Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/NA10.20250128
Published: June 17, 2025

Enhancing Manufacturing Efficiency Through Digital Twin Implementation

Tobias Syring
Graduate Student
Engineering & Management
Florida Polytechnic University
Lakeland, FL, USA
tsyring0082@floridapoly.edu

Abstract

Digital Twin (DT) technology has emerged as a transformative approach in manufacturing, enabling real-time synchronization between physical and virtual environments. This paper explores the implementation and use of Digital Twins, focusing on their role in predictive maintenance, factory planning, and manufacturing execution. By leveraging AI and machine learning, DTs enhance operational efficiency through real-time monitoring, simulation, and optimization. The study also examines how DTs integrate with Industry 4.0 technologies, including IoT and cloud computing, to improve decision-making and reduce downtime. Key challenges such as interoperability, data management, and scalability are discussed, along with potential solutions involving standardized frameworks and automation. Case studies from recent research highlight successful applications of DTs in industrial operations, demonstrating their impact on improving productivity and sustainability. The findings suggest that effective DT implementation requires a structured approach that combines AI-driven analytics, robust data acquisition, and predictive modeling. This research contributes to the growing body of knowledge on digital transformation in manufacturing and provides insights into the future evolution of DT technology.

Keywords

Digital Twin, Industry 4.0, Predictive Maintenance, AI in Manufacturing, Smart Factory

Biography

Tobias Syring received a Bachelor of Engineering in Industrial Engineering from Stralsund University of Applied Sciences, Germany, in 2024. He is currently pursuing a Master's degree in Engineering and Management at Florida Polytechnic University, where he serves as a Graduate Assistant. As a participant in the prestigious Fulbright Program, he actively contributes to educational and cultural exchange initiatives between the United States and Germany. In 2023, Tobias worked as an intern in Procurement at Siemens AG, where he gained hands-on experience in supply chain management and strategic sourcing. He later collaborated with the Greenwind Group on research for his bachelor's thesis, which focused on the implementation of renewable energy in Germany. His research involved developing a predictive model to assess the economic viability of renewable energy projects, aiming to enhance sustainability and optimize energy investment strategies.