

Engineering Economic Analysis of Implementing a Materials Recovery Facility in Jamaica: A Green Industry Approach Towards a Sustainable Developing Economy

Damian S. J. Graham, Ashleigh H. Hall, Damani R. Sulph, Michael A. James, Shawn B. Vassell

Department of Industrial Engineering
University of Technology, Jamaica
Kingston, JM 00000, JM

damian.graham@utech.edu.jm, hallashleigh10@gmail.com, drsulphh@gmail.com,
mikey.jamez@gmail.com, vassellshawn19@gmail.com

This report evaluates the design and feasibility of a Materials Recovery Facility (MRF) in Jamaica as a potential green industry solution to the country's economic and waste management issues. Jamaica is a developing country that is sensitive to climate change, which could have an impact on the country's blue economy and tourism industry. The National Solid Waste Management Authority (NSWMA) of Jamaica only collects a percentage of the annual solid waste produced, which is subsequently transferred to dumpsites. The balance is either burned by the local population or illegally disposed of. These practices negatively impact the environment, threatens the sustainability of economic growth from blue economy and tourism and its waste management system is predominantly a cost center. Implementing an MRF could enhance the manufacturing sector, contribute to economic growth, and serve as a catalyst for the development of a green industry with diverse downstream value chains and supply chain connections.

There is a global movement toward reuse and recycling, which has resulted in the creation of an international market for recycled solid waste. MRFs allow for the efficient sorting of solid waste into desired recoverable commodities, opening the door to international recycling waste trading. In comparison to similar and more advanced regions, research into the current situation and efforts to enhance waste management in Jamaica is discussed. The research looks into the concept of green industrialisation and how it may help fragile small-state economies like Jamaica. MRFs as a seeding factory can anchor the reverse and forward logistics of other green businesses as part of a logistic-centered economy, according to the study. The research also includes an engineering economic analysis that evaluates the feasibility of implementing an MRF in Jamaica.

This study details the probable costs of building and managing an MRF, as well as a realistic cash flow forecast to set a profit benchmark. The approach uses industrial engineering tools and procedures to consider quantitative and qualitative data, assumptions, and modelling. Facility planning, system analysis, and operations research approaches are discussed, with a focus on linear programming techniques. Policy, technological, and public education approaches to overcoming various implementation obstacles are described in depth. The findings of this study provide a credible assessment of the feasibility of implementing an MRF to improve Jamaica's solid waste management and contribute to societal, environmental, and economic benefits, as well as provide an alternative road to economic sustainability.

Keywords

Engineering-economic analysis, facility design, sustainability, solid-waste management and plant layout.

Acknowledgements

Special thanks to Mr. Hugh Cargill of the University of Technology Jamaica for his contributions to the successful completion of this research paper. His guidance in facility planning and project management was essential to the team meeting key deliverables within the scheduled timeframe.

Biographies

Damian St. Jude Graham is an experienced Scholar-Practitioner with a vast business acumen of over 20 years. Currently Program Director for Industrial Engineering at The University of Technology Jamaica. His research interests are in industrial engineering, sustainability and supply chain management. He has worked in a number of industries in an executive role including Urban Development, Mining, Heavy Equipment Rental, Transportation, Adult Beverage (beer and spirits), Fast Moving Consumer Goods (FMCG) and Agriculture. He is former CEO at the Urban Development Corporation in Jamaica, leading the urban development, renewal and revitalizing agenda for the nation. He has held senior executive roles with Jamaica Producers, Red Stripe and Diageo delivering several transformational programs; and an industrial engineer by training and a registered professional engineer in Jamaica and Trinidad & Tobago. He is currently the president of the Society of Caribbean Industrial Engineers and a committee member of the REMC Steering Committee. He holds a doctorate in business administration DBA in Global Operations and Supply Chain Management from Capella University since 2014, a Masters in Philosophy (MPhil) in Industrial Engineering from the University of the West Indies, St Augustine, among other training audits, governance, leadership and coaching of high-performance teams.

Ashleigh H. Hall is a final year student studying Industrial Engineering, with a minor in Engineering Management at the University of Technology, Jamaica. She has served in leadership positions for various team projects primarily relating to Ergonomics, Lean Manufacturing Systems, Project Management, Operations Market and Work Measurement and Design. While attending university, Hall held positions at Jamaica Productivity Centre, The Victoria Mutual Building Society and Factories Corporation of Jamaica. She is an active member of numerous committees and associations, including the Jamaica Institution of Engineer (JIE) and Institute of Industrial and Systems Engineers (IISE) as student members. She also served as the representative for Jamaica students for the Society of Caribbean Industrial Engineers (SCIE). In collaboration with faculty members and students, Hall oversaw the Society of Manufacturing Engineers (SME) Student Chapter S430 three-year roadmap development plan as president in the year 2020 for the University of Technology, Jamaica. With the aims to spark interest and focus on developing skills in the manufacturing industry in Jamaica to foster innovation. Also, to develop leaders to sustain, improve and accelerate the growth of the manufacturing industry.

Damani R. Sulph is a final year Industrial Engineering student with a particular interest in system optimization, efficiency, productivity and ergonomics. With his roots in art and design in all forms, he has had several jobs in graphic design and operates as a freelance designer under the name: Dax-Vision Designs. His love for design does not stop with standard image-based art but bleeds over into other fields such as interior designing, architecture, plant layout, and 3D modelling. He boasts proficiency in several Adobe programs, along with Autodesk AutoCAD and Autodesk Inventor. He was a member at the Jamaica Productivity Centre in 2021 as an intern, where he redesigned the process layout for The Uniform Centre, performed research and reported on how to improve the Jamaica Ministry of Labour and Social Security's warehouse productivity, and constructed Standard Operating Procedures, along with process flowcharts, for all institutional operations. His goal is to help organizations realise their true potential using in-depth, quantitative and qualitative analyses to improve efficiency and increase productivity, starting with Jamaica, his country of birth.

Michael A. James is a final year Industrial Engineering student at the University of Technology Jamaica with over eight continuous years of professional experience in the retailing industry employed at Unicomer Jamaica Ltd. At Unicomer Jamaica, he has been primarily engaged in their Credit Department serving in various units and was a member of the leadership team. He currently serves as their Data Analyst and his application of Industrial Engineering techniques has been critical to his growth in this role. He gained valuable experience as a member of a project team engaged in customer journey mapping, process mapping and process improvement. He holds a Six Sigma Black Belt certification from the International Six Sigma Institute and intends to pursue a Master's in Engineering Management in addition to Project Management, Agile and Scrum Master certifications. He ultimately aspires to provide innovative business solutions key to improving the nation's productivity, technological and economic growth.

Shawn B. Vassell is a student at the University of Technology, Jamaica, pursuing his final studies for a Bachelor of Engineering Degree (B. Eng) in Industrial Engineering. His research interests are in renewable and sustainable energy, energy conservation, and industrial engineering. His professional experiences cover seven years of electrical knowledge in the Construction, Manufacturing, and Distribution industries. He is a former Junior Electrical Engineer at Synergy Engineering Limited and served as Project Coordinator at Caribbean Cement Company Limited (CCCL),

Lasco Distribution Limited, and Appleton Estates. He holds a Diploma in Electrical Engineering with a minor in Electrical Power from the University of Technology, Jamaica. As a young electrical engineer and a licensed electrician in Jamaica, he currently owns and directs Apogee Electrical Solutions. This is an electrical consultation, and installation business undertaking residential and commercial projects in Jamaica and in the near future internationally.