

Enhancing Operational Efficiency Through Workflow Standardization: A Comprehensive Process Map for Managing Engineering Drawing Releases

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Abstract — *This research addresses inefficiencies in managing engineering drawing releases within the Engineering team, stemming from the lack of a standardized process map and adequate training. These challenges result in frequent turnbacks, inconsistent workflows, and delays, negatively impacting productivity and project timelines. To resolve these issues, the study develops a comprehensive process map that standardizes workflows by defining key stages, responsibilities, and dependencies, enhancing clarity and reducing errors. Additionally, tailored training programs equip team members with the skills and knowledge needed to navigate the updated processes, fostering engagement and operational alignment. The study employs performance metrics such as turnback rates, resolution times, and delivery timelines to monitor improvements. Initial results indicate significant reductions in turnbacks and enhanced delivery efficiency, validating the effectiveness of the interventions. Beyond addressing immediate challenges, this research establishes a scalable framework for long-term success, transforming engineering operations into a more efficient and collaborative environment.*

Keywords — *CCDoc, New Drawings, Process Map, Turnbacks.*

INTRODUCTION

With engineering environments becoming increasingly complex, efficient workflow management is essential for achieving operational excellence and consistently delivering high-quality outputs. However, the Engineering team within the organization has faced ongoing challenges due to the absence of standardized workflows and robust training mechanisms. These gaps have led to frequent turnbacks, fragmented processes, and

delayed engineering drawing releases, all of which hinder the team's ability to meet project timelines and organizational objectives effectively. The lack of clear documentation and procedural guidance further compounds these issues, fostering a work environment that struggles to maintain consistency, quality, and productivity.

These inefficiencies are especially evident in the handling of new drawing releases, where the reliance on informal methods and unclear workflows creates significant operational bottlenecks. New hires are disproportionately affected, as they face difficulties in understanding their roles and responsibilities without adequate training and onboarding support. This not only delays their productivity ramp-up but also reduces engagement and increases their dependency on experienced colleagues for guidance, placing additional strain on the team's overall capacity.

To address these challenges, this research focuses on developing and implementing a comprehensive process map that standardizes workflows and explicitly defines roles and responsibilities. This process map serves as a structured visual representation of the workflow, addressing critical pain points and promoting consistency and clarity in task execution. By reducing errors and improving coordination, the process map lays the foundation for enhanced team collaboration and operational efficiency.

In addition to workflow improvements, targeted training programs are introduced to support both new and existing team members. These programs are designed to equip team members with the knowledge and skills necessary to navigate the standardized workflows effectively. By fostering a deeper understanding of responsibilities and workflow requirements, the

training initiatives aim to improve onboarding, enhance engagement, and boost overall productivity.

A critical component of this research is the integration of measurable performance metrics, including turnback rates, resolution times, and delivery timelines. These metrics provide a framework for evaluating the success of the implemented changes and enable a culture of continuous improvement through data-driven decision-making. The metrics ensure that the interventions remain relevant and adaptable to the organization's evolving needs.

By addressing the root causes of inefficiencies and establishing a scalable, sustainable framework, this research aims to transform the Engineering team into a more cohesive, efficient, and resilient unit. The study's outcomes provide a roadmap for achieving sustained operational excellence, ensuring the team is well-prepared to meet future challenges and contribute meaningfully to the organization's long-term success.

RESEARCH CONTEXT AND JUSTIFICATION

In the article "Reducing the Amount of 'Turnback' on the Classification Center" by Francisco J. Colón Galarza [1], the author emphasizes the importance of standardized processes in minimizing errors and improving efficiency. Managing engineering drawing releases efficiently is critical to achieving organizational goals and maintaining high standards of quality and productivity. However, the Engineering team has been hindered by persistent inefficiencies, primarily stemming from the lack of a standardized process map. These inefficiencies manifest as frequent turnbacks, inconsistent workflows, and delayed delivery times, creating bottlenecks that disrupt operations and hinder the team's ability to meet deadlines. Moreover, the absence of proper training exacerbates these issues, leaving new hires struggling to understand their roles and responsibilities, which lowers engagement and productivity across the team.

