Design and Implementation of a Training Compliance Dashboard for a Regulated Manufacturing Site

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Abstract *— This article presents the implementation of an automated dashboard for tracking training compliance in a regulated medical device manufacturing environment. The prior manual process based on Excel spreadsheets led to compliance risks and inefficiencies. The DMAIC methodology was applied to define the problem, measure baseline performance, analyze root causes, and implement improvements. A Power BI dashboard integrated with the Learning Management System (LMS) was developed to enable daily data refreshes, real-time monitoring, and proactive email alerts. Post-implementation data demonstrated a significant reduction in overdue trainings, with an average compliance rate of 99.5% and time savings of up to 90% for the Compliance team. The dashboard also increased accountability and audit readiness. This solution demonstrates how business intelligence tools can enhance quality systems and support proactive regulatory compliance in manufacturing operations.*

Key Terms *— Automation, Compliance Tracking, Dashboard, DMAIC, Training Management.*

PROBLEM STATEMENT

In the medical device manufacturing industry, maintaining training compliance is essential to ensure that all personnel are qualified to perform their assigned duties in accordance with regulatory standards. Agencies such as the U.S. Food and Drug Administration (FDA) and ISO 13485 require documented evidence of employee training and verification of training effectiveness. As a result, training compliance systems are critical not only for internal quality but also for external audit readiness.

At the manufacturing facility under study, training compliance was tracked through manual data extraction and maintenance in Excel spreadsheets. Compliance staff were responsible for extracting data from the Learning Management System (LMS), organizing training records, and identifying overdue or upcoming training requirements by performing manual calculations. This labor-intensive process lacked automation, real-time visibility, and proactive notifications. Consequently, overdue training cases frequently occurred, triggering escalations, deviation reports, and additional administrative burdens on managers and the Compliance team.

These inefficiencies highlighted the need for a more sustainable and reliable solution. The site's existing approach was reactive, with compliance issues often identified only after training deadlines had passed. Without system-driven alerts or centralized visibility, accountability was fragmented, and the risk of regulatory findings remained elevated. Additionally, the Compliance team spent 7–9 hours weekly maintaining the spreadsheet system, time that could otherwise be used for preventive quality activities.

To address this operational and compliance gap, a project was launched using the DMAIC (Define, Measure, Analyze, Improve, Control) methodology. The goal was to design and implement an automated dashboard integrated with the LMS using Microsoft Power BI. This dashboard would provide real-time training compliance metrics, generate automated alerts for upcoming expirations, and reduce manual effort. By transitioning to a digital, proactive system, the project aimed to strengthen audit readiness, improve accountability, and enhance efficiency across departments.

Research Timeline

The project was executed over a two-month period. In the first month, the focus was placed on evaluating the manual tracking process, collecting baseline data, and understanding the structure of training records available through the LMS. This phase also included early brainstorming sessions with key stakeholders to define the project's scope and critical needs. The second month centered on selecting the DMAIC methodology, developing dashboard prototypes, and testing LMS data connections within Power BI. A timeline overview is shown in Figure 1.

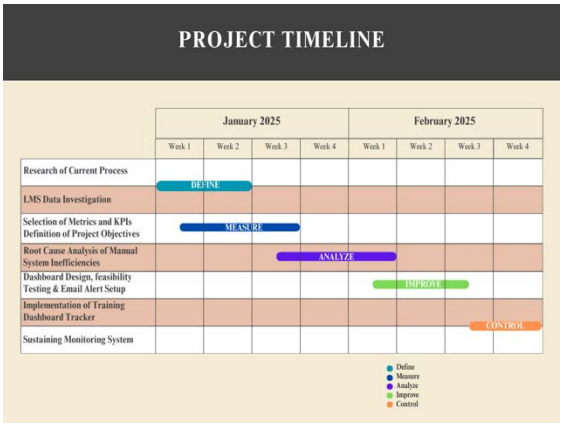

Figure 1
Project Timeline for Training Compliance Dashboard Project following DMAIC Methodology

Research Contributions

The application of the DMAIC methodology provided a structured and disciplined approach that was critical to achieving the project's objectives. Each phase—Define, Measure, Analyze, Improve, and Control—enabled the team to systematically identify inefficiencies in the manual training compliance process, design an automated solution, and validate its long-term effectiveness.

