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SUSTAINABILITY AND INNOVATION TRANSFORMING FASHION OPERATIONS MANAGEMENT

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Abstract: *The fashion industry is currently in a state of flux, driven by growing consumer awareness and increasing regulatory pressure for sustainability and, above all, transparency. This paper examines the intersection of operations management, innovation, and socio-environmental responsibility within the fashion and apparel sector. Using qualitative methods, including an in-depth literature review and semi-structured interviews with leaders of responsible fashion companies, the study identifies key practices, tools and challenges related to the transition to sustainable operations. Findings emphasize the integration of advanced technologies, such as ERP systems and supply chain digitization, to optimize resource utilization and improve traceability. The adoption of circular economy principles, including material recycling and small-scale localized production, appears to be a promising but complex strategy. Persistent obstacles, such as high implementation costs, systemic opacity and technical constraints, remain particularly significant for small and medium-sized enterprises. To address these challenges, the paper recommends systemic collaboration, policy incentives, and investment in education to empower both businesses and consumers. This preliminary study provides actionable insights for practitioners and policymakers, while also identifying opportunities for future research to support the sustainable transformation of the fashion industry.*

Key words: *Sustainable Practices, Circular Economy, Supply Chain Innovation, Ethical Production, Digital Transformation, Socio-Environmental Accountability, Economic Priorities, Ecosilence.*

1. INTRODUCTION

In recent years, the fashion industry has undergone a profound transformation, driven by the rise of the accelerated production model, more commonly known as fast fashion. This model, based on extremely short production cycles, allows brands to frequently update their collections and respond to trends with unprecedented agility. However, this speed comes at a price: it puts increasing pressure on natural resources, working conditions and the environment. The over-exploitation of raw materials, the growing precariousness of workers in the supply chain, and the significant environmental impact of production and distribution are now major challenges. In light of these issues, it has become imperative to rethink operations management in the fashion manufacturing industry by integrating more innovative and responsible approaches. In this context, operations management in this sector is strategic because it encompasses the entire process from sourcing raw materials to delivering the final product. Yet the dominant model remains largely linear (i.e.,"*make–use–throw*," where products are manufactured, consumed, and then discarded without reuse or recycling). It also relies on a globally fragmented supply chain (where different stages of production occur in

different countries), making transparency (knowing what happens at each step) and traceability (tracking the origin and movement of materials) much more difficult.

For companies seeking to adopt more sustainable practices, these constraints present significant hurdles. In addition, while technological advances and digital tools promise more efficient management of production and logistics flows, their implementation still faces financial, technical, and structural barriers. At the same time, growing pressure from consumers, investors, and regulators is pushing more companies to integrate responsible practices. What was once considered a differentiator has become a strategic imperative. However, balancing profitability (generating economic returns), speed (responding quickly to market demand), and environmental commitment (reducing ecological harm) remains a delicate exercise. Many companies face tensions between economic performance and the transition to more ethical models, requiring deep organizational and cultural changes. This article explores how fashion companies strive to combine operational efficiency with sustainable commitments. Using a qualitative approach that blends literature review and interviews, the study reveals both the progress driven by innovation and the structural barriers that remain. It highlights the tools companies are using, the strategies they are pursuing, and the challenges they face in moving towards more responsible models.

2. LITERATURE REVIEW

Operations management plays a key role in coordinating product creation and delivery in the fashion industry, balancing quality, cost, and speed. As global competition intensifies, these functions are increasingly linked to sustainability and ethical responsibilities. Raw material sourcing, in particular, is challenging, as it determines not only product quality but also environmental and social impact. Companies are under pressure to select textiles, dyes, and components that comply with both regulatory standards and consumer demands for ethical production. According to Fletcher [1], traceability and environmental impact assessments have become crucial in differentiating brands in a market leaning toward sustainability. Yet, sourcing remains only the first step in a complex manufacturing chain involving tightly coordinated processes across geographically dispersed suppliers. Payne [2] emphasizes that while lean management helps reduce waste and improve efficiency, the fast pace of fashion cycles hinders the implementation of sustainable practices. This reveals a tension between speed-driven models and the systemic alignment needed for responsible supply chain decisions. As Colombage et al. [3] observe, innovations in materials and production methods offer promising solutions, but their high costs limit accessibility, especially for SMEs, creating disparities in the adoption of sustainable standards across the industry. As products move into distribution, logistics becomes a decisive factor. Rising consumer expectations for rapid delivery, particularly in the digital retail landscape, compel companies to rethink their logistics strategies. Naderi et al. [4] emphasise the importance of omnichannel models, combining central warehouses with physical points of sale, to maintain efficiency and manage costs. However, such models remain out of reach for many smaller companies facing financial and technological limitations. Fletcher [1] further critiques the sector’s industry's intensive use of high-emission transport like air freight and advocates for localized production as a strategy where regional know-how, short supply chains and a strong