The need for a structured and efficient workflow is clear, as the current situation not only delays projects but also negatively impacts team morale and the quality of outputs delivered to clients. Without a clear framework, team members rely on informal methods to manage tasks, resulting in variability, errors, and wasted effort. Recognizing these challenges, this research aims to develop and implement a comprehensive process map tailored to streamline the management of engineering drawing releases. This initiative is expected to significantly reduce turnbacks by addressing error-prone stages in the workflow and providing clarity on task execution.

In addition to improving workflow efficiency, the proposed process map will serve as a foundation for developing targeted training programs for the Engineering team. These programs aim to address knowledge gaps, particularly for new hires, by providing clear, step-by-step guidance on critical tasks such as Change Request creation, CCDoc preparation, and tracelink additions. By equipping team members with the necessary tools and knowledge, the research seeks to improve engagement, foster confidence, and enhance overall productivity.

Beyond addressing immediate inefficiencies, this study is designed to create a scalable framework that supports continuous improvement and adapts to evolving organizational needs. By integrating measurable metrics into the workflow, the project ensures that performance can be monitored and optimized over time. Metrics such as turnback rates, resolution times, and delivery efficiency will provide actionable insights, enabling the team to make data-driven decisions and sustain long-term operational improvements. This adaptability is crucial for ensuring the resilience of the Engineering team in the face of future challenges.

RESEARCH DESCRIPTION

The Engineering team faces specific challenges due to the absence of a clear and detailed process

map for managing the sequence of new drawings by the Engineering Change Analyst. This lack of standardization leads to inefficiencies in critical processes, including inconsistent task execution, reliance on informal communication, and delays in drawing releases. These inefficiencies are particularly problematic for new hires, who often struggle with unclear workflows, reducing their ability to contribute effectively.

Developing a comprehensive process map is vital to standardizing workflows, minimizing errors, and streamlining the onboarding experience. By clearly defining roles, responsibilities, and decision points, the process map will provide team members with a reliable framework to execute tasks efficiently. This structured approach will foster collaboration, ensure consistency, and enhance overall operational efficiency, enabling the Engineering team to meet organizational demands more effectively.

Moreover, this research seeks to address the recurring issues associated with the lack of clarity and guidance in key stages of the workflow. By documenting and validating each step in the process, the study ensures that the process map reflects the actual needs and expectations of the team. This initiative is crucial for creating a productive and cohesive working environment.

RESEARCH OBJECTIVES

This research focuses on creating a structured process map to improve how new drawings are managed within the Engineering team. By addressing inefficiencies caused by a lack of structured documentation, the project aims to reduce errors and turnbacks by streamlining workflows and minimizing error-prone stages. Additionally, improving task execution will help enhance delivery times, ensuring the team can meet project deadlines more consistently. A key aspect of the study is improving the onboarding process, providing new hires with clear documentation and training resources to increase confidence and productivity.

Beyond immediate improvements, this research also aims to establish measurable metrics to track progress and drive continuous improvement. By integrating performance tracking, the team can monitor efficiency, identify trends, and make data-driven decisions for long-term optimization. Ultimately, this project creates a framework that not only resolves current inefficiencies but also provides a scalable solution that can adapt to future challenges.

RESEARCH CONTRIBUTIONS

This research significantly improves the Engineering team's efficiency and effectiveness by addressing challenges in managing engineering drawings. One major impact is the reduction of time spent on rework and turnbacks through a well-documented and structured process map, eliminating inefficiencies caused by unclear workflows. This enhances task execution, ensuring faster project delivery with greater precision and fewer delays. A standardized process helps the team meet deadlines consistently while adapting to changing project demands. Additionally, improved quality control minimizes errors, strengthening client trust and reinforcing the team's reputation for reliable and high-value deliverables.

Internally, this research fosters better team dynamics and productivity by introducing structured training materials and documentation, which accelerate the onboarding process and reduce reliance on informal knowledge sharing. This improves morale, engagement, and collaboration, creating a more cohesive work environment. Optimized workflows and performance monitoring tools further empower the team to operate efficiently and adapt to future challenges. Ultimately, by streamlining processes and fostering continuous improvement, this research ensures that the Engineering team is well-positioned for sustained growth, innovation, and long-term success.

