Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 10, October - 2025

Design and Implementation of an Integrated Quality Management System using SAP QM

Kesava Immidi, Kalpak Chaudhari, Shirish Mane

Abstract
This paper presents the design and implementation of an Integrated Quality Man- agement System (IQMS) leveraging the SAP Quality Management (QM) module. The objective was to establish a centralized, automated, and analytics-driven framework for managing quality processes across procurement, production, and maintenance. Prior to implementation, the organization faced challenges including inconsistent inspection meth- ods, delayed defect resolution, limited audit traceability, and absence of real-time insights. The proposed solution integrates SAP QM capabilities such as quality planning, au- tomated inspections, defect management, and audit standardization into a unified frame- work. Real-time dashboards and reporting tools provide actionable insights that support proactive decision-making. Results indicate improvements in inspection accuracy, defect resolution speed, audit compliance, and organizational responsiveness. The system also fostered accountability and continuous improvement, demonstrating that SAP QM can evolve from a compliance-focused tool into a strategic enabler of operational excellence.

***Keywords*: SAP QM, Integrated Quality Management System, Defect Management, Audit Automation**

CONTENTS

IJERTV14IS100014

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 10, October - 2025

1 INTRODUCTION

Quality management has become a critical determinant of competitiveness and compliance readiness in our company. Before implementation, we relied heavily on spreadsheets and man- ual inspections, which often led to inefficiencies, lack of traceability, and delayed defect res- olution. To overcome these challenges, we implemented an Integrated Quality Management System (IQMS) built on SAP QM.

Our IQMS embeds quality processes across procurement, production, inventory manage- ment, warehouse management and customer returns, ensuring consistency and accountability throughout the value chain. By integrating automation and real-time analytics, the system provides end-to-end visibility, supports proactive decision-making, and strengthens both com- pliance readiness and operational excellence.

2 LITERATURE REVIEW

The integration of Quality Management (QM) processes within Enterprise Resource Planning (ERP) systems has been a growing area of research, motivated by the need to enhance oper- ational efficiency, compliance, and decision-making. The academic discourse broadly confirms that embedding QM into ERP platforms provides organizations with a structured, data-driven framework for improving both process reliability and overall performance.

Several studies highlight the organizational impact of ERP-based quality management. Ce- bekhulu and Ozor [1] applied Structural Equation Modeling to public-sector organizations and found that while traditional QM practices indirectly influence performance, ERP systems exert a more direct and measurable effect. This suggests that the underlying technology platform itself is a key driver of efficiency gains.

Similarly, a study published in *Emerald Insight* [2] emphasized how ERP's centralized data model supports inspection, control, and cost tracking, while simultaneously capturing data for advanced analytics. This dual role of control and data capture is consistently identified as a core value of ERP-enabled QM.

At the architectural level, research has proposed design principles for integrated systems. Li [3] explored the fusion of ERP with Statistical Process Control (SPC), outlining functional module design for robust ERP-based quality systems. This work provided early blueprints for embedding specific quality methodologies directly within enterprise systems.

Expanding on this, Balić [4] introduced a theoretical model framing ERP system qual- ity as a dynamic organizational capability. His framework demonstrated that system qual- ity—measured through information, system, and service dimensions—can directly enhance both financial and non-financial performance.

Emerging scholarship extends the discussion toward predictive and intelligent quality man- agement. Ji [5] proposed Bayesian and simulation-based decision support embedded within QMS frameworks, positioning data analytics as a pathway to predictive quality intelligence. Such work reflects a shift from reactive defect handling toward proactive, data-driven preven- tion.

While these studies provide theoretical insights and quantitative models, much of the lit- erature remains either industry-specific or limited to partial aspects of QM–ERP integration. A clear gap exists for comprehensive case-based analyses that demonstrate the full lifecycle of an integrated SAP QM implementation—from system architecture and phased deployment to the measurement of tangible performance outcomes in industrial settings. This paper addresses that gap by presenting a practical case study, supported by real performance data and a layered architectural framework, that illustrates how SAP QM can evolve from a compliance tool into a strategic enabler of operational excellence.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 10, October - 2025

3 PROBLEM STATEMENT

Before we implemented IQMS, our company faced several challenges in managing quality pro- cesses effectively:

- Unstructured quality control with inconsistent inspection methods across teams.
- Delayed defect resolution due to the absence of centralized tracking and visibility.
- Limited audit traceability and no integrated CAPA (Corrective and Preventive Actions).
- Lack of real-time insights, making it difficult to prioritize recurring issues.
- Non-standardized processes across different regions and product lines, leading to varia- tions in quality practices.

