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SUSTAINABLE DEVELOPMENT OF THE FASHION INDUSTRY THROUGH UPCYCLING

Abstract. This article examines the main directions of the circular economy in the fashion industry, highlighting the key differences between upcycling and recycling. It investigates upcycling as a key innovative strategy, ensuring the sustainable development of the fashion industry. Primary attention is given to the comparative analysis of global and niche upcycling strategies of leading fashion brands. The authors systematised the key types of upcycling used by manufacturers and assessed their specific social and environmental impact. Four main types are identified (artisan reconstruction, industrial transformation, technical, and conceptual upcycling). Based on the examples of companies such as Maison Margiela, Levi's, Stella McCartney, KSENIASCHNAIDER, and others, it is proven that upcycling is a powerful source of creative, functional, and economic value. The research results confirm that the application of upcycling is not only an environmentally responsible choice but also a fundamental factor for innovative development and the formation of conscious consumption.

Keywords: circular economy, upcycling, recycling, innovative development, sustainable development, brand strategies, textile waste, eco-design.

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СТАЛИЙ РОЗВИТОК ІНДУСТРІЇ МОДИ ЧЕРЕЗ АПСАЙКЛІНГ

Анотація. У статті проаналізовано основні напрями циркулярної економіки в модній індустрії та виявлено ключові відмінності апсайклінгу від ресайклінгу. Досліджено апсайклінг (Upcycling) як ключову інноваційну стратегію, що забезпечує сталій розвиток індустрії моди. Основну увагу приділено порівняльному аналізу глобальних та нішевих апсайклінг-стратегій провідних модних брендів. Авторами систематизовано ключові типи апсайклінгу, які використовуються виробниками, та оцінено їхній конкретний соціальний і екологічний вплив. Виокремлено чотири основні типи (художня реконструкція, промислова трансформація, технічний та концептуальний апсайклінг) та на прикладі компаній Maison Margiela, Levi's, Stella McCartney, KSENIASCHNAIDER та ін. доведено, що апсайклінг є потужним джерелом креативної, функціональної та економічної цінності. Результатами дослідження підтверджують, що застосування апсайклінгу є не лише екологічно відповідальним вибором, але й фундаментальним чинником інноваційного розвитку та формування свідомого споживання.

Ключові слова: циркулярна економіка, апсайклінг, ресайклінг, інноваційний розвиток, сталій розвиток, стратегії брендів, текстильні відходи, екодизайн.

Introduction. The fashion industry is one of the largest polluters due to the excessive consumption of primary resources and the generation of significant amounts of waste within the traditional linear "take-make-dispose" model [1–4]. The necessity for a radical shift in this paradigm has led to the global transition toward the Circular Economy, the goal of which is to minimise waste and reuse materials multiple times, ensuring their maximum retention in circulation [1–3]. The implementation of this model in the light industry requires a reorientation towards durable materials, closed-loop systems, and innovative approaches to waste management [5].

The Circular Economy begins at the design stage, where the future environmental impact of a product is determined [6]. Key concepts include "design for durability" (using high-

quality monomaterials) and "design for deconstruction" (creating products that are easily disassembled for subsequent reuse or recycling) [7–8]. Furthermore, the application of modern digital technologies (Industry 4.0), such as 3D modelling and big data analytics, ensures the optimisation of production processes and traceability of products throughout their entire life cycle [9].

An important strategy of the circular economy is extending the product life cycle through repair, rental, and resale of used goods [10–11]. In this context, Upcycling – the creative reuse of unwanted or used products into a new item with greater aesthetic or functional value [12–14] – stands out as an innovative strategy that transforms waste into a source of creative and economic value.

Despite the general recognition of upcycling, there is currently a lack of systematisation and comparative analysis of its implementation by leading market players. An unresolved part of the problem is the detailed investigation of the specific types of upcycling applied by manufacturers and the quantitative and qualitative assessment of their real social and environmental impact on the formation of a sustainable fashion economy. Research into these practices is necessary to create an effective roadmap for the sustainable development of the fashion industry.