Beyond immediate operational improvements, this research establishes a foundation for

continuous growth and adaptability within the Engineering team. By implementing performance monitoring tools and structured guidelines, the team can track progress, identify inefficiencies, and make data-driven decisions for ongoing process optimization. The standardization of workflows not only enhances consistency and accuracy but also ensures that improvements remain sustainable over time. As a result, the Engineering team is better equipped to navigate complex projects, integrate new technologies, and respond effectively to evolving organizational needs, positioning itself as a key contributor to long-term business success.

RESEARCH FOUNDATIONS AND ANALYSIS

This section explores the theoretical foundations and existing research relevant to improving engineering workflows. Prior studies emphasize the importance of standardized processes and structured training in enhancing efficiency, reducing errors, and fostering collaboration. Organizations that implement well-documented workflows experience fewer inconsistencies, improved coordination, and streamlined operations.

Process mapping emerges as a key tool in identifying inefficiencies, clarifying dependencies, and improving task execution. Research highlights that teams with structured process maps report greater accuracy, reduced ambiguity, and more effective onboarding for new hires. By visualizing the workflow, this study pinpoints bottlenecks and enhances operational clarity.

Comprehensive training programs further support workflow improvements by equipping team members with essential skills. Studies show that organizations investing in training see faster onboarding, higher engagement, and increased productivity. This research integrates standardized workflows with tailored training to address both inefficiencies and onboarding challenges, ensuring sustained operational excellence.

By bridging process optimization with human resource development, this study offers a holistic,

scalable solution. Standardized procedures enhance consistency, while training programs reinforce best practices, fostering a resilient and adaptable engineering team. The integration of these methodologies ensures tangible benefits such as improved task accuracy, reduced turnbacks, and optimized delivery timelines. This chapter provides a strong theoretical foundation for the research, linking best practices with practical implementation to drive long-term success.

METHODOLOGY

Building on the challenges and objectives identified in the previous chapters, this methodology outlines the structured approach designed to address the inefficiencies in managing engineering drawing releases. With the implementation of a comprehensive process map and targeted training programs as central solutions, this chapter details the stages undertaken to achieve the research objectives while ensuring measurable and sustainable outcomes.

In the article "Guideline for the Development of a Capable Training Program for New Hire Employees in the Design Area of an Aerospace Industry in Puerto Rico" by José A. Ayala Román, [2] the author addresses challenges similar to those in our current project. The study emphasizes the importance of implementing a structured training program to enhance process efficiency and reduce errors. The methodology of our project is divided into five key stages: **Data Collection, Process Mapping, Training Development, Implementation, and Continuous Improvement**. Each stage is carefully planned to address specific objectives and lay the groundwork for achieving operational efficiency and process standardization.

Figure 1 shows the first stage, **Initial Assessment, and Data Collection**, which establishes the foundation for this project by evaluating the current state of workflows and identifying inefficiencies. Through interviews with stakeholders and team members, combined with a review of historical data, recurring issues such as

frequent turnbacks and delayed delivery times are identified. Metrics such as average turnbacks per project and time spent resolving issues serve as the baseline for measuring improvements throughout the study. The turnbacks log, introduced during this stage, quantifies these challenges and provides actionable insights into their root causes.

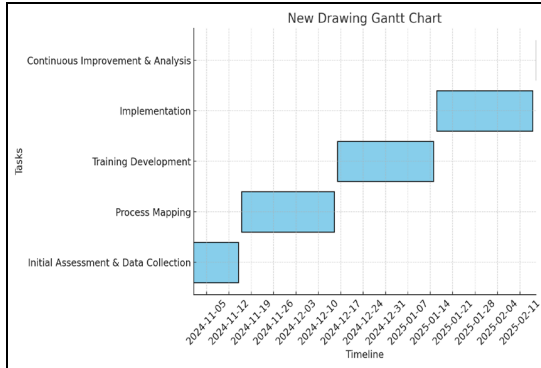


Figure 1
New Drawing Gantt Chart

The second stage, **Process Mapping**, focuses on designing a clear and standardized process map to address workflow inefficiencies. The map defines roles, responsibilities, and decision points, ensuring that all steps are clearly articulated and consistent across the team. Feedback loops are incorporated to account for quality checks and revisions, minimizing the likelihood of errors. Once completed, the process map undergoes validation with stakeholders to ensure accuracy and relevance to the team’s operational needs.

