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## Toward Sustainable Manufacturing of Natural Rubber: The Case of a Concentrated Latex Mill

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### Abstract

Natural rubber (NR) processing industry plays a critical role in the economies of many developing countries where the rubber exports have been one of the major foreign exchange earners. At present, the growth of NR processing industry has been challenged by low productivity, rising cost of production and many environmental issues (large volumes of wastewater, greenhouse gas emissions, etc.) occurred due to its material and energy intensive nature. In order to face these challenges, adapting sustainable manufacturing measures which address the use of less energy, water and materials, and producing less waste is crucial. Accordingly, based on a case study of a Sri Lankan concentrated latex mill, this study highlights the importance of using sustainable manufacturing techniques and tools to uncover the underlying potentials for improving performances in NR processing sector. This study consists of three steps; (i) Material and economic loss, and global warming potential (GWP) quantification through the deployment of material flow analysis (MFA), material flow cost accounting (MFCA), and life cycle assessment (LCA) in a gate-gate basis, (ii) Selection and proposal of improvement options with the help of Pareto and one-way sensitivity analyses, field interviews, and literature, and (iii) Validation of suggested improvement options through the re-execution of MFA, MFCA, and LCA. With the support of this methodical hierarchy, the underlying economic and environmental hotspots in the current manufacturing process can be identified, and moreover, the degree of improvement potential can also be evaluated. Final outcomes indicate that the current manufacturing process can considerably be improved to become more economically and environmentally sustainable. To conclude, this study's research methodology and findings are believed to be enormously beneficial in both introducing and establishing a sustainable manufacturing model in NR processing industry to sustain its growth in the future.

**Keywords:** Natural rubber processing, Sustainable manufacturing, Material flow analysis (MFA), Material flow cost accounting (MFCA), Life cycle assessment (LCA)