

Leveraging Digital Twins: A Framework for Sustainable Supply Chain of Perishable Goods in Bangladesh

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Abstract

The sustainable business of a perishable product (i.e. vegetables) concerns primarily on the assurance of freshness and quality, while simultaneously minimizing waste and dealing with economic impact. Approximately 31.5% of vegetable and fruit production is subjected to waste throughout the supply chain (SC) process. To address this issue, this study takes advantage of a Simulation-Based Decision-Making Framework, leveraging the Digital Supply Chain Twin paradigm to deal with the urgent challenges faced by the perishable goods supply chain in Bangladesh. Computational simulations were employed to model the perishable products i.e. vegetable supply chain, enabling the identification of integrated nodes and the optimization of routes between them. However, the research lacks sufficient data for running the actual model simulation. In this paper, we offer a generalized decision-making framework for using digital twins in SC as well as delineate how digital twins can contribute to waste reduction in SC along with making it further resilient. Utilizing the framework, organizations can monitor the need for replenishment based on the shelf life of certain produce, and make decisive actions from the optimized routing system in real time. Also, they can make predictions of potential disruptions that might lead to food loss such as demand forecasting inaccuracy, insufficient inventory management, transportation issues etc. Through the exhibition of a decrease in waste, improvement in quality, and enhanced contingency measurements, the research findings underscore the importance of data availability between the nodes to implement the SC digital twin to support an effective and sustainable supply chain of perishable goods.

Keywords

Digital Twin, Decision-Making Framework (DMF), Sustainability, Supply Chain (SC), Perishable Goods.

Biographies

Mohammad Jawadul Hoque Rohan is currently an undergraduate student of Industrial and Production Engineering at Ahsanullah University of Science & Technology. He is currently the Director of the Newsletter & Publication of IEOM Society AUST Student chapter. His research interests consist of Supply Chain, Manufacturing Process, Industry 4.0, and Biomedical Engineering. His experience includes researching decision analysis, product design and development as well as business and economic analysis. Thus leading him to participate in numerous competitions that cover fields like engineering, business, and supply chain.

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