These challenges created inefficiencies, increased compliance risks, and raised operational costs due to recurring defects and inconsistencies across regions.

4 PROPOSED SOLUTION: INTEGRATED QUALITY MANAGEMENT SYS- TEM

To address these challenges, we designed and implemented an Integrated Quality Management System (IQMS) using SAP QM. The system was tailored to embed quality processes directly into our company's procurement, production, inventory management, and customer returns workflows. The solution was structured around the following interconnected modules, each addressing a complementary dimension of enterprise quality management:

4.1 Quality Planning

We established a structured foundation for inspections by defining inspection plans and mas- ter inspection characteristics (MICs). By linking these to SAP master data, we ensured that quality requirements remained consistent across materials, equipment, and suppliers. This elim- inated ad-hoc inspections and enforced a uniform baseline for quality measurement. Reusable inspection plans also reduced duplication and improved efficiency.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 10, October - 2025

4.2 Quality Inspection

Automated inspections were configured at critical control points, including goods receipt, in- process checks, and customer returns. The automatic creation of inspection lots improved compliance and traceability, removing reliance on manual triggers. By integrating inspections with procurement, production, and return processes, we ensured seamless alignment with both supply chain and customer-facing operations.

4.3 Defect Management

Defect handling was standardized through SAP QM notifications (QM01). Each defect was logged with a unique identifier and linked to equipment, supplier batches, or production lots. Standard defect codes and severity levels enabled faster categorization, escalation, and reso- lution, while providing traceability for root-cause analysis. Workflow-driven notifications also ensured accountability by automatically routing issues to responsible stakeholders.

Returned items underwent defect analysis and necessary repairs before being reintroduced into inventory. However, when a product was returned multiple times for the same issue, the system flagged it as a repeat offender and recommended scrapping to prevent recurring failures.

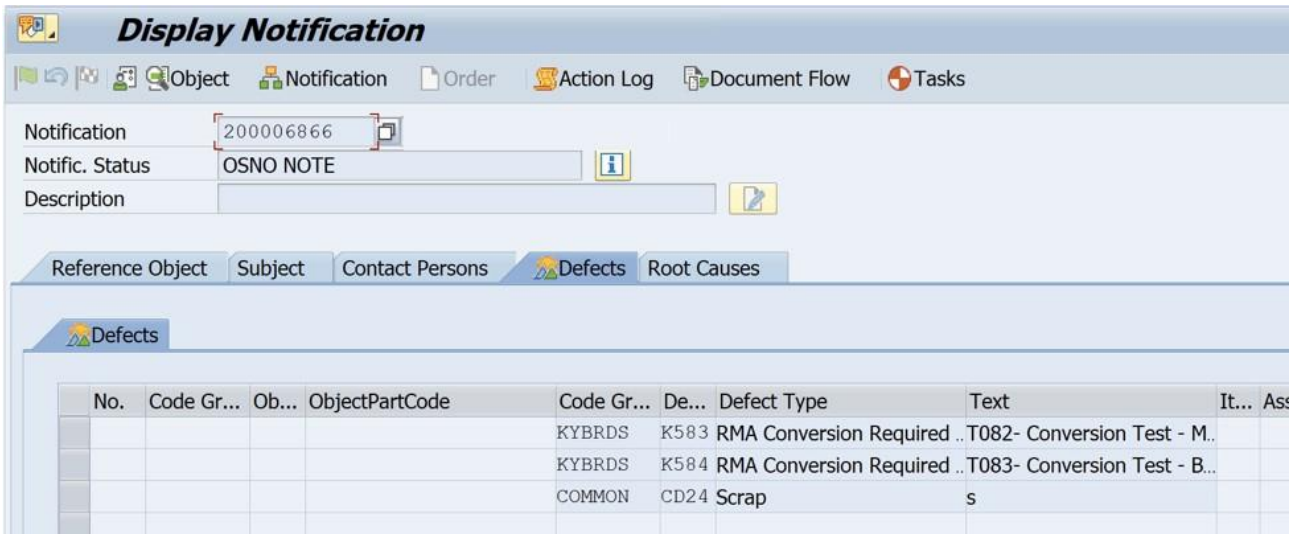


Figure 1: Quality Notification (QM01): Standardized defect logging with coding, severity, and links to equipment, supplier batches, or production lots.

