Leveraging Resilience of Infant Formula Milk (IFM) Supply Chain

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Abstract

Infants undergo rapid development in the initial two years, which underscores the importance of proper and adequate nutrition. This emphasizes the importance of the quality and availability of Infant Formula Milk (IFM), which plays a vital role as it is crucial for infants' growth and development especially when there is an absence of mother's milk. Over the last decade, the IFM supply chain has faced various risks and disruptions all over the globe. These disruptions vary in origin, magnitude, and impact on the product and the supply chain continuity. In this research, we provide a general framework for leveraging the resilience of IFM supply chain. The framework begins by analyzing different stages and processes of the IFM supply chain starting from the cultivation product development phase until the IFM product reaches retailer stores. After that, through adapting the Hazard and Operability Study (HAZOP) application to the supply chain, the possible risks were detected. The risks were categorized to prioritize critical ones, enabling the formulation of a general contingency plan to leverage the resilience of the IFM supply chain. K means ++ and K clustering algorithms were used to cluster the risks based on severity, using eight attributes that are cost, product availability/quantity, lead times, health impact, probability of occurrence, risk velocity, risk detectability, and risk persistence. These attributes were evaluated for each risk based on the experience of the team, where as a result the most critical 17 risks were identified and targeted to mitigate their possible negative effect. The mitigation plan was built from a general subset of proactive and reactive measures that target critical risks using both standard mitigation practices and innovative practices involving the use of industry 4.0 technologies. As a result, the IFM supply chain can be more resilient toward unexpected disruptions.

Keywords
Chain Resilience, Supply Chain Risk Management, Infant Formula Milk Supply Chain, Risk Assessment, and Risk Mitigation.

Biography / Biographies

Maryam Al-Khatib is a Ph.D. candidate and research assistant in Engineering Management at the Department of Mechanical and Industrial Engineering of Qatar University. Her background is in Industrial and System Engineering. Maryam was involved in various research that focused on optimization of various aspects of supply chain management.

Prof. Mohamed Haouari is a Professor of Industrial Engineering at Qatar University. Prof. Haouari published widely in international reputed journals and published more than 100 papers in international journals. Furthermore, he supervised 18 Ph.D. dissertations and 15 Master dissertations. While his main area of expertise is the mathematical modeling and optimization of complex systems, he has been involved in several projects related to supply chain and solution of large-scale linear, discrete, and nonlinear optimization problems.

Dr. Mona Haji works as Head of Materials and Contracts for Qatar Foundation. Over the past ten years, she has worked as a Senior Materials Engineer and Maintenance Engineer for Qatar Foundation. Additionally, she has established maintenance contracts for the Foundation in addition to her experience in materials and store management. Logistics and supply chain management are two of her areas of interest. Her papers have been published in several renowned international journals and conferences. She earned her PhD at Hamad Bin Khalifa University (HBKU), College of Science of Engineering (CSE), Logistics and Supply Chain Management Program. She holds an MSc in Engineering Management from the Science and Engineering Department at the University of Qatar and a BSc in Mechanical Engineering from the Science and Engineering Department at the University of Colorado at Denver.

Dr. Mohamed Kharbeche is a Research Associate at Qatar Transportation and Traffic Safety Center, Qatar University, Qatar. He holds a Ph.D. in Operations Research/Management Science and has extensive experience in solving complex problems (linear and non-linear) using heuristics, metaheuristics, and exact methods. He has vast knowledge of supply chain problems and mathematical modeling software such as CPLEX. He has worked in several areas of optimization and scheduling. He is the principal investigator/mentor in many research projects on pedestrian behavioral analysis, traffic system modeling and simulation, and hazardous material transportation funded by Qatar National Research Fund.