into a natural output of processes. Through the process approach, continuous improvement mindset, data-driven decision making, and standardized operational structures, enterprises can reduce error rates and optimize resource utilization.

Within the scope of this study, quality management system practices implemented in a sample aluminum production enterprise were examined, and the effects of the improvement activities on organizational performance were evaluated.

## 1. QUALITY MANAGEMENT SYSTEM AND ITS BASIC STRUCTURE

The Quality Management System (QMS) is a systematic management approach that enables organizations to manage their processes in a planned, controlled, and continuously improvable manner in order to achieve their quality objectives. Today, the understanding of quality encompasses not only product quality but also process performance, employee involvement, customer satisfaction, and sustainable development.

The primary objective of QMS implementations is to transform quality from an element inspected at the final control stage into the natural outcome of all processes. Accordingly, the definition of processes, establishment of performance criteria, implementation of traceability systems, and execution of continuous improvement activities constitute the fundamental building blocks of a quality management system.

In manufacturing enterprises, the creation of standard work instructions, determination of quality control points, and effective use of measurement systems are of great importance for quality performance. Furthermore, digital record systems enable production processes to be traced retrospectively and facilitate faster root cause analysis of non-conformities that occur.

Figure 1 illustrates the structure of process interactions within the organization. The figure shows that procurement, production, quality control, warehouse management, and shipping processes are directly interconnected with one another. In addition, support processes such as maintenance and repair, human resources, training, and information technology support operational activities. Through the process approach, coordination across the organization is strengthened, and process standardization is achieved.

Performance measurement also plays an important role in quality management systems. Indicators such as production efficiency, error rates, customer complaints, and the number of non-conformities are used to evaluate process performance. Thanks to a data-driven management approach, enterprises can identify problems more quickly and plan improvement activities more effectively.

## 2. CASE ENTERPRISE APPLICATIONS

The case enterprise examined within the scope of this study operates in aluminum extrusion, machining, assembly, and surface treatment processes. The enterprise carries out production for the automotive, defense industry, and energy sectors.

Initial site inspections revealed documentation deficiencies, disorganized workplace structure, non-standard practices, and coordination problems between processes. Furthermore, it was observed that quality control activities were not sufficiently systematic and that processes were largely carried out based on employee experience.

### 2.1.SWOT ANALYSIS

A SWOT analysis was conducted to evaluate quality management system practices at the enterprise. According to the analysis results, one of the enterprise's strengths is its experienced workforce. When examining weaknesses, documentation deficiencies, processes being carried out depending on individuals, and the inability to fully ensure sustainability in 5S practices stand out. Among the opportunities, the development of digital traceability systems and the expansion of lean manufacturing applications come to the forefront. Within the scope of threats, failure to sustain process discipline, unplanned production changes, and audit non-conformities were assessed as significant risks.

Table 1 presents a detailed evaluation of the SWOT analysis, indicating that process standardization and digitalization are strategic elements that can enhance enterprise performance.

S	W	O	T
Strengths (Güçlü Yönler)	Weaknesses (Zayıf Yönler)	Opportunities (Fırsatlar)	Threats (Tehditler)
EİP altyapısının mevcut olması	Dokümantasyon altyapısının yeterli olmaması	ISO sistemlerinin Kaizen ile güçlendirilmesi	Kaizen çalışmalarının süreklilik kazanmaması riski
Tecrübeli ve süreçlere hakim üretim personeli	Dokümanların sahada etkin kullanılmaması	5S ile iş güvenliği risklerinin azaltılması	Dokümantasyon eksikliği nedeniyle denetim uygunsuzlukları oluşması
Üst yönetimin iyileştirme ve gelişime açık yaklaşımı	Dokümantasyon-uygulama uyumsuzlukları	Kaizen ve yalın üretim uygulamalarıyla kalite verimlilik artışı sağlanması	Planlı üretim değişikliklerinin süreç titizliğini bozması riski.
Kaizen ve 5S konularının birlikteliğinin olması	5S uygulamalarında sürdürülebilirliğin sağlanmaması	Dijital doküman yönetim sistemine geçiş imkânı	Proses disiplininin sağlanmaması durumunda fire ve personelin işleme oranlarının artması.
Sahada yüksek iyileştirme potansiyelinin bulunması	Kaizen çalışmalarının sistematik bir yapıya sahip olmaması	Standart iş ve genel yönetim uygulamalarında stabiliteyi sağlanabilirliği.	İyileştirme faaliyetlerinin takip edilememesi durumunda kazanımların kaybedilmesi riski.