Setting the Task. The goal of the research is to systematise and analyse the successful upcycling strategies of leading global and Ukrainian fashion brands to determine the mechanisms that transform upcycling into an innovative driver of sustainable development for the fashion industry. To achieve this goal, the following interconnected tasks are set: to formulate the main directions of the circular economy in the fashion industry; to identify the key differences between upcycling and recycling; to investigate and classify the different types of upcycling used by leading companies; to analyse their specific environmental and social impact.

Research Methods. To achieve the stated goal and systematise empirical data, a set of general scientific and specific methods was used in this work. Theoretical analysis and synthesis were applied to the critical understanding and generalisation of existing scientific works, concepts, and programmes related to the circular economy, sustainable development, eco-design, and textile waste management. The systemic approach was used to view the fashion industry as a complex system and to define the role of upcycling as an innovative mechanism within this system. A case study was the method for collecting and analysing the practical experience of leading global and Ukrainian fashion brands (Maison Margiela, Levi's, Stella McCartney, KSENIASCHNAIDER, etc.). Classification and typology were applied to group and systematise the identified upcycling strategies by type (artisan reconstruction, industrial transformation, technical upcycling). Comparative and evaluative analyses were used to compare various upcycling strategies and assess their social and environmental impact.

Research Results. The circular economy is a fundamental approach in the fashion industry that requires a shift from the linear model ("take-make-dispose") to a philosophy of conscious design. It aims to rethink the entire system of production and consumption, as well as restore the true value of clothing [15].

In the initial phase of the research, the authors examined the primary methods of implementing the circular economy in the fashion industry. They grouped them by stages of the product life cycle:

I. Eco-design and Resource Minimisation (Production Stage).

During the design of a new product, the principles of eco-design and waste minimisation are established. These principles influence the product before manufacturing, aiming to lessen environmental impact and simplify its future lifecycle. These include:

1) Design for Circularity:

- design for durability – manufacturing clothing that lasts longer;

- design for disassembly – creating items that are easy to take apart for repair or recycling;
- minimisation of mixed fibres that are difficult to recycle.

2) Sustainable and Innovative Materials:

- use of organic, regenerative fibres (organic cotton, hemp, linen);
- application of biomaterials (mycelium, bio-leather, fermented fibres, etc.);
- use of secondary materials (for example, making polyester fibres from plastic).

3) Waste Reduction in Production:

- zero-waste pattern cutting;
- optimisation of supply chains and production processes;
- digital design and 3D fitting to reduce returns, which directly impacts the volume of waste.

II. Product Life Cycle Extension (Usage Stage).

At the consumption stage, a policy for extending the product life cycle is implemented, which includes:

- 1) Repair & Care:
 - repair services offered by brands;
 - instructions and guides for care that extend the life of clothing.
- 2) Creative Reuse:
 - upcycling and artisan reconstruction – creative reprocessing of old items into a new product with higher value;
 - repurposing with design modification.
- 3) Access Models:
 - rental of clothing, especially evening and formal wear;
 - fashion-sharing services, including subscriptions for children's clothing or business suits.
- 4) Resale & Trade-in:
 - resale platforms (Vinted, Poshmark) and second-hand stores;
 - Trade-in programmes and buy-back/exchange from brands;
 - reconditioned clothing – items restored by the manufacturer to "like-new" condition.

III. Resource Recovery and Transparency (End Stage).

At the final stage of the product life cycle in the circular economy implemented in the fashion industry, the following is provided:

- 1) Recycling:
 - collection of old clothing by brands or retailers (Take-back schemes).
 - processing textile waste into new material.
 - implementation of technologies for chemical and mechanical recycling for fibre recovery.
- 2) Transparency and Traceability:
 - use of QR codes, RFID, and blockchain for tracking the origin and movement of materials;
 - openness of brands regarding production chains and the component composition of the clothing.

