

LIFE CYCLE ENVIRONMENTAL IMPACTS OF THE SMART
APPAREL INDUSTRY

Kande Lekamlage Shanika Prabuddhika
(179258H)

Degree of Master of Engineering in Manufacturing Systems Engineering

Department of Mechanical Engineering

University of Moratuwa
Sri Lanka

August 2023

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Kande Lekamlage Shanika Prabuddhika
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A dissertation submitted in partial fulfilment of the requirements for the degree of
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Dissertation under my supervision.

Name of Supervisor 1: Prof. HKG Punchihewa

Signature of supervisor 1:

Date: 10 / 08 / 2023

Name of Supervisor 2: Dr. JR Gamage

Signature of Supervisor 2:

Date: 10 / 08 / 2023

Abstract

The smart apparel industry has witnessed rapid growth in recent years, powered by technological developments and the increasing demand for innovative and connected clothing. However, as the industry expands, concerns regarding its environmental impacts have emerged. Therefore, this study aims to analyze the life cycle environmental impacts of the smart apparel industry, from raw material extraction to end-of-life disposal.

The research adopts a life cycle assessment (LCA) methodology to evaluate the environmental performance of smart apparel products. This involves quantifying various impact categories, including greenhouse gas emissions, energy consumption, water usage, and waste generation by considering the life cycle, from cradle to grave.

The findings reveal both positive and negative environmental impacts associated with the smart apparel industry. On one hand, the integration of technology into clothing offers opportunities for improved energy efficiency, enhanced product durability, and reduced resource consumption. On the other hand, the production and disposal of electronic components and sensors pose challenges in terms of electronic waste and hazardous material management. In addition, the study investigates potential strategies and opportunities to mitigate the environmental impacts of the smart apparel industry. These include eco-design principles, the use of sustainable materials, recycling and recovery programs, and extended producer responsibility initiatives.

Overall, this research contributes to an in-depth understanding of the environmental implications of the smart apparel industry and provides insights for industry stakeholders, policymakers, and consumers to make informed decisions regarding sustainable practices and choices. By addressing these challenges, the smart apparel industry can strive towards a more sustainable and environmentally responsible future.

Key words: Smart Textile, LCA, Wearable Technology

Acknowledgements

First and foremost, I would like to express my sincere gratitude to Prof. HKG Punchihewa and Dr. JR Gamage for guiding me through this project and for being the project supervisors. Their guidance and supervision were invaluable.

I would also like to express my gratitude for the colleagues at National Cleaner Production Center (NCPC) for supporting me and providing access to use the LCA software and databases.

Finally, I would like to express my sincere gratitude to the Director of Innovation, Mr. Gihan Philip, for granting permission to collect data related to a wearable tech garment manufactured at MAS Active Pvt. Ltd.

KLS Prabuddhika

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List of abbreviations

Abbreviation	Description
BOM	Bill of Materials
CE	Conformity with Europe
EF	Environmental Footprint
EPD	Environmental Product Declaration
EoL	End of Life
FDA	Food and Drug Administration
GSM	Grammes per Square Meter
ISO	International Organization of Standardization
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
ZDHC	Zero Discharge of Hazardous Chemicals

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Appendix A: Transportation and electricity consumption

Appendix B: Waste and wastewater details

Appendix C: LCI data

Appendix D: Impact variation results with +/- 10% parameter variation