In the third stage, **Training Development and Implementation**, tailored training programs are introduced to align team members with the newly standardized workflows. These programs include hands-on workshops, simulation exercises, and supporting resources such as quick-reference guides and FAQs. By addressing knowledge gaps and providing structured guidance, the training ensures that both new hires and existing team members adopt the process map efficiently. The effectiveness of these programs is measured through improved onboarding times and participant feedback, further refining their delivery.

The fourth stage, **Implementation**, involves deploying the process map into daily operations. At

this stage, team members actively integrate the newly defined workflows into their tasks, fostering improved collaboration and reduced delays. Metrics such as adherence to workflows, reduction in turnbacks, and delivery times are monitored to assess the immediate impact of the implementation phase.

Finally, the fifth stage, **Continuous Improvement and Analysis**, ensures the sustainability and adaptability of the implemented solutions. Metrics gathered during this stage are compared with the baseline data to evaluate success and identify areas for refinement. Recurring issues from the turnbacks log are addressed, further improving the process map and training initiatives. This iterative approach guarantees ongoing optimization, ensuring that the Engineering team remains resilient and adaptive to future challenges.

Through these systematic stages, this methodology ensures that the research objectives are met effectively by addressing the root causes of inefficiencies within the Engineering team’s workflows. By employing a structured and phased approach, the methodology not only resolves immediate operational challenges but also lays the groundwork for sustained improvement. Each stage has been carefully designed to tackle specific issues, such as inconsistent processes, delayed project timelines, and the lack of standardized training, ensuring that every aspect of the problem is comprehensively addressed.

The methodology fosters the development of a high-performing and cohesive team environment by integrating process optimization with team development. Standardized workflows provide clarity and reduce ambiguities, enabling team members to execute their tasks with greater precision and confidence. Concurrently, tailored training programs empower team members by equipping them with the knowledge and skills required to navigate these optimized workflows effectively. This dual focus on process and people creates a synergistic effect, enhancing not only individual productivity but also overall team dynamics.

Moreover, the process extends beyond immediate problem-solving to establish a scalable and adaptable framework for continuous development and operational excellence. By incorporating measurable performance metrics, such as turnback rates, resolution times, and workflow adherence, the methodology enables ongoing evaluation and refinement of processes. This iterative approach ensures that the team can adapt to evolving organizational needs, technological advancements, and changing project requirements. The framework supports a culture of continuous learning and improvement, where feedback loops and data-driven insights guide decision-making and foster long-term resilience.

Ultimately, this methodology serves as a comprehensive solution that addresses current inefficiencies while preparing the Engineering team for future challenges. By balancing immediate impact with scalability, the approach ensures that the team is well-positioned to maintain high standards of quality, productivity, and collaboration. The integration of structured workflows, targeted training, and performance monitoring establishes a robust foundation for sustained operational success, empowering the team to achieve organizational objectives with efficiency and confidence.

RESULTS

In line with the best practices highlighted by Treynor Sloss, Nukala, and Rau [3], this study emphasizes the importance of focusing on metrics that truly capture user experience and operational performance.

The authors discuss the significance of client-side metrics in providing a comprehensive view of system efficiency, which often reveals inefficiencies overlooked by traditional server-side measurements. Applying this principle, the engineering process map developed in this project

incorporates feedback loops to monitor real-time performance and identify the root causes of turnbacks. Furthermore, Treynor Sloss et al. [3] underscore the value of long-tail monitoring, such as tracking the 95th and 99th percentiles for latency, as a way to ensure consistent performance. Similarly, this study establishes specific thresholds for key metrics, including turnback rates and delivery times, to evaluate the impact of the newly implemented workflows. Finally, the emphasis on continuous monitoring and benchmarking, as advocated by Treynor Sloss et al. [3], aligns with this project's approach of integrating ongoing performance evaluations to adapt workflows to future demands. These strategies collectively aim to improve engineering efficiency, reduce delays, and create a more resilient and effective team environment.