4.4 Repairs Integration

Defects requiring corrective action were addressed through repair or rework activities directly managed within the IQMS framework. Once identified, defects were logged, analyzed, and routed for corrective action. Based on defect type and historical records, the system suggested possible repair actions, guiding technicians toward standardized and effective resolutions. Re- pair progress and history were tracked to ensure accountability, and completed repairs under- went re-inspection before items were cleared. This closed-loop cycle—from defect identification to repair verification—ensured that nonconforming products were not reintroduced into inven- tory without quality assurance.

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 10, October - 2025

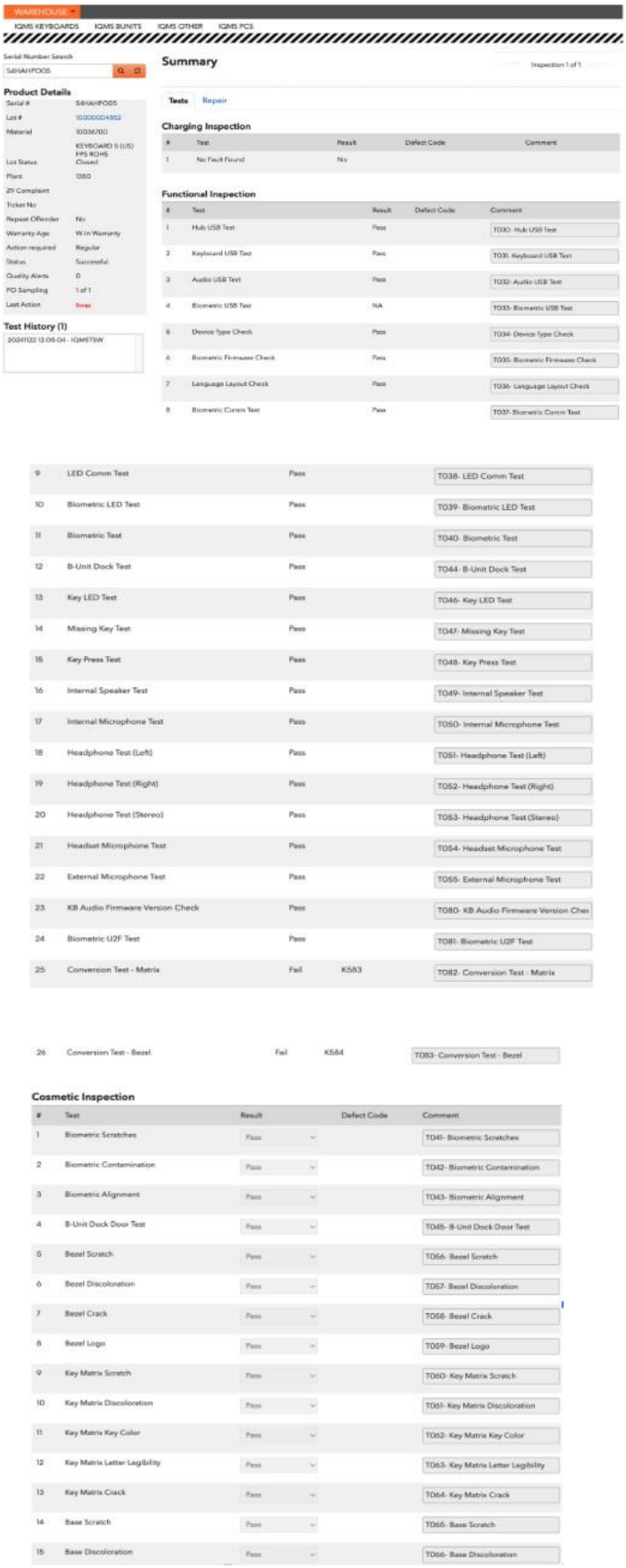


Figure 2: Defects & Repair: Closed-loop corrective workflow showing defect capture, system- suggested repair actions, and re-inspection before inventory return.

IJERTV14IS100014

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 10, October - 2025

4.5 Analytics and Reporting

The analytics layer transformed inspection, defect, and return data into actionable insights. Real-time dashboards highlighted defect trends, inspection performance, repair status, and audit compliance.