sense of place can model systemic change and drive global sustainability shifts. Though some businesses explore sustainable logistics and shared networks, these remain exceptions rather than the rule. Efforts to optimise resources, whether materials, labour, or energy, are increasingly prioritised, as Burman [5] explains through a framework highlighting the benefits of data analytics and digitalisation. Nevertheless, fragmented global supply chains complicate coordination and standardisation, diluting the impact of sustainability initiatives. While larger companies can invest in advanced systems such as ERP and IoT, smaller companies, while representing a significant portion of the industry, are often precariously positioned with limited access to such technologies and must rely on local resources and tight partnerships as an uncertain means to optimize operations and resource utilization. Additionally, current research overlooks crucial areas such as employee training and change management, both vital for successful transitions toward responsible practices. As technologies like automation and blockchain offer new efficiencies, they simultaneously introduce challenges of affordability and energy consumption [5]. Environmental and social priorities are reshaping the industry's agenda, with the circular economy and ethics gaining prominence. Yet, as Payne [2] points out, without supportive public policies and accessible certification processes, many firms struggle to scale their sustainable ambitions. Despite the breadth of existing research, gaps remain in understanding how businesses can manage global complexity, improve technology adoption, and integrate the human dimension into sustainable transformations [6].

3. METHODOLOGY

This study uses a qualitative approach to explore the practices and challenges faced by fashion companies as they strive for sustainability. It aims to understand the strategies they use to integrate socio-environmental principles, while identifying the structural barriers that make this shift difficult. To build a solid foundation, an extensive literature review was conducted, drawing on academic research, industry analysis, and examples of best practices in responsible fashion. These findings guided the design of semi-structured interviews conducted with three key actors in the field: specifically, one founder and two senior managers of companies committed to sustainable approaches. The selection criteria focused on small- to medium-sized companies in markets where sustainable practices were already established. The data collected were analyzed thematically, combining deductive coding based on existing literature with inductive coding that revealed new and unexpected findings. This combination allowed for a rich and nuanced understanding of the realities faced by these companies. A qualitative method was essential to capture the internal dynamics of their operations and the often complex gap between their ambitions and the practical constraints of implementation. By adopting this perspective, the study offers deeper insights into both the opportunities and obstacles that shape the journey towards more sustainable practices in the fashion industry.

4. OVERVIEW OF THE STUDY AND ITS PRELIMINARY RESULTS

The fashion industry is undergoing a profound transformation now, driven by increasing environmental concerns and growing consumer expectations for greater transparency and ethical practices. This study examines the operational strategies of

companies committed to sustainability and the balance they seek between technological innovation and economic constraints. Many companies still oscillate between traditional models of mass production and emerging sustainable approaches that emphasize careful planning, better resource management, and eco-innovation. The rise of integrated systems such as ERP underscores the desire to better predict demand and minimize overproduction, which helps reduce waste and environmental impact. However, access to these technologies remains uneven, creating a gap between large corporations with ample resources and smaller companies that often lack the means to implement such solutions. Beyond resource optimization, production methods themselves are beginning to evolve. Practices such as made-to-order manufacturing, closer collaboration with certified suppliers, and strategies to reduce unsold inventory reflect a genuine commitment to more responsible models. These changes are not isolated gestures, but part of a broader shift in industry dynamics. But despite this progress, significant challenges remain. Competitive pressures and the relentless pursuit of profitability continue to slow the adoption of sustainable practices across the board. Small and medium-sized companies, in particular, face the burden of high upfront costs associated with sustainable materials and certification processes, making the transition even more complex for those with limited financial capacity. The opacity of the supply chain adds another layer of difficulty. The fragmented and globalized nature of sourcing makes it difficult to track raw materials and verify supplier working conditions. Without transparency, companies' commitments to sustainability risk being perceived as superficial. This could undermine consumer confidence and encourage what is becoming known as “ecosilence”. In other words, a strategic silence that companies adopt by avoiding disclosing their environmental performance or procurement practices. Unlike greenwashing, which involves making exaggerated or misleading claims about sustainability, eco-silence is characterized by silence or statements of little substance. It is often adopted to avoid scrutiny, regulation or reputational risk. In response, some forward-thinking brands are investing in advanced tracking technologies, such as blockchain and IoT, to improve visibility across their logistics networks. But despite their potential, these solutions require stronger regulatory frameworks and standardized protocols not yet fully in place, leaving companies to navigate this transition largely on their own. Ultimately, the transition to a sustainable fashion model cannot rely solely on the initiatives of individual companies. A collective effort involving companies, institutions and consumers is essential to structurally embed these changes. Access to targeted financing, shared infrastructure, and harmonized standards will help level the playing field and enable wider adoption of responsible practices. Without systemic support, sustainable fashion risks remaining a niche movement rather than the new industry standard. By aligning innovation with socio-environmental responsibility and fostering collaboration among all stakeholders, the sector can lay the groundwork for a more resilient and ethical future.