As a result of this project, a Power BI dashboard was developed to automate the tracking of employee training compliance by connecting directly to the Learning Management System (LMS). The dashboard refreshes daily and provides real-time visibility to Compliance, Engineering, HR, and Production teams. One of its most impactful features is the automated email alert sent to managers five days before a training is due, promoting proactive action and reducing administrative workload.

The implementation of the dashboard also established new process ownership roles within the Compliance department. Analysts are now responsible for monitoring the tool's performance, validating data integrity, and training end users. This continuous support model helps ensure the solution's sustainability and contributes to overall audit readiness.

Beyond addressing the site's immediate compliance tracking needs, the dashboard serves as a scalable model for future applications. Its structure can be adapted to other business units or extended to monitor related quality processes such as CAPAs and NCMRs. The research outcomes align with broader organizational goals in automation, efficiency, and continuous improvement.

These contributions are summarized in Figure 2, which highlights the dashboard's impact on real-time visibility, proactive compliance behavior, and long-term sustainability.

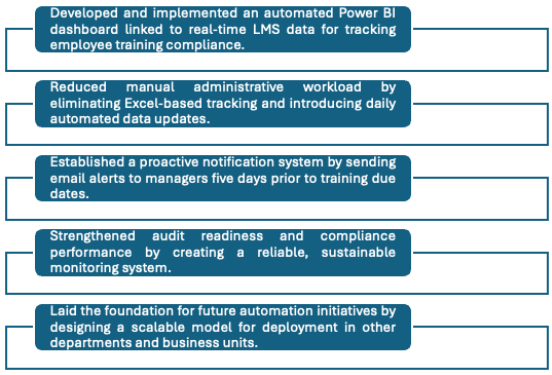

Figure 2
Key Research Contributions

Literature Review

Training compliance is a core requirement in regulated industries, particularly medical device manufacturing, where employee qualifications directly impact product quality and patient safety. Regulatory frameworks such as the FDA's 21 CFR Part 820 and ISO 13485:2016 mandate documented training programs, ongoing competency

assessments, and timely record maintenance [1] [2]. Failure to comply with these standards has been repeatedly cited in FDA warning letters issued to manufacturers, particularly in cases where training records were missing, outdated, or unverifiable [3].

Despite these expectations, many organizations continue to rely on manual systems—most commonly Excel spreadsheets—for tracking training compliance. While convenient in small-scale environments, such systems introduce risks related to human error, outdated data, and limited visibility. They also impose a high administrative burden on Quality and Compliance teams, especially when managing large volumes of training records across departments. In the case studied, analysts spent an estimated 7–9 hours per week updating spreadsheets, verifying due dates, and issuing manual reminders.

Business Intelligence (BI) tools have emerged as a powerful alternative to manual tracking, enabling organizations to visualize and manage compliance data in real time. Microsoft Power BI offers functionality such as customizable dashboards, dynamic filtering, and interactive drilldowns that make it suitable for compliance monitoring applications [4]. These tools allow for timely decision-making, improved oversight, and reduction of non-value-added tasks.

The implementation of BI tools also aligns with broader trends in digital transformation. As described in the business intelligence literature, these platforms are increasingly viewed as essential for organizations seeking to enhance operational agility and support data-driven decision-making [5]. By integrating BI systems with core quality data sources, companies can improve not only compliance tracking but also performance monitoring and audit readiness.

Furthermore, standards such as ISO 9001:2015 emphasize the importance of documented competence, training effectiveness, and continual improvement of quality systems [6]. An automated, real-time dashboard supports these goals by providing reliable, accessible, and actionable training compliance metrics across the organization.

This review confirms that an integrated BI solution addresses the key limitations of manual tracking and aligns with both regulatory expectations and modern quality management practices.