The key objectives of the circular economy are focused on preserving materials in circulation for the longest possible time and increasing their value, using recycling and upcycling strategies. Recycling in the fashion industry is the process of reprocessing waste (used plastic bottles, old textiles, etc.) into new raw materials for creating clothing, footwear, and accessories. This helps extend the service life of materials and reduce the amount of textile waste that ends up in landfills. Upcycling is the creative use and modification of existing

materials, textile scraps, or worn-out products, aimed at increasing the aesthetic and functional value of the material.

Table 1 groups the economic, environmental, and aesthetic differences between upcycling and recycling.

Table 1
Economic, Environmental, and Aesthetic Differences Between Upcycling and Recycling

Comparison Criterion	Upcycling	Recycling
Economic Difference	<p>Value increase: This method transforms ready-to-dispose low-value material into a premium, author-developed product with high commercial value.</p> <p>Conscious design: It proves that conscious design can be economically viable.</p>	<p>Energy costs: Often, using this method requires a significant amount of energy for processing.</p> <p>Quality reduction: This method typically involves reducing material quality (downcycling), which can limit its subsequent commercial value.</p>
Environmental Difference	<p>Resource conservation and waste minimisation: This method aims to preserve material integrity and prevent waste generation.</p> <p>Raw materials: It is an environmentally responsible practice as it reduces the need for virgin raw materials.</p> <p>Circularity: It supports the principles of a circular economy, where waste from one process becomes raw material for another.</p>	<p>Energy intensity: This method often requires a considerable amount of energy.</p> <p>Material quality: Although this method utilises recycled raw materials, it may need chemical or mechanical processing that reduces the material's quality.</p>
Aesthetic Difference	<p>Value enhancement: This method aims to enhance the aesthetic and functional value of the material.</p> <p>Creating exclusivity: It creates new exclusive products.</p> <p>Design: This method promotes the development of individual masterful design.</p> <p>Symbolism: It is capable of providing a deep symbolic load, transforming the archetype of everyday clothing (such as a polo) into a high-fashion item (like a corset), embodying a metaphor for rebirth.</p> <p>Purpose: to enhance the aesthetic or functional value of the final product.</p>	<p>Goal: Utilisation and reuse of raw materials, not necessarily the enhancement of the aesthetic or functional value of the final product.</p>

Source: table compiled by the authors based on personal research and [1–20].

Thus, upcycling is a strategy focused on the quality, functionality, and durability of the product. Unlike recycling, which focuses on technical processing, upcycling emphasises creative reuse, ensuring not only environmental responsibility but also significant economic and aesthetic value growth in the material.

Unlike approaches that merely aim to preserve the quality of the material, upcycling does not involve the destruction of the original material. Instead, it preserves it, adding

uniqueness, aesthetic appeal, and significantly extending its life cycle [15]. Upcycling typically requires less energy and fewer chemicals, which underscores its environmental advantage and allows brands to combine ecological responsibility with design exclusivity.

Today, upcycling is actively used by brands as a source of limitless creativity, which increases product premiumness. An analysis of global and Ukrainian cases allows for the identification of several key strategies, which the authors have classified by type and assessed for their impact (Table 2).

