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Logistics performance in Saudi Arabia: A Case Study Using Six Sigma DMAIC, FMEA

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Abstract

This study aims at a set of quality issues recurring in a leading third-party logistics provider in Saudi Arabia, where products often arrive damaged in sealed cartons. Such incidents denote inefficiencies in handling, packaging, and inventory management that raise operational costs, curb customer satisfaction, and might even result in a breach of trade law. A comprehensive assessment of the damage and reduction thereof employ Lean Six Sigma principles through the DMAIC framework, aided by Failure Mode and Effects Analysis (FMEA). DMAIC goes about defining the damage problem, establishing baseline measures for quantifying the damage, determining the root causes of the damage, and contriving improvements to suit each cause accompanied by controls for sustainability. FMEA assessment of potential failure modes in handling and storage operations calculates the Risk Priority Number (RPN) for each and addresses those modes evidencing the highest risk levels first. Adopting this integrated approach shall considerably reduce the destruction of cartons by improving packaging standards and handling procedures. Secondary problems such as incorrect labeling and short shipment also become addressed under improved process visibility and compliance monitoring. The findings show how the lean six sigma methods, combined with risk-based prioritization, build a solid quality-assurance system geared towards logistics operations. This case contributes to practice and literature by extending the applications of Lean Six Sigma and FMEA evaluation to the Middle Eastern logistics context to support Saudi Vision 2030 for operational excellence and supply chain resilience.

Keywords
Lean Six Sigma, DMAIC, FMEA, Logistics Quality, Saudi Vision 2030

Biographies
Dr. Hasan Balfaqih is an Assistant Professor in the College of Business at Effat University, Jeddah, specializing in Operations and Supply Chain Management. Dr. Balfaqih has held several academic and leadership roles, including Head of the Supply Chain Management Department at the University of Business and Technology. He has taught across undergraduate and graduate levels in areas such as decision science, operations management, logistics, and strategic supply chain fundamentals. His research interests include supply chain performance, sustainability, Lean Six Sigma, and desalination supply chains. He has published in leading journals such as Desalination, Computers in Industry, and Uncertain Supply Chain Management, and has presented at international conferences including IEOM and the International Conference on Business and Technology, receiving a Best Paper Award. He is also an editorial board member and reviewer for several journals and an active member of professional societies such as IEOM, APICS, POMS, and EUROMA.

Sara Alashar is a senior undergraduate student pursuing a Bachelor of Science in Supply Chain Management at Effat University, Jeddah, Saudi Arabia. She has developed strong academic and teamwork skills throughout her studies and is actively engaged in extracurricular activities, including being a volleyball player, which has strengthened her discipline, leadership, and collaboration abilities. Sara's academic interests include supply chain optimization, logistics, and sustainable business practices. She is dedicated to applying her knowledge and skills to real-world challenges and aims to contribute to the development of efficient and sustainable supply chain solutions in the future.

Malak Ali is a senior undergraduate student pursuing a Bachelor of Science in Operations and Supply Chain Management at Effat University, Jeddah, Saudi Arabia. She is passionate about diverse areas within her field, including procurement, logistics, supply chain strategy, quality management, sustainability, and digital transformation. As an active member of the IEOM (Industrial Engineering and Operations Management) Student Chapter, she has strengthened her leadership, teamwork, and organizational skills while connecting with peers and industry professionals. Her academic and professional interests focus on how artificial intelligence, data analytics, and emerging technologies can improve supply chain resilience, enhance supplier reliability, and support Saudi Arabia's Vision 2030 goals. Fluent in Arabic and English, Malak brings strong communication, problem-solving, analytical thinking, adaptability, and project management skills to her work. She is dedicated to bridging theory and practice by contributing innovative solutions that drive efficiency, sustainability, and competitiveness in business operations.

Rand Balkhair is an undergraduate student pursuing a Bachelor of Science in Operations and Supply Chain Management at Effat University in Jeddah, Saudi Arabia. Throughout her studies, she has built strong analytical, problem-solving, and teamwork skills and has actively participated in various academic projects focused on logistics, sourcing, and smart systems. Her academic interests include supply chain optimization, sustainable logistics solutions, and business development. Rand is passionate about applying her knowledge to real-world challenges and aims to contribute to advancing innovative and sustainable supply chain practices in Saudi Arabia.