METHODOLOGY

This project followed the DMAIC methodology, a structured Six Sigma approach used to improve existing processes through data analysis, targeted solutions, and sustained control. Each phase, Define, Measure, Analyze, Improve, and Control, was applied to transition the training compliance tracking process from a manual, reactive model to an automated, real-time system. Table 1 summarizes the DMAIC phases and their descriptions.

Table 1

DMAIC Methodology

DMAIC Phase	Description
DEFINE	Define the training compliance tracking problem and project objectives.
MEASURE	Collect and measure data from the existing manual tracking system.
ANALYZE	Analyze the data to identify inefficiencies and root causes.
IMPROVE	Develop and implement the Power BI dashboard solution.
CONTROL	Establish controls to maintain and monitor training compliance improvements.

In the Define phase, the problem was scoped by identifying key inefficiencies in the manual Excel-based tracking system. These included a lack of visibility, excessive time demands on the Compliance team, and delayed identification of overdue trainings. The project goal was established: develop a dashboard that could automate compliance tracking, reduce administrative burden, and enable proactive management.

The Measure phase involved collecting baseline data from the Learning Management System (LMS) to quantify overdue training frequency, time spent on manual tracking, and communication delays. It was determined that the Compliance team dedicated an average of 7–9 hours per week to maintaining spreadsheets, and that more than 1,000 training records were overdue in 2024.

In the Analyze phase, a root cause analysis using a Fishbone Diagram identified key contributing factors: manual calculations, lack of system alerts,

inconsistent communication, and unclear accountability. These factors resulted in frequent escalations, late training completions, and added compliance risk.

The Improve phase focused on designing and implementing a Power BI dashboard that integrated directly with LMS data. The dashboard provided real-time visibility of training statuses and overdue cases and included automated email alerts to managers five days before training expiration. Stakeholders reviewed prototypes, and iterative changes were made based on user feedback. Metrics were visualized by department and job role to support targeted follow-up actions.

The Control phase established ownership for dashboard maintenance and included a documented control plan. Compliance analysts were assigned to perform daily data validation checks and weekly alert reviews, while managers received ongoing access to training metrics. Quarterly audits of the dashboard's functionality were included to ensure long-term reliability and effectiveness.

The application of the DMAIC methodology provided a structured foundation for problem-solving, ensured stakeholder alignment, and resulted in a sustainable, scalable solution for training compliance management.

RESULTS AND DISCUSSION

This section presents the analysis of results, and the discussion of the problem addressed through the design and implementation of a Power BI Training Compliance Dashboard. The solution was developed using the DMAIC methodology and targeted the inefficiencies identified in the manual training tracking process. Each phase of the methodology—Define, Measure, Analyze, Improve, and Control—guided the project toward a sustainable, automated system that improved training compliance and reduced administrative burden.

Define

The project began by defining the limitations of the existing training compliance tracking system used at the manufacturing site. The process was entirely manual and required the Compliance team to extract LMS data, format Excel spreadsheets, and calculate expiration dates for each employee's training. Notifications to managers were sent manually, and compliance status was reviewed reactively, often after due dates had passed.

This approach resulted in frequent escalations, unnecessary workload, and recurring instances of overdue trainings. Analysts and managers lacked real-time visibility, and there were no system-driven alerts to prompt timely action. As a result, training compliance was maintained through continuous manual effort and frequent interventions, increasing the administrative burden and the risk of noncompliance during audits or inspections.

To address these issues, the project scope was defined as the design and implementation of an automated dashboard solution. The goal was to replace the spreadsheet-based process with a scalable, real-time tool that would proactively monitor compliance status, reduce overdue cases, and minimize reliance on manual calculations and follow-up communications.

Measure

The Measure phase focused on evaluating the current state of the training compliance process, identifying inefficiencies, and collecting baseline data. At the time of the project, training status was monitored manually using Excel exports from the SumTotal Doppler Dashboard Reports Summary. These reports listed each employee's required training by role and due date, but the process for tracking them was entirely manual. The compliance team filtered, organized, and validated data for each employee individually, a process that consumed 7 to 9 hours per week.

No automated alert system existed to notify managers of upcoming expirations. As a result, trainings frequently became overdue without warning. When this occurred, managers were required to submit a Product Impact Late Assessment to explain the cause of non-compliance. If the assessment was not completed within 14 days,

the case escalated to the Quality organization. This reactive system increased administrative burden and elevated compliance risk.

