Optimizing Training Efficiency In Manufacturing Industry Shop Floors Through Digitized Training Solutions

Saravanan M[1], Dr. N. Sangeetha[2], G. Ramesh[3], Guna[4], Dr. V. R. Murganantham[5]
[1]Dept of Textile Engineering
[2, 5]Associate Professor, Dept of Mechanical Engineering
[1, 2, 5]Kumaraguru college of technology,Coimbatore 641049, Tamil Nadu, India
[3]Divisional Manager, Ashok Leyland Limited, Unit 1, Hosur 635109, Tamil Nadu, India
[4]Forge, FORT (SIPCOT Industrial Innovation Centre), Hosur 635109, Tamil Nadu, India

Abstract- *This case study explores a manufacturing industry's innovative solution to streamline training processes amidst time constraints. By integrating video Standard Operating Procedures (SOPs), the training duration was reduced to 3-4 days, allowing for more practical skill development. Personalized training sessions tailored to individual needs replaced repetitive content, alleviating trainer discomfort. Additionally, the adoption of digital evaluation systems eliminated manual tasks, enhancing efficiency and accuracy.This transformative approach showcases the potential of digital solutions to optimize training in manufacturing industries, offering unparalleled efficiency, scalability, and adaptability to meet evolving industry demands.*

Keywords- Digitized training, Manufacturing industry, Knowledge, Efficiency, Performance, Cost reduction, Safety measures, Skills, Competency, Training efficiency, Skill development, Shop floor

I. INTRODUCTION

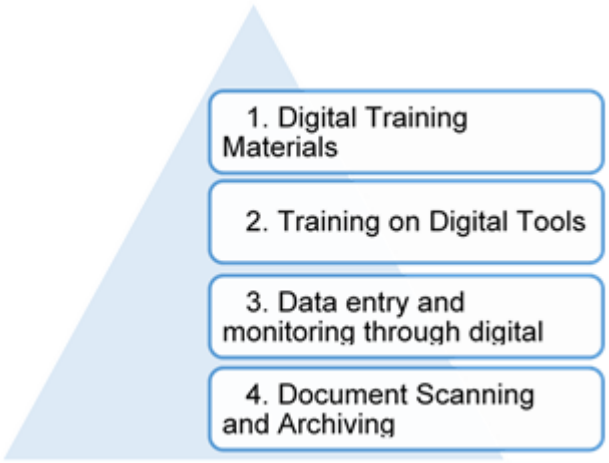
The manufacturing industry operates within a dynamic and competitive landscape, where maximizing efficiency and performance are paramount for success. Traditional training methods often struggle to keep pace with evolving industry demands, leading to inefficiencies and increased operational costs. In response to these challenges, many manufacturing companies are turning to digitized training solutions to streamline their training processes and empower their workforce. This paper investigates the benefits of digitized training in addressing the unique needs of the manufacturing sector.

This paper proposes a solution to optimize training efficiency for employees working on manufacturing industry shop floors by implementing digitized training methods. With a limited training timeframe of six days, traditional theoretical classes often consume significant time, leaving insufficient room for practical skill development. By integrating digital training solutions, theoretical training sessions can be condensed to four days, allowing for an additional two days dedicated to hands-on skill development. This paper outlines a methodology for implementing such a solution, aiming to enhance training effectiveness and workforce competency within constrained timeframes.

Challenges of Traditional Training Methods:

Traditional training methods in manufacturing often entail lengthy onboarding processes, high costs associated with in-person training sessions, and limited scalability. Moreover, maintaining consistency in training content and ensuring compliance with safety regulations pose significant challenges. These inefficiencies can impede productivity and hinder the ability of manufacturing companies to adapt to market dynamics.

II. METHODOLOGY



Solution Identification

A thorough analysis of all factors, combined with a brainstorming session with project and department leads, pinpointed a solution for unfinished operations. This collaborative effort examined every aspect of the Training process, maximizing the effectiveness of the identified fix.The specific Solution selection is shown below;

Alternatives	Pros	Cons
E-learning	Cost-effective, scalable, flexible	Can be isolating, may not be as effective for complex topics
Micro learning	Quick, easy to consume, well-suited for busy learners	Not as comprehensive as traditional training
Blended learning	Combines the benefits of traditional and e-learning	Requires more planning and coordination than traditional or e-learning alone
Social learning	Connects learners, fosters collaboration	Can be difficult to moderate and control
Gamification	Motivating, engaging, helps learners to track progress	Can be expensive and time-consuming to develop

The solution concept for digital training in the manufacturing industry involves the development and implementation of an innovative, technology-driven training program aimed at enhancing the skills, efficiency, and adaptability of the workforce. The solution encompasses various components to ensure a comprehensive and effective training experience.