Implementing the comprehensive process map marked a pivotal step in addressing the inefficiencies within the engineering team's workflows. By standardizing processes and introducing measurable metrics, this study aimed to achieve significant improvements in operational efficiency, reduce turnbacks, and streamline the onboarding experience for new hires. The following section presents the results derived from the application of these methodologies, highlighting key performance metrics such as turnback rates, delivery times, and process adherence. Additionally, the discussion evaluates the effectiveness of the implemented workflows, drawing comparisons with baseline data to underscore the impact of the standardized process map. These results provide valuable insights into how structured workflows and well-defined metrics can transform engineering operations, fostering a more collaborative and productive team environment while paving the way for continuous improvement.

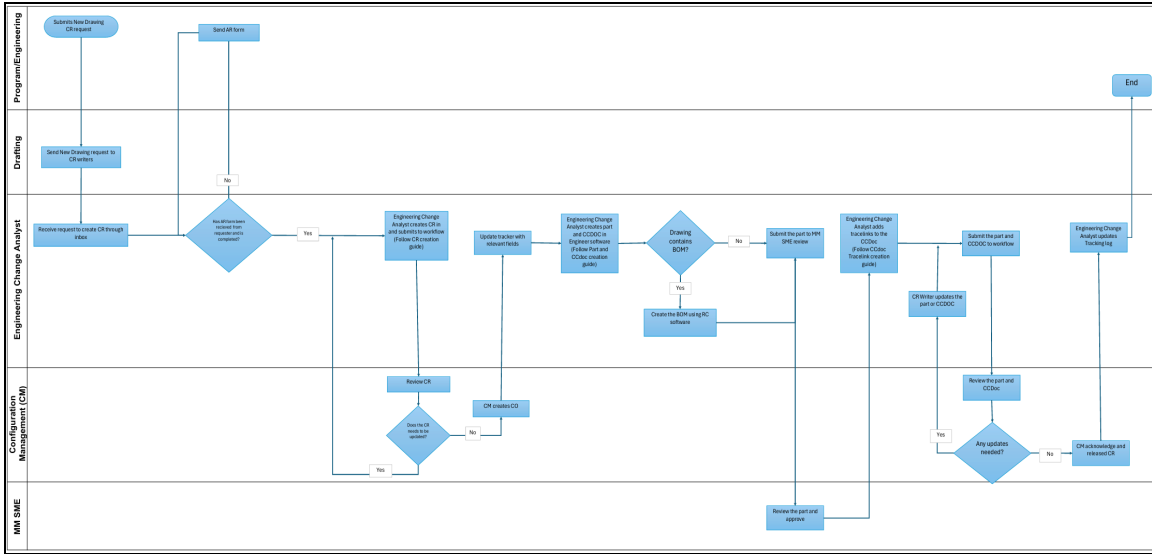


Figure 2
New Drawing Process Map

Figure 2 illustrates the process map for the New Drawing request workflow, highlighting the steps where the Engineering Change Analyst team frequently encounters turnbacks. To address these recurring challenges, targeted training has been developed for each critical step requiring specialized knowledge and procedural accuracy.

The process begins with the Program/Engineering team submitting a New Drawing Change Request (CR), which includes the Approved Request Form (ARF). This request is then forwarded to the Drafting team, who subsequently send the New Drawing request to the Engineering Change Analyst via inbox. Once the required information is received, the Engineering Change Analyst initiates the Change Request (CR) and submits it to the workflow.

The first critical step where turnbacks commonly occur is during the submission of the CR. At this stage, the Engineering Change Analyst may receive turnbacks due to incomplete or inaccurate information, highlighting the need for proper adherence to the CR creation guidelines. If no turnbacks are received, the Configuration Management (CM) team proceeds to create the Change Order (CO), while the Engineering Change Analyst simultaneously creates the part and the CCDoc within the designated engineering software.

If the part does not contain a Bill of Materials (BOM), it is submitted for review to the Material Master Subject Matter Expert (MM SME). Upon approval, the part is forwarded to Configuration Management, and the Engineering Change Analyst must add trachelinks to the CCDoc. This step marks the second critical point where turnbacks are frequently encountered, as errors in part creation, CCDoc preparation, or trachelink additions can lead to workflow disruptions.