To establish a performance baseline, training records from March to December 2024 were analyzed. Table 2 summarizes the total overdue and on-time completions recorded each month. Despite a high average on-time completion rate of approximately 98.7%, hundreds of trainings still expired each month, triggering deviation reports and escalations.

Table 2

Training Compliance Summary – March to December 2024

Month	Overdue YTD	Completed On-time	Overdue (%)	Complete On-time (%)
Mar-24	130	13005	0.97%	99.1%
Apr-24	150	14122	1.05%	98.9%
May-24	265	18397	1.42%	98.6%
Jun-24	184	8291	2.17%	97.8%
Jul-24	159	10447	1.50%	98.5%
Aug-24	182	10589	1.69%	98.3%
Sep-24	138	13489	1.01%	99.0%
Oct-24	177	12348	1.42%	98.6%
Nov-24	157	14586	1.06%	98.9%
Dec-24	129	12421	1.03%	99.0%

Figure 3 presents a monthly overview of overdue training cases, highlighting notable spikes and a sustained volume of delays. These ongoing issues necessitated follow-up actions and the documentation of deviations by management.

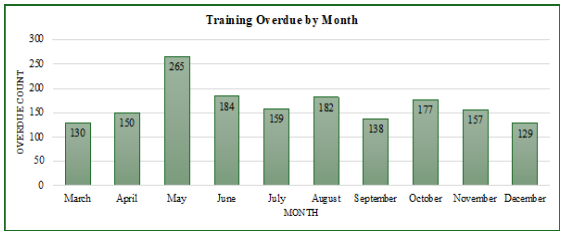

Figure 3

Training Overdue by Month – 2024

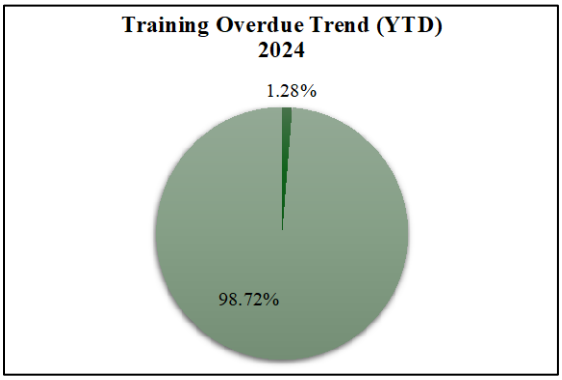

Figure 4

Training Overdue Trend (YTD) – 2024

Additionally, the overall year-to-date trend is shown in Figure 4. While the average overdue rate was just 1.28%, this translated to more than 1,000 overdue training instances, each requiring justification and manual follow-up.

Key limitations identified during this phase included the lack of real-time data visibility, the absence of automated alerts, and excessive time spent by the Compliance team maintaining spreadsheets. These findings validated the need for a centralized dashboard with live LMS integration, automated notifications, and role-based access to training compliance data.

Analyze

The Analyze phase aimed to identify the underlying causes of overdue trainings and the inefficiencies of the manual compliance tracking process. While the LMS platform contained accurate records, the tracking system in place was disconnected, reactive, and highly dependent on human intervention.

To structure the investigation, a Fishbone Diagram was developed and is presented in Figure 5. This diagram categorized the root causes into four key domains: People, Process, System, and Communication. Under the People category, the analysis revealed that managers lacked visibility into employee training due dates and were not directly accountable for maintaining compliance within their departments.

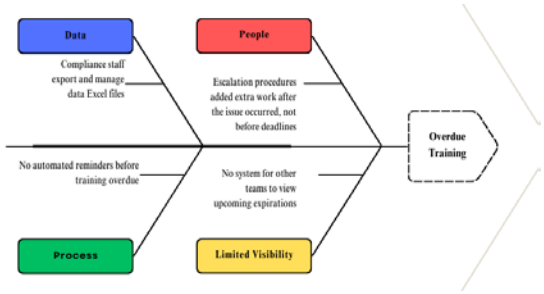

Figure 5

Root Cause Analysis - Training Compliance

The Process category highlighted that the system triggered responses only after non-compliance had occurred. There was no structured mechanism to identify at-risk trainings before the

expiration date. This led to a high number of escalations and required repeated completion of Product Impact Late Assessments.