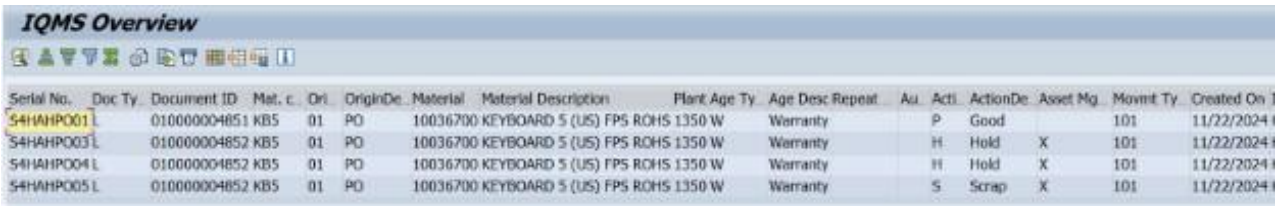


Figure 3: IQMS Overview Dashboard: Real-time KPIs for inspections, defect trends, re- turns analysis, repair turnaround, and audit status.

Managers could drill down by location, supplier, or product category, enabling proactive decision-making and fostering continuous improvement. Predictive insights further allowed us to anticipate recurring issues before they escalated, strengthening resilience and cost efficiency.

5 SYSTEM ARCHITECTURE

The architecture of our IQMS was designed to embed quality processes seamlessly across pro- curement, production, inventory management, and customer returns, while positioning SAP QM as the central quality hub. Figure 4 presents a layered view of the architecture.

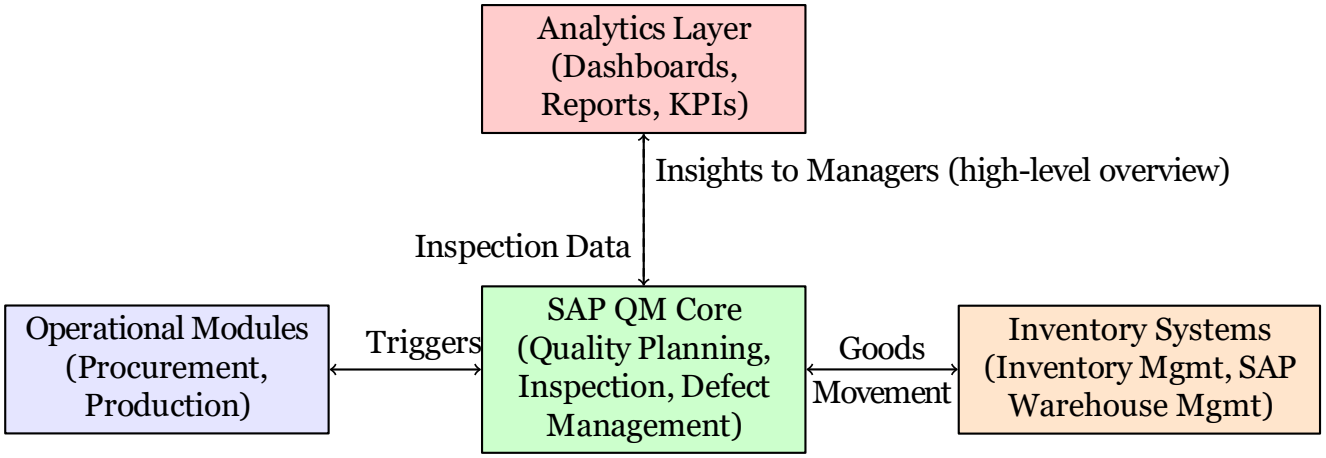


Figure 4: Revised Hub-and-Spoke Architecture of the IQMS with SAP QM Integration

This layered view highlights how:

- Users interact through inspection entry, defect logging, repairs, and audit review.
- Processes define checkpoints where quality integration occurs (procurement, production, inventory, and customer returns).
- SAP QM Core acts as the backbone for inspections, defect workflows, repairs, and quality audits.
- Inventory Systems (Inventory Management and SAP Warehouse Management) han- dle goods movement and ensure that repaired or quality-approved items are properly reintroduced into stock.
- Analytics Layer consolidates inspection and defect data into dashboards and KPIs, delivering actionable insights to managers for high-level decision-making.