Technology Integration:

Selecting and integrating appropriate technologies such as Learning Management Systems (LMS), virtual reality (VR), augmented reality (AR), and simulation tools is crucial. These technologies should seamlessly align with existing manufacturing processes and infrastructure, enhancing the overall training experience by providing immersive and interactive learning environments.

Adaptive Learning Content:

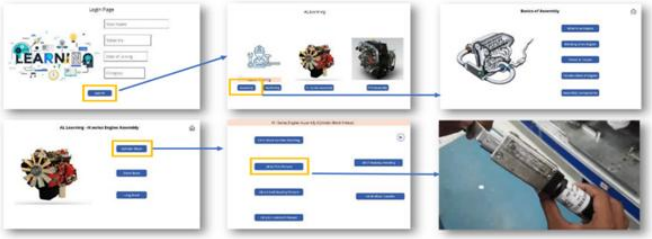
Developing adaptive learning content is essential to cater to diverse learning styles and individual employee needs. Engaging and interactive content, enriched with multimedia elements and realistic simulations, ensures maximum retention of information. This approach fosters skill development tailored to the specific requirements of the manufacturing industry, facilitating effective knowledge transfer and application.

Continuous Monitoring and Evaluation:

Establishing key performance indicators (KPIs) enables continuous monitoring and evaluation of the digital training system. Metrics such as completion rates, skill improvement, and user satisfaction provide valuable insights for ongoing improvement. This data-driven approach ensures the long-term effectiveness of the training solution by identifying areas for enhancement and refinement in real time.

Digitized Training Platform Selection:

Identifying and selecting a suitable digitized training platform is crucial for delivering comprehensive training content relevant to shop floor operations. The platform should offer customization options to tailor training content to the specific needs of the manufacturing industry, providing a flexible and scalable solution for workforce development.



Curriculum Development:

Collaborating with subject matter experts, the development of a streamlined curriculum condenses theoretical training content into a focused four-day program. Interactive modules, videos, and simulations enhance engagement and retention, ensuring optimal knowledge transfer and skill acquisition.

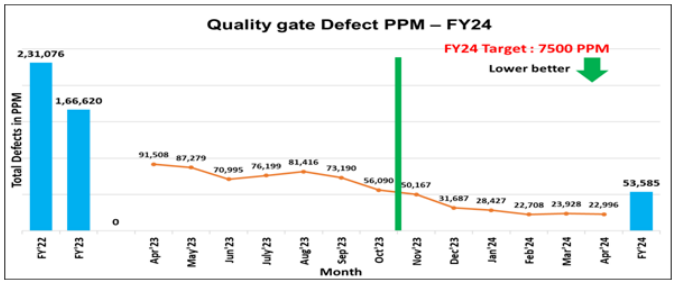
III. RESULTS

The implementation of digitized training results in improved abnormality detection capabilities, with a significant reduction in defect rates from 25000 to 28000 parts per million (PPM) per month to below 70000 PPM. Furthermore, the number of employees nominated for spot awards increased

from 85 individuals over three months to 30-40 individuals over six months, indicating enhanced performance and recognition.

1. Reduction in Defect Rate:

The implementation of digitized training resulted in a substantial decrease in the defect rate, from 25000 to 28000 PPM per month it was around 70000 PPM before. This improvement can be attributed to the enhanced skills and knowledge acquired through the optimized training program.



2. Increase in Spot Awards Nomination:

The number of employees nominated for spot awards, which recognize outstanding performance, saw a notable increase. Before digitized training implementation, 30-40 individuals over six months. After the implementation, 85 individuals were nominated over three months the increased number indicating improved performance and recognition of employee contributions.

3. Enhanced Abnormality Detection:

Digitized training enabled individuals to effectively identify abnormalities in manufacturing processes. By providing interactive modules and simulations, employees gained a deeper understanding of process variations and were better equipped to detect and address issues in real time.

IV. DISCUSSION AND CONCLUSION

This case study demonstrates the transformative potential of digitized training solutions in the manufacturing industry. By integrating technology and innovative methodologies, the presented solution successfully addressed the challenge of optimizing training efficiency within a limited timeframe.

The key takeaways from this study include:

Reduced Training Time: Digitizing theoretical components freed up valuable time for practical skill development, leading to a more well-rounded workforce.

- Improved Knowledge Retention:Interactive multimedia content and simulations enhanced learning and knowledge retention compared to traditional methods.
- Enhanced Performance: The reduction in defect rates and the increase in spot award nominations highlight the positive impact of digitized training on employee performance.
- Increased Adaptability: The ability to continuously monitor and evaluate the training program allows for ongoing improvement and adaptation to evolving industry needs.