Table 2

Analysis of Upcycling Strategies and Their Impact

Brand / Country	Collection / Program	Upcycling Type	Environmental, E / Social Impact, SI
<i>Maison Margiela (France)</i>	Artisanal Collection	Artisan Reconstruction	E: 100% models from recycled materials, reduced textile waste. SI: Inspires the reinterpretation of fashion as art.
<i>Levi's (USA)</i>	Repair, Reimagine, Recycle Program	Industrial Reimagining	E: Saves up to 7,000 litres of water per pair of jeans, with 80% of materials sourced from secondary raw materials. SI: Changes consumer awareness towards repair and reuse.
<i>RÆBURN (UK)</i>	"RÆMADE" Philosophy	Technical Upcycling	E: Transformation of military surplus material (parachutes, tents) into functional clothing. SI: Maximizes durability.
<i>Marine Serre (France)</i>	"Regenerated" Line	Conceptual Upcycling	E: Uses old T-shirts, vintage scarves, and bedding to create avant-garde collections. SI: Driver of design innovation.
<i>KSENIASCH NAIDER (Ukraine)</i>	Pre-Fall 2025 "Army of Me" Collection	Vintage Denim Rework	E: Recycles ≈45 tonnes of denim per year. SI: It emphasizes national identity and resource conservation.
<i>Patagonia (USA)</i>	Worn Wear ReCrafted Program	Product Life Extension	E: 85% of clothing does not end up in landfills, resulting in a 20% reduction in CO ₂ emissions compared to new production. SI: Encourages long-term use of gear.
<i>Hodakova (Sweden)</i>	Fall 2025 "String Theory" Collection	Experimental Repurposing	E: The zero-waste design collection uses 100% vintage materials. SI: Inspires young designers.
<i>RCR Khomenko (Ukraine)</i>	Upcycled Drop	Discarded Clothing Rework	E: Reduces landfill waste. SI: Supports humanitarian projects, fosters conscious consumption.
<i>Stella McCartney (UK)</i>	Circularity Program, Summer Campaign (PFW)	Luxury Circularity	E: 60% material regeneration via take-back, 40% CO ₂ reduction. SI: Activism through collections, shifting awareness towards cruelty-free fashion.

Source: table compiled by the authors based on personal research and [1–20].

Analysing the research results, four main types of upcycling can be identified:

1. Artisan Reconstruction Strategy (Niche Luxury): Brands like Maison Margiela and Bode use antique textiles and vintage products. Their strategy focuses on preserving historical value and craftsmanship, ensuring high premiumness and unique identity.

2. Industrial Transformation and Scaling: Levi's (Repair, Reimagine, Recycle program) and Re/Done focused on scaling up upcycling by deconstructing vintage jeans to create new silhouettes. This transformed upcycling from an art process into a commercially successful, industrial-creative approach [15].

3. The British brand RÆBURN is a prime example, specialising in transforming military surplus materials (such as parachutes and military tents) into functional and modern clothing. Their approach adds high functional value to the product. Patagonia (Worn Wear ReCrafted program) also follows this strategy, focusing on product life extension.

4. Conceptual and Cultural Upcycling: Marine Serre has made upcycling an integrated part of its DNA at the high fashion level, using waste to create avant-garde collections. In Ukraine, brands KSENIASCHNAIDER and RCR Khomenko [16–17] integrate upcycling not only as an eco-design approach but also as an element of national identity and a response to external challenges.

The analysis confirms that upcycling is a multifaceted strategy, and its innovative and ecological potential extends not only to waste reduction but also to generating unique value, which is a key element of the modern circular economy.

Conclusions. The research confirmed that upcycling is a fundamental innovative strategy for achieving sustainable development goals in the fashion industry.

Upcycling offers a unique value shift, transforming waste into exclusive products that enhance both the aesthetic and functional value of the material while minimising energy costs compared to recycling.

The analysis of successful cases demonstrates that upcycling is a powerful driver of innovation, allowing brands to diversify their business models. The authors' classification of upcycling strategies by type and their assessment based on socio-environmental impact provides a practical tool for the further implementation of these approaches.

Sustainability and Awareness: The systematic implementation of upcycling strategies leads to a significant minimisation of textile waste and resource conservation. It actively promotes the development of a responsible consumer culture, encouraging buyers to opt for durable and repurposed products.

Thus, upcycling is not merely a design trend but a systemic tool for transformation that ensures the economic growth of enterprises without excessive resource consumption, which is critically important for the sustainable future of the fashion industry.

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