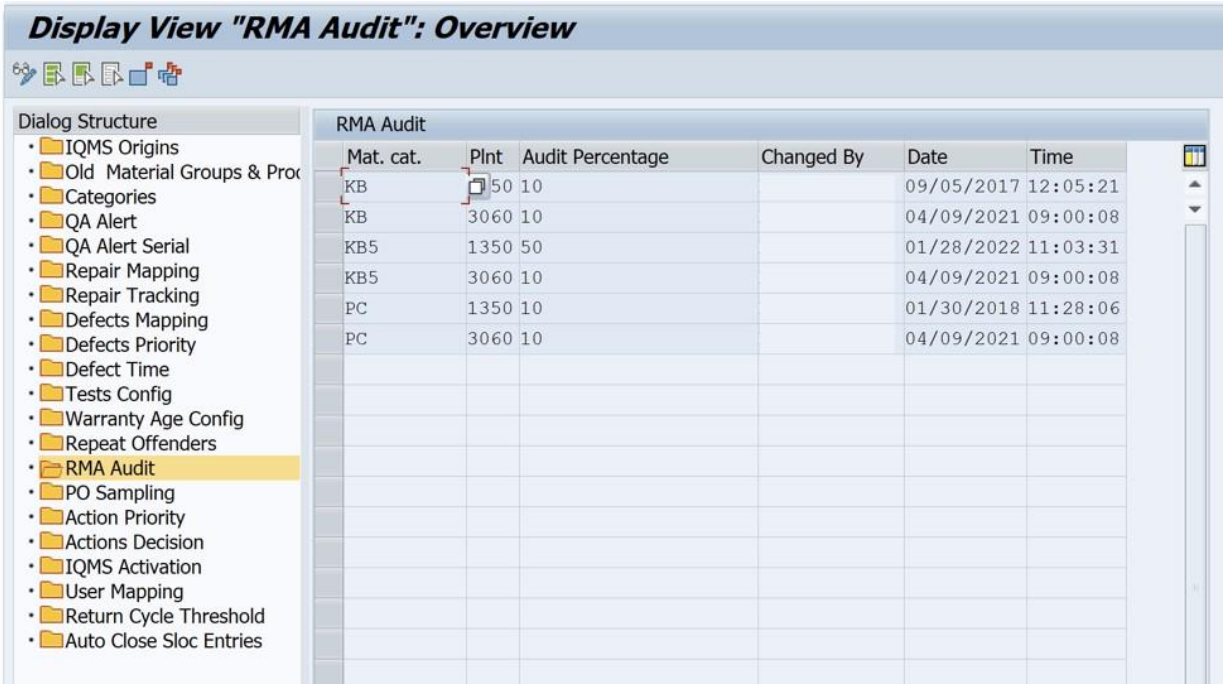
International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 10, October - 2025

6 METHODOLOGY AND IMPLEMENTATION

The implementation of the Integrated Quality Management System (IQMS) in our company followed a structured rollout strategy inspired by ERP deployment best practices. The project was executed over a 12-month period, during which system configuration, module integration, and analytics enablement were carried out in phased stages. Throughout the process, data was collected from system-generated logs, audit reports, and feedback sessions with key users across procurement, production, quality, and inventory teams.

6.1 Stage 1: Configuration

In the initial stage, we configured inspection types for goods receipt, in-process checks, and customer returns. Master Inspection Characteristics (MICs) were standardized and linked to material and equipment master data to ensure consistency across regions and product lines. Defect codes and severity levels were established to support structured categorization and reporting. Audit structures were formalized using predefined checklists and recurring schedules, aligning with ISO 9001 compliance requirements.



International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 10, October - 2025