These findings contribute to the growing body of research supporting the effectiveness of digitized training in manufacturing.

Conclusion

In conclusion, this case study offers a compelling argument for the adoption of digitized training solutions in the manufacturing sector. By streamlining training processes, enhancing knowledge retention, and fostering a culture of continuous improvement, digitized training empowers the workforce and paves the way for increased efficiency, productivity, and overall business success.

Future Research Directions

Further research could explore the long-term impact of digitized training on employee morale, job satisfaction, and turnover rates. Additionally, investigating the cost-effectiveness of digitized training compared to traditional methods would provide valuable insights for manufacturing companies considering this approach.

REFERENCES

[1] Komaki, G., Moghaddam, K. N., &Dolatabadi, H. R. (2018). The impact of digitalization on production planning and control: https://www.researchgate.net/publication/328500898_The_Impact_of_Digitalization_on_Production_Planning_and_Control_A_Review
Computers & Industrial Engineering, 125, 756–771. DOI: 10.1016/j.cie.2018.09.002.

[2] Chen, Y., Zhang, D., & Zou, P. X. (2020).
Digitalization of manufacturing operations: A systematic literature review and future research directions
https://www.researchgate.net/publication/344338803_Digitalization_of_Manufacturing_Operations_A_Systematic_Literature_Review_and_Future_Research_Directions
Journal of Manufacturing Systems, 54, 221–237. DOI: 10.1016/j.jmsy.2020.08.007.

[3] Wang, X., Xu, X., & Li, Z. (2019). Digitalization-enabled shop floor management: A review and a research agenda
https://www.researchgate.net/publication/330510939_Digitalization-enabled_shop_floor_management_A_review_and_a_research_agenda
Journal of Manufacturing Systems, 52, 72–84. DOI: 10.1016/j.jmsy.2019.03.005.

[4] Rong, K., Hu, G., & Lin, Y. (2020).
Smart manufacturing systems for Industry 4.0: Conceptual framework, scenarios, and future perspectives
https://www.researchgate.net/publication/341654100_Smart_manufacturing_systems_for_Industry_40_Conceptual_framework_scenarios_and_future_perspectives
Journal of Cleaner Production, 255, 120292. DOI: 10.1016/j.jclepro.2020.120292.

[5] Andersson, O., Semere, D., Melander, A., Arvidsson, M., & Lindberg, B. (2016).
Digitalization of Process Planning of Spot Welding in Body-in-white
https://www.sciencedirect.com/science/article/pii/S22128271163035 8X
Procedia CIRP, Elsevier B.V., 618–623. DOI: 10.1016/j.procir.2016.05.082.

[6] Lee, J., Ardakani, H. D., & Yang, S. U. (2018).
Digitalization of business processes: A literature review and framework for future research
https://www.researchgate.net/publication/328289451_Digitalization_of_Business_Processes_A_Literature_Review_and_Framework_for_Future_Research
Journal of Business Research, 91, 177–189. DOI: 10.1016/j.jbusres.2018.06.018.

[7] Hashem, I. A. T., Chang, V., Anuar, N. B., Adewole, K., Yaqoob, I., Gani, A., & Ahmed, E. (2016). The role of big data in smart city
https://www.researchgate.net/publication/305906268_The_Role_of_Big_Data_in_Smart_City
International Journal of Information Management, 36(5), 748–758. DOI: 10.1016/j.ijinfomgt.2016.05.002.

[8] Ivanov, D., &Dolgui, A. (2021).
A digital supply chain twin for managing the disruption risks and resilience in the era of Industry 4.0
https://www.tandfonline.com/doi/full/10.1080/00207543.2020.1852313
International Journal of Production Research, 59(7), 2133–2151.DOI:10.1080/00207543.2020.1852313.

[9] Khan, S., Wood-Harper, T., Wood, B., & Waheed, A. (2019). [Digital transformation framework: A conceptual construct for SMEs
https://www.researchgate.net/publication/332759225_Digital_Transformation_Framework_A_Conceptual_Construct_for_SMEs
Journal of Enterprise Information Management, 32(4), 563–587. DOI: 10.1108/JEIM-02-2018-0039.

[10] Sarkar, S., Mohapatra, S., & Dubey, S. K. (2020)
Investigating the impact of Industry 4.0 and lean manufacturing practices on sustainability:
https://www.researchgate.net/publication/340368553_Investigating_the_impact_of_Industry_40_and_lean_manufacturing_practices_on_sustainability_A_hybrid_approach
Journal of Cleaner Production, 267, 122122. DOI: 10.1016/j.jclepro.2020.122122.