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Improving Operational Efficiency and Reducing Downtime: Applying Lean Six Sigma in Material Recovery Facilities

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Abstract

In response to challenges within the solid waste industry in Puerto Rico, this research focused on enhancing Material Recovery Facility (MRF) operations using Lean Six Sigma. Employing the DMAIC framework, the study tackled recurring downtime at one Puerto Rico MRF. Key findings include identifying root causes, such as conveyor jams and material entanglements, and proposing improvements like continuous professional development, preventive system upkeep, and specialized equipment additions like the Industrial Bag Opener and Motorized Brush. The study projected a 30% downtime reduction, yielding an annual saving of around \$97,630. This ROI calculation factored in operational enhancements and equipment costs, highlighting the financial benefits of Lean Six Sigma integration. Emphasizing Lean Six Sigma's value in MRF operations, the study provides insights for the industry and underscores data-driven waste management enhancements. Moreover, its alignment with UN Sustainable Development Goals 8, 9,

and 11 highlights contributions to decent work and economic growth (SDG 8), industry, innovation, and infrastructure (SDG 9), and sustainable cities and communities (SDG 11). The research showcases the practical advantages of Lean Six Sigma in MRF operations, serving as a model for the broader waste management sector and affirming the value of data-driven enhancements.

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Keywords

Industrial engineering, Downtime, Lean Six Sigma, Recycling, Solid Waste Industry

1. Introduction

This research paper examines the challenges faced by the solid waste industry in Puerto Rico, particularly in material recovery facilities (MRFs), which are essential for sorting and processing recyclables. According to EPA & FEMA (2020), these facilities need more downtime, decreasing operational efficiency, increasing costs, and potential waste accumulation. The study explores the application of Lean Six Sigma, a methodology combining Lean's waste-elimination and process-optimization principles with Six Sigma's focus on reducing process variation and defects, as a solution to these challenges. While Lean Six Sigma has been successful in other industries, its application in Puerto Rican solid waste management, particularly in MRFs, is under-researched (Closed Loop Partners, 2020).

The research focuses on a case study of an MRF in Puerto Rico, implementing Lean Six Sigma and its DMAIC methodology. Considering its unique operational context, it aims to identify strategies and best practices for applying this methodology in this MRF. The study will discuss the results and advantages of Lean Six Sigma implementation in the MRF, address challenges and barriers, and provide recommendations for successful integration. This research contributes to understanding Lean Six Sigma's application in the solid waste industry and material recovery facilities, offering potential solutions to improve efficiency and reduce downtime.

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