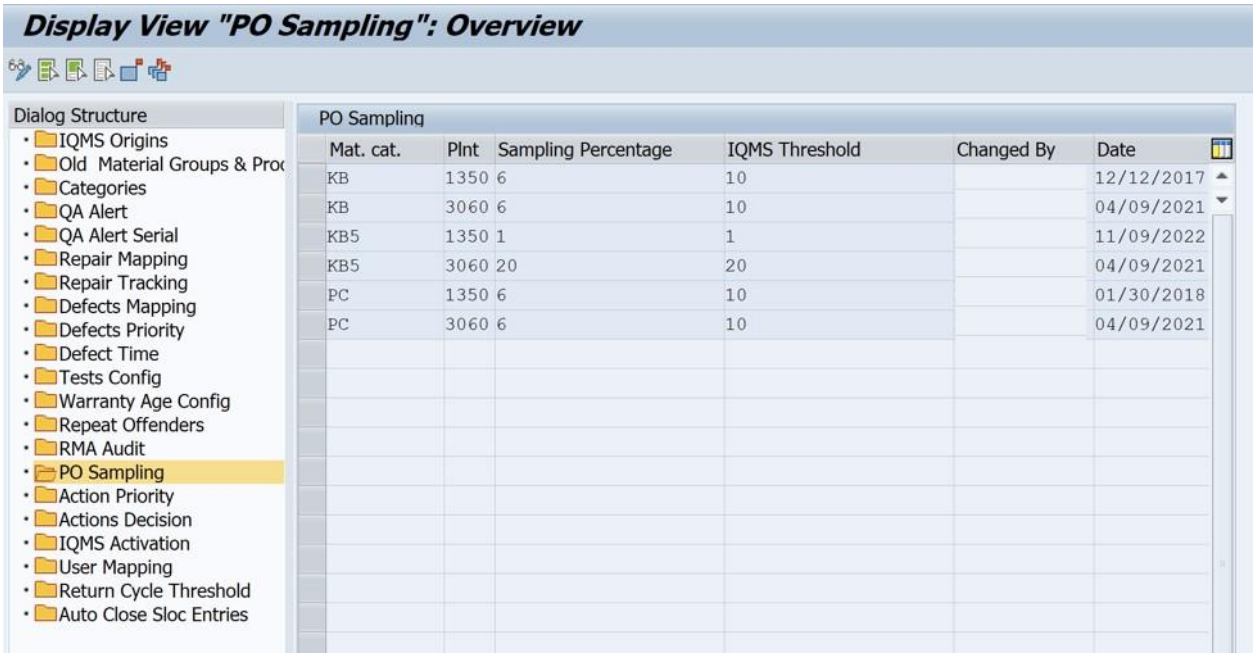


Figure 5: Configuration – Inspection Types & MICs: Standardized inspection types (GR, in-process, returns) and master inspection characteristics linked to material/equipment master data.

6.2 Stage 2: Integration

Next, SAP QM was integrated with the Procurement, Production, Inventory Management, and Warehouse Management modules. This ensured that:

- Inspections were automatically triggered at goods receipt, production checkpoints, and during customer returns.
- Defects logged in QM notifications (QM01) were tracked, analyzed, and routed for cor- rective repair or scrapping decisions before items were reintroduced into inventory.
- Real-time feedback loops connected quality, procurement, production, and inventory teams, fostering cross-functional collaboration and ensuring accountability for defect res- olution.

6.3 Stage 3: Analytics and Reporting

In the final stage, an analytics layer was deployed using embedded SAP reporting tools. To- gether with stakeholders, we defined key performance indicators (KPIs) such as inspection cycle time, defect resolution turnaround, audit closure rates, return frequency, and compliance adherence. Dashboards were customized to provide both high-level summaries for managers and detailed drill-down views by supplier, product, or defect type. Predictive analytics models were also piloted to identify repeat offenders and recurring defect patterns, enabling proactive decisions on repair or scrap.
By adopting this phased methodology, we minimized disruption to ongoing operations while steadily increasing system maturity, user adoption, and the overall effectiveness of quality management.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 10, October - 2025

7 RESULTS AND BENEFITS

The implementation of the Integrated Quality Management System (IQMS) in our company delivered measurable improvements across inspection accuracy, defect resolution, audit compli- ance, and decision-making speed. To assess impact, we compared performance data collected over six months prior to implementation with results from the six months following deployment.

7.1 Comparative KPI Improvements

Table 1: Pre- and Post-Implementation KPI Comparison

KPI	Before IQMS	After IQMS	Improvement (%)
Average inspection cycle time	10 hours	7 hours	-30%
Defect resolution turnaround	5 days	3 days	-40%
Audit closure timeline	15 days	9 days	-40%
First-pass inspection compliance	78%	91%	+17%
Cross-functional issue resolution meetings	12/month	7/month	-42%

7.2 KPI Visualization

To complement the tabular data, Figure 6 provides a visual comparison of our performance indicators before and after IQMS implementation.