From a System perspective, the LMS was not integrated with any visualization or alert tool. Compliance analysts relied on manual data exports, sorting, and formatting in Excel. This disconnected workflow not only consumed time but also failed to support proactive decision-making.

Under the Communication category, the findings indicated a lack of standardized alerts or reminders. Notifications were sent manually and inconsistently, often arriving after training deadlines had already passed.

As visualized in Figure 5, these findings demonstrated that the core issue was not a lack of training availability but rather the absence of a real-time, automated infrastructure to support proactive compliance management. These insights directly informed the design of the Power BI dashboard, which was structured to address visibility, ownership, and timely communication across all departments.

Improve

The Improve phase centered on designing and implementing a dashboard to address the root causes identified in the Analyze phase. The objective was to automate the tracking of training compliance, enable proactive follow-up, and reduce manual administrative burden.

A Power BI dashboard was developed and integrated with the LMS to perform daily data refreshes. It featured department-level KPIs, overdue training counts, role-based filters, and slicers to visualize training status by employee, due date, and training module. Managers were granted interactive access, allowing them to track their team's performance and take action before expirations occurred.

The final dashboard included multiple visualizations: an overview of training compliance distribution, overdue trend by month, product impact assessments, and escalation summaries. As shown in Figure 6, the layout was designed for clarity, responsiveness, and immediate insight, allowing both Compliance analysts and department managers to interpret data immediately.

Figure 6
Training Compliance Dashboard Overview – Power BI Implementation (Displays real-time data by department, role, and training category)

To automate communication, Power Automate was used to trigger email alerts five days before a training due date. Alerts included the employee's name, training title, expiration date, and a link to the dashboard for immediate access. This reduced reliance on manual notifications and encouraged timely action.

The impact of these improvements was measurable. As shown in Table 3, the number of overdue trainings fell to fewer than 60 in both March and April 2025, with on-time completion rates averaging 99.5% and overdue cases dropping to just 0.49%.

Table 3
Training Compliance Metrics Post-Dashboard Implementation

Month	Overdue YTD	Completed On-time	Overdue (%)	Complete On-time (%)
Mar-25	56	9747	0.57%	99.4%
Apr-25	52	12354	0.42%	99.6%

These results are further illustrated in Figure 7, which presents the YTD training compliance distribution. The figure highlights the drastic reduction in overdue trainings and demonstrates how the system transitioned from a reactive process to a proactive, data-driven tool.

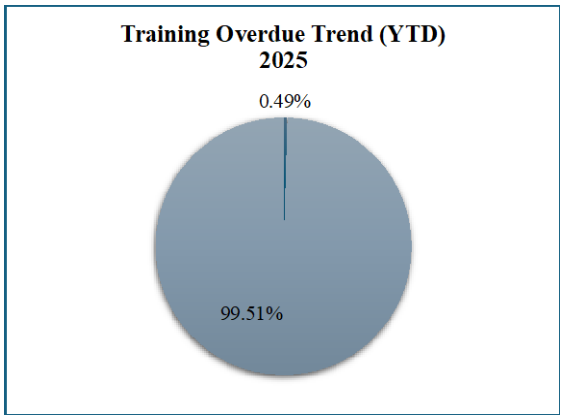

Figure 7
Training Overdue Trend (YTD) 2025

Informal user feedback further validated the effectiveness of the solution. Compliance analysts reported an estimated 80–90% reduction in time spent manually managing training records, allowing them to focus on higher-value quality tasks. Department managers consistently noted improved awareness of training obligations and increased accountability for timely completions. Overall, the dashboard successfully addressed the deficiencies identified in the root cause analysis by enhancing visibility, automating communication, and establishing clear ownership across the dimensions of people, process, system, and communication.

Design

The Control phase focused on securing the long-term effectiveness of the Power BI Training Compliance Dashboard and ensuring that the process improvements remained in place without reverting to manual practices.