Table 1

## 2.2. DOCUMENTATION STANDARDIZATION

Standardizing the documentation structure is of great importance for the sustainability of quality management system practices. Initial inspections revealed that procedures, work instructions, and record systems at the enterprise were not sufficiently systematic.

Within the scope of the work carried out, operational instructions, quality control forms, maintenance instructions, organizational charts, and process flow documents were prepared. Additionally, traceability forms were reorganized in order to standardize quality records.

Graph 1 illustrates the implementation stages of documentation processes. The graph shows that work instructions, procedures, quality records, and revision tracking systems were implemented in a phased manner. It was determined that, particularly with the introduction of procedures and control forms, process standardization increased and operational activities became more controlled. As a result of the work carried out, it was observed that tasks and responsibilities became clearer, information flow was conducted systematically, and operational error rates decreased.

## 2.3. QUALITY CONTROL POINTS

In the initial stage, it was determined that quality control activities were largely carried out at the final inspection stage, while in-process controls were not sufficiently systematic. This situation led to late detection of non-conformities and increased rework costs.

Within the scope of the work carried out, separate control criteria were established for raw material acceptance, machining, assembly, surface inspection, and final quality control processes. Furthermore, in-process quality control points were increased to enable early detection of non-conformities.

Quality control forms, measurement records, and process tracking charts were prepared, making quality control activities more standardized and measurable. As a result of the implemented practices, it was determined that rework rates decreased and quality

performance became more controlled.

## 2.4. TRACEABILITY AND NON-CONFORMITY MANAGEMENT

In order to ensure the effective execution of traceability and non-conformity management processes, process-based record systems were established. Thus, in the event of any non-conformity, it became possible to systematically analyze through which processes the product had passed.

For the purpose of improving measurement systems, regular calibration processes were established for calipers, micrometers, and hardness testing devices. Additionally, measurement results were ensured to be evaluated according to standard quality criteria.

Within the scope of non-conformity management, Fishbone (Ishikawa) and 5 Whys analyses were applied. As a result of the analysis, the root cause of the problem was determined to be "inadequate mold maintenance processes." Within the scope of corrective actions taken, periodic maintenance plans were established, process parameters were standardized, and operator training was increased.

Graph 2 shows that non-conformity rates steadily decreased throughout the year 2024. The total non-conformity rate, which was at 12% in January, decreased to 6% in June. Significant improvements were achieved particularly in surface defects and hardness value non-conformities. Graph 3 shows the distribution of defect types, indicating that production defects have the highest share at 40%.



Graph 2



Graph 3

## 2.5.WORKPLACE ORGANIZATION AND 5S APPLICATIONS

Initial site inspections revealed disorganized layouts, uncontrolled material flow, and inadequate visual management practices in the production areas. Accordingly, the production floor was reorganized, and walkways and storage areas were standardized.

Within the scope of visual management practices, forklift routes, quality control zones, and raw material areas were clearly demarcated with floor markings. This ensured that material movements were carried out in a more controlled manner.

Within the scope of 5S applications, the stages of Sort (Seiri), Set in Order (Seiton), Shine (Seiso), Standardize (Seiketsu), and Sustain (Shitsuke) were systematically implemented. As a result of the audits conducted, the total 5S score was determined to have increased from 71 to 116, representing an overall improvement rate of 63.38%. As a result of workplace organization practices, material mix-ups decreased, operational discipline was strengthened, and positive improvements in occupational safety performance were achieved.

## CONCLUSION

Within the scope of this study, quality management system practices implemented in a sample aluminum production enterprise were examined, and the effects of the improvement activities on organizational performance were evaluated.

In line with the findings obtained, it was determined that documentation standardization, establishment of quality control points, digital traceability systems, non-

conformity management, and 5S applications had directly positive effects on process performance. In particular, the reductions in non-conformity rates and increases in 5S performance, as seen in the graphs, indicate that the activities carried out enhanced operational efficiency.

In conclusion, it has been assessed that quality management systems are not merely about quality control activities, but rather a strategic management approach that directly affects organizational culture, process reliability, employee performance, and customer satisfaction. It is concluded that quality management system practices are of critical importance for sustainable growth and competitive advantage, especially for enterprises operating in the aluminum production sector.

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