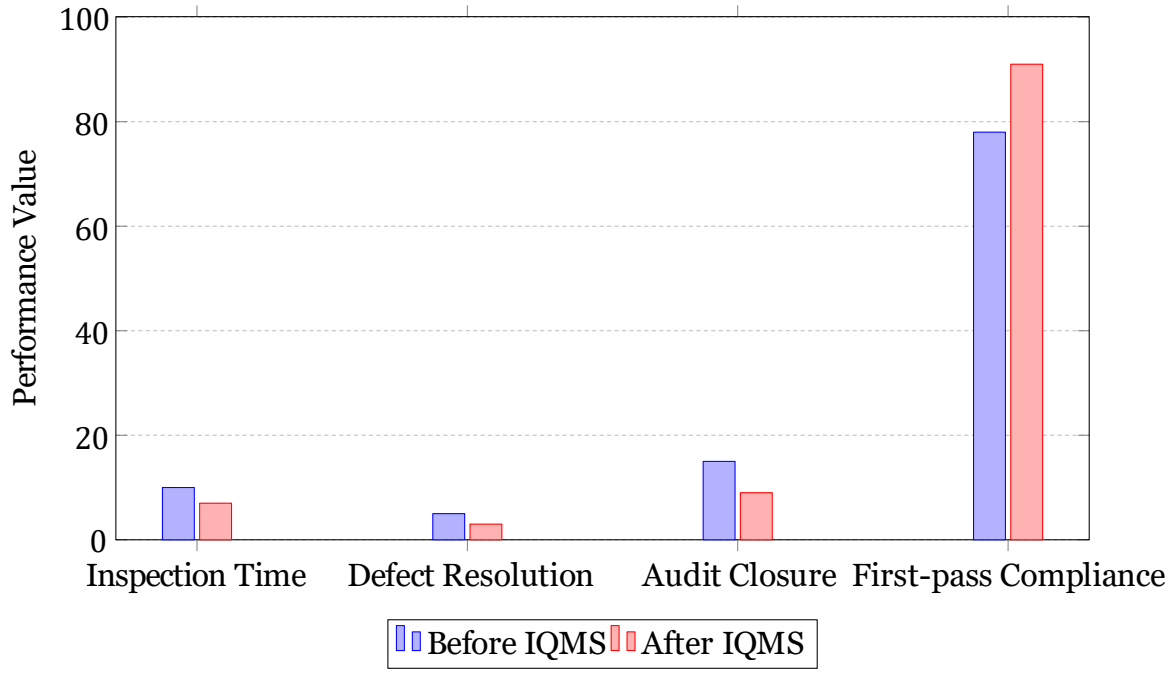


Figure 6: KPI comparison before and after IQMS implementation

The results clearly show that inspection and defect resolution times improved by 30–40%, audit readiness strengthened with a 40% reduction in closure timelines, and compliance scores increased significantly. The reduced number of cross-functional escalation meetings demon- strated smoother collaboration and faster resolution cycles.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 10, October - 2025

7.3 Visualization of Improvements

Figure 7 illustrates the downward trend in recurring defects after IQMS implementation, con- firming the effectiveness of our closed-loop defect management and repair cycle.

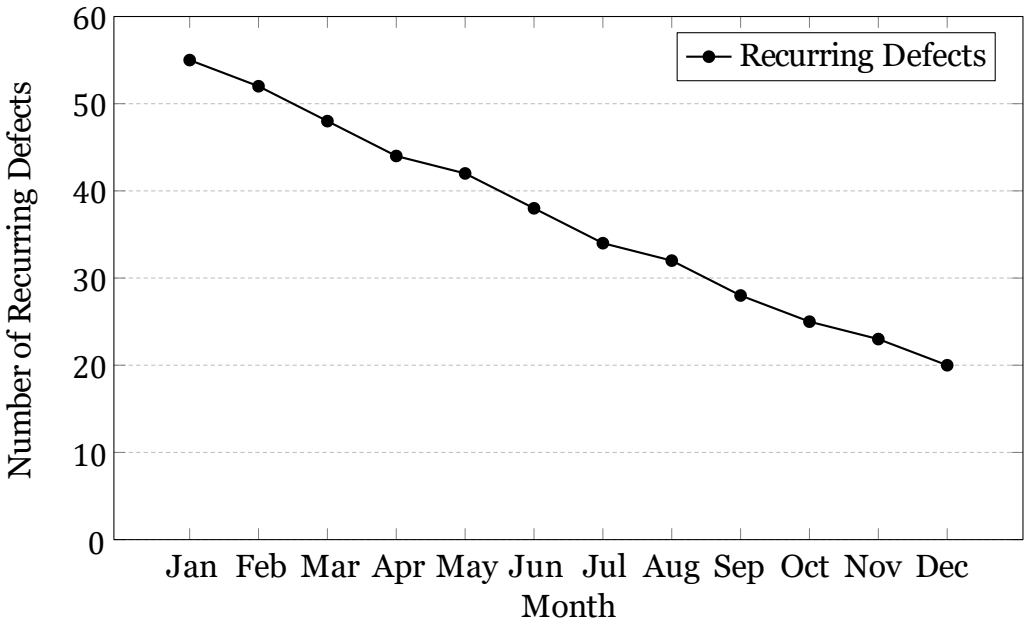


Figure 7: Trend of recurring defects before and after IQMS implementation

7.4 Summary of Benefits

From our implementation, the following benefits were realized:

- 30–40% reduction in inspection and defect resolution times: Automated inspec- tion lot creation, structured defect handling, and integration with inventory workflows reduced manual interventions and eliminated delays, ensuring faster issue resolution.