To sustain the improved system, process ownership was clearly defined across key stakeholders. The Compliance team retained responsibility for maintaining LMS data accuracy, confirming the daily dashboard refresh, and ensuring that Power Automate alerts continued to trigger as expected. Functional managers were tasked with reviewing email alerts and monitoring team-level metrics through the dashboard, shifting their role from reactive documentation to proactive prevention. Additionally, HR and Engineering leadership utilized dashboard insights for broader planning, including identification of training gaps and function-level trends.

The dashboard was configured to refresh automatically once daily through a direct LMS connection. The Compliance team monitored the Power Automate workflows weekly, confirming the successful delivery of 5-day pre-expiration email alerts. Informal feedback loops were established through interactions between Quality personnel and end-users to capture usage insights, resolve questions, and implement minor improvements without needing a formal governance structure.

To mitigate risks and ensure system stability, a control plan was developed. Table 4 outlines the plan's monitoring elements, responsible parties, and frequencies. These controls ensured that system performance, data integrity, and user engagement would be sustained with minimal resource overhead.

Table 4
Control Plan for Training Compliance Dashboard.

Control Element	Monitoring Method	Responsible Party	Frequency
Data Refresh Accuracy	Confirm successful daily sync from LMS	Compliance Analyst/ Quality	Daily
Alert Functionality	Review Power Automate logs for delivery confirmation	Compliance / IT Support	Weekly
Manager Usage	Track informal feedback, resolve questions/issues	Compliance Team/ Quality	Monthly
Dashboard Performance	Validate filter functions, KPIs, and visual layouts	Power BI Developer (Quality Engineer)/Admin (Compliance team)	Quarterly

The structured control plan enabled the organization to remain audit-ready while minimizing administrative workload. By embedding these responsibilities into routine workflows and empowering department-level accountability, the dashboard transitioned from a project deliverable into a durable compliance infrastructure integrated within the site's Quality System.

Conclusion and Recommendations

This project addressed a crucial operational challenge at a regulated medical device manufacturing site by enhancing employee training compliance tracking. The site previously relied on manual LMS exports, spreadsheet calculations, and reactive measures for training expirations.

Using the DMAIC (Define, Measure, Analyze, Improve, Control) methodology, the team improved and successfully implemented a real-time Power BI

dashboard with automated email alerts. This solution created a proactive training management system, significantly enhancing compliance tracking and reducing the risk of training lapses.

CONCLUSION

Each DMAIC phase contributed to a structured transformation of the process. The team identified performance gaps, measured baseline inefficiencies, and analyzed the root causes of overdue training and unnecessary escalations. The resulting solution—a fully automated Power BI dashboard—delivered measurable improvements in visibility, efficiency, and compliance control.

Key outcomes included:

- A reduction of approximately 80–90% in time spent by Compliance staff on spreadsheet tracking and overdue investigations.
- Automated alerts are sent to managers five days before due dates, enabling preventive action.
- Improved visibility through real-time training metrics, promoting cross-functional accountability.
- Positive feedback from users confirming the tool's usability and its impact on compliance performance.

The site moved from a reactive to a proactive compliance model. The dashboard enhanced, not replaced, the LMS, acting as a layer of transparency, accessibility, and operational decision support.

RECOMMENDATIONS

While the core objectives were achieved, the following recommendations are proposed to support long-term sustainability and wider adoption:

- Maintain System Integrity: Validate LMS-to-Power BI connections and Power Automate workflows regularly to ensure reliable performance.
- Formalize Manager Engagement: Embed dashboard use into existing review structures to reinforce ownership and consistent usage.
- Replicate Across Sites or Systems: Adapt the dashboard framework for other quality metrics such as CAPAs and NCMRs.
- Capture Ongoing Feedback: Collect and act on user input to refine functionality, improve navigation, and address evolving needs.

This project demonstrated that data visualization and automation can drive meaningful improvements in regulatory compliance and operational efficiency. With continued support, the dashboard can evolve into a long-term compliance tool that contributes to a broader culture of quality and readiness.

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