To mitigate these issues, the Engineering Change Analyst team has developed comprehensive guidelines, including:

- New Drawing Change Request Creation Guidelines
- How to Create a Part for a New Drawing
- How to Create a CCDoc
- How to Add Trachelinks to the CCDoc

These resources ensure consistency and accuracy in executing these critical steps. Once all tasks are completed without turnbacks, the final stages involve submitting the CCDoc and part to Configuration Management. After the CM team acknowledges and approves the submission, the Change Request is officially released.

This process map provides a structured visualization of the New Drawing request workflow, identifying key areas for improvement

and standardization. By addressing the most error-prone steps with targeted training and procedural documentation, the Engineering Change Analyst aims to reduce turnbacks, improve efficiency, and enhance overall process reliability.

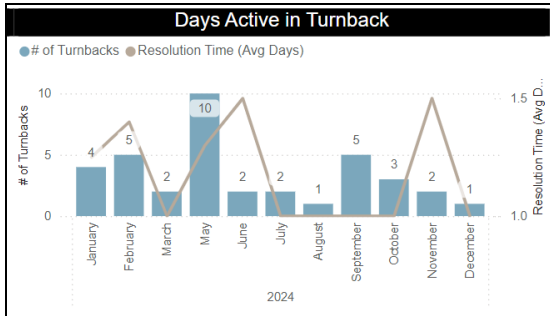


Figure 3
Metrics

Figure 3 illustrates the monthly number of turnbacks and their corresponding average resolution times throughout 2024, highlighting a clear improvement following the implementation of the process map and targeted training initiatives in November 2024. Turnbacks were consistently observed in the months before the implementation, with notable peaks in March and May, reaching 10 and 5 turnbacks, respectively. During these months, the average resolution time also spiked to approximately 1.5 days, indicating inefficiencies in addressing errors. These peaks align with recurring challenges in critical workflow steps such as the creation of Change Request (CR) and tracelink additions, which lacked clear process documentation and adequate training.

After the process map and training initiatives were introduced in November 2024, the Engineering team experienced a remarkable and measurable improvement in performance metrics, particularly in the reduction of turnbacks. The number of turnbacks, which had been a recurring and significant issue, dropped sharply to just two instances per month in both November and December. This reduction represents a significant improvement compared to the pre-implementation period, during which turnbacks frequently disrupted workflows and delayed project timelines. Concurrently, the average resolution time for

addressing issues also decreased noticeably, dropping to approximately one day from previously higher averages that often extended task completion timelines.

To further support these improvements and enable real-time tracking of performance metrics, Power BI was implemented as a centralized tool for monitoring turnbacks and other key indicators. By leveraging Power BI's data visualization capabilities, the team was able to create interactive dashboards that provided actionable insights into workflow performance, resolution times, and error trends. This tool not only made it easier to identify bottlenecks and recurring issues but also facilitated data-driven decision-making, ensuring that corrective actions could be taken promptly. The integration of Power BI also enhanced transparency across the team, as stakeholders could access up-to-date metrics and track progress toward operational goals.

The improvements achieved through the standardized workflows and training programs, complemented by the Power BI dashboards, underscore the tangible benefits of a structured and technology-enabled approach. By equipping team members with clear, step-by-step guidelines and readily accessible resources, the new process provided a framework that allowed tasks to be executed with greater precision and fewer errors. The ability to track resolution times and turnbacks in real time further reinforced these gains, helping the team maintain consistency and focus on continuous improvement.

The consistent reduction in turnbacks and resolution times demonstrates the success of the newly implemented strategies and reflects sustained efficiency gains across the Engineering team. This progress not only validates the importance of structured workflows in mitigating errors but also emphasizes the critical role of comprehensive training and advanced monitoring tools, like Power BI, in enabling team members to adapt quickly and effectively to new processes. Together, these elements have created a more streamlined and reliable engineering change management process,

reducing bottlenecks and fostering smoother task execution.