5. DISCUSSION AND CONTRIBUTIONS

The results of this study illustrate how the transformation of the fashion industry depends on the gradual integration of sustainability principles into operations. As shown in Figure 1, the sustainable value chain emerges at the intersection of environmental, social and economic dimensions, supported by internal and external factors and driven by innovation in

fashion operations. Companies are increasingly turning to sustainable materials, digitalization of production flows and smart logistics as levers for progress, reflecting a genuine effort to reconcile economic efficiency with socio-environmental responsibility. These initiatives are not merely symbolic: they represent real progress in reducing the sector's environmental footprint and improving labor practices, while responding to growing consumer demand for transparency and accountability. However, the study reveals persistent barriers slowing widespread adoption. The high initial investment required for sustainable materials, advanced technologies and certification continues to disproportionately affect small and medium-sized enterprises (SMEs), which often lack sufficient resources. Supply chains, which are fragmented and opaque, remain a major challenge for traceability and alignment of standards among stakeholders. While large companies have the capacity to implement ERP systems and smart manufacturing tools, smaller structures struggle to follow suit, perpetuating inequalities within the sector. Moreover, despite the momentum of public opinion and regulatory pressure, the tension between profitability and sustainability remains unresolved. Responsible practices are increasingly valued in the marketplace, but their implementation collides with economic realities that are difficult to overcome. The analysis highlights the importance of structured external support to enable systemic change. The convergence of stakeholders (governments, investors, NGOs, etc.) is important to reduce barriers and promote shared responsibility. Policies supporting circular economy initiatives, incentives for eco-innovation and shared infrastructure could significantly reduce the gap between large corporations and SMEs.

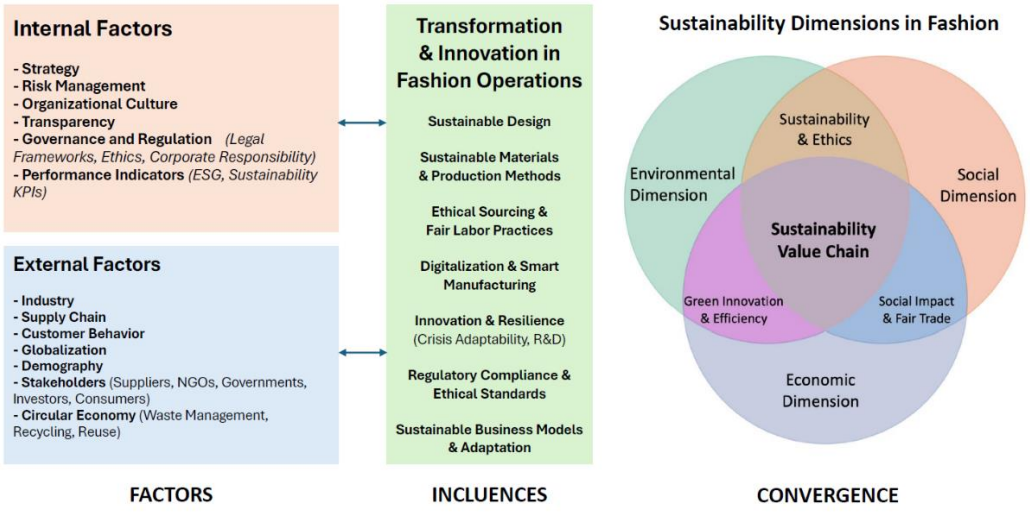

***Fig. 1**: Interactions of Factors and Dimensions in the Transition to a Sustainable Fashion Value Chain*

Figure 1 illustrates how internal governance, regulations, and resilient innovation must align with external forces such as stakeholder engagement and circular practices to drive change. Without coordination, sustainable fashion risks remaining a niche rather than an industry standard. This study advances academic and professional discourse by proposing an integrated framework that captures the complexities of the fashion supply chain and pathways to embed sustainability at its core. It highlights the urgency of collective mobilization and

targeted investment to accelerate the transition to a truly sustainable fashion ecosystem.

6. CONCLUSIONS

The sustainable transformation of the fashion industry relies on the adoption of advanced technologies, supply chain optimization, and the application of circular economy principles. However, small-medium-sized enterprises (SMEs), continue to face significant challenges such as high costs, limited visibility into supply networks, and technical constraints. Balancing profitability with social and environmental responsibility remains a major concern. To move forward, it is important to rely on collaborative initiatives, supportive public policies, and targeted investments in innovation and consumer education. As the sector reaches a tipping point, the collective commitment of all stakeholders, including companies, institutions and consumers, is essential to establish a more ethical and sustainable model. The digitization of logistics flows, and the use of integrated ERP systems strengthen traceability and improve operational efficiency. At the same time, practices such as material recycling and local production open up new opportunities but require significant structural adjustments. By combining innovation with accountability, the fashion industry can move towards more resilient management practices. It can also meet growing expectations for sustainability and transparency while building a more sustainable business model. As Payne [2] points out, the definition of sustainability in fashion remains fluid and contextual, particularly across business scales in terms of production volume and capacity to act. This calls for a more integrated view, where resource efficiency and streamlined operations are important, but must be aligned with life cycle thinking and mindful communication as key elements to drive circularity and address consumer perception biases. Their alignment across scales and functions is essential to foster more coherent and transformative practices.

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