- Higher compliance readiness through standardized audits and traceability: Consistent audit processes with predefined checklists and digital CAPA tracking provided complete traceability and made ISO 9001 compliance more seamless. This significantly reduced preparation time and regulator follow-ups.

- Improved decision-making speed via real-time dashboards and predictive ana- lytics: Managers gained access to consolidated dashboards with KPIs covering inspection accuracy, repair turnaround, and return analysis. Predictive models flagged repeat of- fenders early, enabling us to make proactive repair-or-scrap decisions.

- Stronger cross-functional collaboration between procurement, production, qual- ity, and inventory teams: With integrated workflows, customer returns were system- atically inspected and either repaired or scrapped before re-entering inventory.

  This closed-loop cycle reduced handover delays and improved accountability across teams.

- Sustainable continuous improvement: Transparency in defect trends, repairs, and returns management enabled ongoing improvement. Automated workflows enforced ac- countability while analytics provided insights for process refinement, embedding continu- ous improvement in day-to-day operations.

Overall, the IQMS helped us transition from a reactive, compliance-driven approach to a proactive, analytics-driven, and strategically integrated quality management framework. It not only assured compliance but also created tangible business value through operational excellence.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 10, October - 2025

8 CONCLUSION AND FUTURE WORK

The implementation of the Integrated Quality Management System (IQMS) in our company demonstrated how SAP QM can transform quality management from a compliance-focused, reactive activity into a proactive and strategic capability. With IQMS, we achieved measurable improvements such as a 40% reduction in defect resolution times, faster audit closure, higher inspection accuracy, and stronger collaboration between procurement, production, quality, and inventory teams. By embedding quality processes across procurement, production, inventory management, and customer returns, SAP QM became a central enabler of operational excellence in our organization.

Beyond measurable KPIs, IQMS also fostered a culture of accountability and continuous improvement. The introduction of real-time dashboards and predictive insights empowered managers with data-driven decision-making capabilities, ensuring that recurring quality issues were anticipated and addressed early. The system shifted our quality management approach from corrective to preventive, building resilience and long-term competitiveness into our oper- ations.

FUTURE WORK

Looking ahead, we plan to further extend the value of IQMS through the following initiatives:

- AI-driven defect prediction: Leveraging machine learning models on historical defect data to forecast and prevent potential failures.
- IoT-enabled monitoring: Integrating sensor data to capture real-time quality param- eters from equipment and processes, enhancing early detection.
- Blockchain for supplier traceability: Establishing immutable quality records across our global supply chain to increase transparency and trust.
- Digital twins: Simulating production and return cycles to anticipate quality risks and optimize repair-or-scrap decisions.

In conclusion, the IQMS implementation using SAP QM provided us with a strong foun- dation for quality excellence. With future integration of AI, IoT, blockchain, and digital twin technologies, we aim to evolve our system into a fully intelligent, autonomous quality ecosystem that not only supports compliance but also drives strategic business value.

REFERENCES

[1] B. M. B. Cebekhulu and P. A. Ozor, "The influence of quality management and ERP systems on organisational culture and performance," Proceedings on Engineering Sciences, vol. 4, no. 1, pp. 41–50, 2022, doi:10.24874/PES04.01.007.

[2] J. Author (unknown), "Quality management based on ERP," Industrial Manage- ment & Data Systems, Emerald Insight, vol. 102, no. 1, pp. 52–60, 2002. doi:10.1108/02635570210415125.

[3] Y. Li, "Research and implementation of quality management system under ERP environ- ment," in IFIP International Federation for Information Processing, Vol 207, Advances in Production Management Systems, Springer, Boston, MA, 2006, pp. 497–502, doi:10.1007/0- 387-34403-9_78.

[4] M. Balić, "ERP quality and the organizational performance," Information, vol. 13, no. 10, art. 474, pp. 1–15, 2022, doi:10.3390/info13100474.

[5] X. Ji, "Simulation-based analytics for fabrication quality–associated decision support," arXiv preprint arXiv:1903.10565, pp. 1–12, 2019. Available: https://arxiv.org/abs/ 1903.10565.

[6] H. Bennani, J. Outseki, and M. Benhaddouch, "The influence of enterprise resource plan- ning systems on the management control function in large companies," Journal of Gover- nance and Regulation, vol. 13, no. 4, pp. 144–154, 2024, doi:10.22495/jgrv13i4art14.