Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/NA10.20250073
Published: June 17, 2025

Evaluating Innovation Diffusion of Digital Twin Adoption for Enhanced Quality Control in Saudi Arabia's Industrial Sector

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Abstract

Innovations, particularly digital technologies, are pivotal in advancing Saudi Arabia's economic strategy, as the country makes significant investments to boost its innovation ecosystem. In the 2024 Global Innovation Index, Saudi Arabia ranks 47th overall, with a strong 36th place in innovation inputs, reflecting its well-developed infrastructure, policies, and support for innovation. However, the country faces challenges in translating these investments into tangible outputs, ranking 66th in innovation outputs. Key obstacles include selecting effective diffusion models and evaluating the factors influencing adoption rates across industry segments, including Innovators, Early Adopters, Early Majority, Late Majority, and Laggards. This study focuses on the industrial sector in Saudi Arabia, examining the adoption and diffusion of digital twin technology. Digital twins offer transformative potential through real-time monitoring and optimization, significantly enhancing manufacturing efficiency. The research will evaluate the characteristics of managers and employees within industrial organizations, analyzing factors that influence adoption rates and levels of digital twin technology. By identifying and assessing these factors, the study aims to accelerate successful diffusion of digital twin frameworks, supporting Saudi Arabia's goal to lead in industrial innovation and align with its vision of sustainable economic growth.

Keywords
Digital Twin Technology, Innovation Diffusion, Quality Control, Industrial Sector, Saudi Arabia.

Biographies
Dr. Mohammed Alqahtani is an accomplished academic and engineer with a Ph.D. in Industrial Engineering. Dr. Alqahtani has extensive experience in global project management, particularly in pipeline engineering and industrial operations. He has worked with leading organizations such as Saudi Aramco, where he was involved in various pipeline projects and maintenance operations. His professional journey also includes a teaching career, where he has

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Fahad Alasim is an Assistant Professor in the Industrial Engineering Department at King Saud University (KSU). He received his B.S. in Industrial Engineering from KSU, and M.S. in Industrial Engineering from University of Central Florida (UCF). In addition, Dr. Alasim received a Ph.D. in Industrial Engineering from UCF. His research interests include operations management, artificial intelligence, simulation, virtual reality, and advanced manufacturing.

Abdullah Al Fatais is an Assistant Professor in the Industrial Engineering Department at King Khalid University (KKU). He received his B.S. in Industrial Engineering from KKU, and M.S. in Engineering Management and Leadership from Santa Clara University (SCU). In addition, Dr. Al Fatais received a Ph.D. in Industrial Engineering from UCF. His research interests include Advanced Manufacturing Technologies, artificial intelligence, and operation management.