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Advancing Organisational Life Cycle Assessment in the Fashion Industry: Strategies for Sustainable Corporate Practices

Salik Ahmed [1,4,5], Marco Ciro Liscio [1,2], Paolo Sospiro [1,2,4], Irene Voukkali [3], Antonis A. Zorpas [3]

[1] EUAbout, Bruxelles, 1000, Belgium

[2] C.I.I./Dipartimento di Ingegneria dell'Informazione, Università Politecnica delle Marche, Ancona, Via Brecce Bianche 12, 60131, Italy

[3] Laboratory of Chemical Engineering and Engineering Sustainability, Faculty of Pure and Applied Sciences, Open University of Cyprus. Giannou Kranidioti 89, Latsia, Nicosia, 2231, Cyprus

[4] Università Telematica eCampus, Novedrate (CO), 22060, Italy

[5] CREAR/Dipartimento di Ingegneria Industriale, Università di Firenze, Firenze, 50139, Italy

corresponding author: Marco Ciro Liscio
e-mail: m.c.liscio@pm.univpm.it

Abstract The fashion industry, particularly fast fashion, is one of the most environmentally destructive sectors, accounting for 10% of global carbon emissions and consuming approximately 93 billion cubic meters of water annually. Textile production alone is responsible for 20% of global clean water pollution due to dyeing and finishing processes. With over 150 billion garments produced each year, the industry generates vast amounts of waste, with 87% of discarded textiles in the EU either incinerated or sent to landfills.

This paper examines the environmental impact of fashion, assessing corporate sustainability practices through methodologies such as Life Cycle Assessment (LCA) and Organisational Life Cycle Assessment (OLCA). A detailed case study of an Italian apparel manufacturer is presented, evaluating its environmental footprint over a one-year period using the SimaPro LCA tool and the Ecoinvent database.

The findings highlight critical areas for improvement, particularly in resource consumption, emissions reduction, and waste management. Recommendations focus on increasing resource efficiency, adopting renewable energy, and ensuring transparent sustainability reporting to combat greenwashing. By identifying data-driven solutions, this paper contributes to the broader discourse on sustainable fashion, offering practical strategies for reducing the industry's environmental footprint and supporting long-term sustainability goals.

Keywords: Organisational Life Cycle Assessment (OLCA), Environmental Sustainability, Fashion Industry, Corporate Environmental Practices, Life Cycle Assessment (LCA), Sustainable Development

1. Introduction

The Organisational Life Cycle Assessment (OLCA), as outlined in (ISO/TS 14072, 2024), is primarily designed to facilitate internal improvements within an organization rather than for benchmarking against other companies or public classification. Unlike product LCA, OLCA lacks a functional unit that would enable direct comparisons between organizations. While this might seem like a limitation, from a company's perspective, it remains highly beneficial. OLCA allows businesses to assess their environmental performance over time, supporting self-comparison across different operational years, which is its primary intended use (Salik Ahmed et.al, 2024).

LCA and OLCA serve as critical analytical tools for evaluating environmental impacts across various levels, including product manufacturing, process execution, and overall organizational activities. Specifically, OLCA plays a crucial role for micro, small, and medium-sized enterprises (MSMEs), as it offers a holistic perspective on environmental sustainability. By integrating OLCA with product LCA, companies can gain a more comprehensive understanding of their ecological footprint and identify areas for improvement. These methodologies aid businesses in making strategic and technological decisions that enhance their position in the global value chain while aligning with sustainability requirements. However, the adoption of LCA and OLCA can be hindered by technical complexities and resource constraints, making implementation challenging for many organizations.

Despite its significant potential, OLCA remains underutilized in industrial practice. A review of existing literature reveals that only 12 case studies were conducted under the UNEP-SETAC-LCI framework following the publication of OLCA guidelines, with very few applications in the fashion industry (UNEP-SETAC-LCI, 2017). This highlights a critical research gap which this paper aims to address. By presenting an OLCA case study conducted in a fashion firm in Italy, this research

contributes to expanding OLCA applications in the sector. The findings not only provide valuable insights into sustainability challenges in fashion but also offer solutions tailored to industry-specific obstacles, thereby promoting life cycle thinking among fashion businesses (Marco Ciro Liscio et al., 2024)

The case study focuses on an apparel manufacturer based in Italy, which, for confidentiality reasons, remains anonymous. The study evaluates the company's environmental performance using a life cycle approach and provides recommendations to enhance sustainability efforts. The assessment was conducted using the "SimaPro" LCA software and the Ecoinvent database.

This research addresses key questions regarding sustainability in the fashion industry. Firstly, it explores potential strategies for achieving environmental sustainability in the sector. Secondly, it examines the effectiveness of OLCA as a methodology to quantify environmental burdens within fashion organizations and develop actionable solutions. Lastly, it investigates the advantages of integrating OLCA into sustainability frameworks for fashion enterprises.

2. Methodology

A case study of an apparel manufacturing company in Italy was conducted using OLCA to assess its sustainability performance over a one-year period. The SimaPro LCA tool and the Ecoinvent database were utilized to analyze environmental impacts, including resource consumption, emissions, and waste management.

Key performance indicators were established to measure sustainability efforts, highlighting opportunities for improvement through better resource efficiency, renewable energy adoption, and waste reduction strategies.

3. Results and Discussion

The study preliminary results underscore the significant environmental footprint of the fashion industry, particularly in production and processing. Findings reveal that textile dyeing and finishing processes contribute significantly to water pollution, while excessive energy consumption exacerbates carbon emissions.

The adoption of sustainability certifications and environmental management frameworks, which can improve industry transparency and corporate accountability. To mitigate environmental impact, companies must prioritize eco-friendly materials, innovative production techniques, and circular economy initiatives.

4. Limitations

Despite the potential of OLCA, some limitations were identified in this study. A major challenge is the lack of dedicated OLCA software (Forin Silvia et.al, 2019), forcing organizations to rely on product LCA tools like SimaPro and Excel-based models, which require adaptation for data modelling to achieve accurate assessments. Defining precise system boundaries is another critical issue. This complexity is further compounded by data availability challenges, with primary data often difficult to obtain, forcing reliance on secondary sources that may lack precision and relevance. Additionally, the general unfamiliarity with ISO standards among organizations presents obstacles in effectively interpreting and applying OLCA results, leading to inconsistencies in environmental performance reporting. Lastly, this study highlighted the lack of comprehensive inventory data, particularly for items such as office and technical equipment, which limit (Manzardo Alessandro et.al, 2016)the scope and comparability of assessments. Addressing these challenges is crucial for the broader adoption and refinement of OLCA methodologies.

5. Conclusion

This paper highlights the urgent need for sustainability reforms within the fashion industry, advocating for robust environmental management and policy interventions. By integrating LCA and OLCA methodologies, organizations can enhance their sustainability performance and contribute to global environmental goals.

Future research should explore the scalability of sustainable practices across different regions and fashion supply chains to ensure widespread adoption and effectiveness.

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