Additionally, the observed improvements have broader implications for team morale and collaboration. With fewer errors and delays to manage, team members can redirect their focus toward value-added activities, enhancing productivity and engagement. The integration of Power BI has further fostered a culture of accountability and data-driven decision-making, ensuring that the team remains proactive in addressing potential issues. The positive impact of these changes extends beyond immediate performance metrics, laying the groundwork for a culture of continuous improvement and operational excellence. This progress serves as a compelling example of how systematic process enhancements, targeted training initiatives, and advanced analytics tools can drive meaningful change, ultimately contributing to the long-term resilience and success of the Engineering team.

CONCLUSION

This research successfully addressed critical inefficiencies within the Engineering team by developing and implementing a comprehensive process map for managing engineering drawing releases. The study's findings highlight that the lack of standardized workflows and insufficient training were the primary causes of frequent turnbacks, inconsistent processes, and delayed delivery times. These challenges not only hindered the team's ability to meet project timelines but also negatively impacted productivity, collaboration, and the onboarding experience for new hires. By integrating structured workflows, targeted training programs, and measurable metrics, the project achieved significant improvements in operational efficiency and established a foundation for long-term success.

Schilling & Neubauer [4] emphasize that “the foundation of any effective quality control system is the ability to measure, monitor, and standardize processes to ensure predictable and repeatable outcomes”. This principle directly aligns with the

implementation of performance metrics in this study, including turnback rates, resolution times, and delivery timelines, which provide actionable insights into process effectiveness. By integrating these measurable parameters, the Engineering team can assess workflow efficiency and identify areas for continuous improvement. The implementation of the process map streamlined workflow steps that were previously prone to errors and delays. Critical processes, such as Change Request creation, CCDoc preparation, and tracelink additions, were clearly defined and supported by detailed guidelines. This clarity reduced ambiguities and reliance on informal knowledge-sharing practices. Training programs tailored to the Engineering Change Analyst team provided team members with the tools and confidence necessary to perform these tasks effectively.

As a direct result, turnbacks decreased by more than 50% within the months following implementation, while average resolution times declined to approximately one day. These measurable improvements are supported by the metrics presented in this study, which clearly illustrate the reduction in turnbacks and highlight the success of the implemented strategies. The metrics also demonstrate how team members adapted to the process map and training, contributing to sustained efficiency gains and overall productivity.

In addition to addressing existing inefficiencies, the research introduced a framework for continuous performance monitoring and improvement. Metrics such as turnback rates, resolution times, and delivery timelines provided actionable insights into the effectiveness of the implemented workflows. These metrics enabled the team to identify areas requiring further optimization and to make data-driven decisions that supported sustained operational improvements. The establishment of a turnback log and regular benchmarking practices ensured that the process map remained adaptable to evolving organizational and project demands.

The project also placed significant emphasis on improving the onboarding experience for new hires. The development of tailored training materials, including quick-reference guides and simulation exercises, helped new team members become productive and confident contributors more quickly. This focus on structured onboarding not only reduced the time required for new hires to integrate into the team but also improved overall team morale and engagement.

Furthermore, this research demonstrated the value of structured process mapping and targeted training in transforming engineering operations. By addressing inefficiencies and fostering a culture of continuous improvement, the study created a scalable framework that ensures resilience and adaptability to future challenges. In the article "*Right to Operate Training Metric Improvement*" by Magaly Peña Castillo [5], the author highlights the critical role of structured training programs in maintaining operational efficiency and ensuring compliance with standardized processes. The study emphasizes that "monitoring training metrics is essential for identifying gaps and ensuring that operators are adequately prepared to support manufacturing operations effectively." This aligns with our project's focus on the importance of maintaining accurate metrics to evaluate process performance and optimize workforce readiness.

In summary, this research has laid a robust foundation for operational excellence by addressing root causes of inefficiencies, standardizing workflows, and embedding practices for continuous development. The achievements of this project extend beyond resolving immediate challenges; they provide a strategic model for engineering teams to enhance their efficiency, collaboration, and overall value to the organization. The metrics presented in this study underscore the significant reduction in turnbacks and demonstrate how the integration of process mapping and targeted training programs can deliver measurable improvements, driving the Engineering team toward sustained success.

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