

DEVELOPING A SUSTAINABLE DENIM COLLECTION: VIEWS, ASPIRATIONS & METHODS OF ETHICAL DENIM

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Abstract: *The article introduces the fundamental principles of sustainability in fashion and textiles and presents the critical factors of ethical denim by analyzing waste, water usage, chemical treatments, and recycling management. It introduces some of the latest literature and research dealing with these issues. It announces the aspirations of denim designers and their influence on fashion trends. It analyses some of the brands' developments and their implementation's global economic impact, social outcome, and environmental benefit. The article presents the latest innovative technologies applied in the denim industry over the last decade, analyzing the development in fabric composition, cotton/recycled cotton/organic cotton, and synthetic fibers. In this part, the most prominent literature and references available on this topic will be analyzed. The methodology of developing a sustainable denim collection is introduced in functional models. The method will be discussed on the example of developing sustainable designer brand and denim collection IKONIKA. The article presents the latest principles of developing a sustainable denim collection, compressively analyzing the innovative views, aspirations, methods, and technologies applied in the denim industry over the last decade. It introduces the model comprising some denim designers and brands' methodology, comparing them to the vision, technology, and form experiments used to develop an autonomous brand collection.*

Keywords: *design, denim garments, environmental sustainability, ethical denim*

INTRODUCTION

Fashion changed much during the past years. The overall sustainability pushed specific sectors of the fashion industry backstage. Simultaneously, the mainstream of active and healthy lifestyles promoted sectors, such as intelligent textiles, sportswear, or functional garments. Denim, the omnipresent fabric, also known to be one of the most polluting sectors in the textile and fashion industry, is considered to change. [1] Making the blue jeans' lifespan more sustainable is a new spirit driving all the denim industry innovators, inspiring them to join the forces that present innovative, new sustainable denim manufacturing and finishing methods almost daily. [2] [3] Designers and manufacturers are introducing new methods and techniques resulting from worldwide programs, collaboration, and interaction of denim mills, producers, technologists, and designers. The core goal is to meet new corporate social responsibility standards, environment, and chemical usage, which will meet the renewed criteria of the sustainable denim policy. Last years, increased social and environmental responsibility has been present in the denim sector, and the industry actors are striving to focus on the new requirements of the denim supply chain. This mainstream results in a different aesthetical and technical approach to creating a classical pair of jeans and developing a denim collection.

CRITICAL ISSUES OF SUSTAINABILITY IN DENIM

Critical sustainability issues, often mentioned in connection with the textile and fashion industry, are very prominently and explicitly present in the denim industry and the ethical ones. The fundamental principles of sustainability applied today in the fashion and textile industry are also present in the denim

industry. [4] [5] [6] Then: *What is wrong with the denim industry?* The denim industry became open to discussing the following matters to integrate the good practices in its system.

Environmental impacts of jeans production: water consumption and toxic pollution

The denim industry has a catastrophic impact on the environment. The jeans industry is the most polluting sector of the fashion industry – the second largest polluting industry globally. The jeans go through a particularly energy- and water-intensive dyeing and finishing process, starting with what gives the fabric its distinctive indigo color. After dyeing, the clothes are treated and washed with various chemicals, such as bleach, to soften, fade, or texturize the fabric. Most of our favorite shades and styles (acid washed or distressed) require additional treatments and chemicals. Overall, producing a single pair of jeans requires vast water and energy and causes significant pollution. The ecological damage is rising as the industry grows and the denim market emerges.

Denim is made primarily with cotton; however, it is often blended with synthetic polyester or elastin. Cotton is a very water-demanding crop: production of 1 kilogram of cotton can require up to nearly 20 000 liters of water. Until approximately 750 million people in the world do not have access to drinking water until about 1.5 trillion liters of water are used by the fashion industry every year. At the same time, 200 tons of fresh water are needed to dye one ton of fabric. [1] (Fig 1)



Figure 1: Visualization of facts about the water consumption of the fashion industry

The denim washing industry is considered the major industrial waste generator; the wastewater from the wash goes untreated, primarily into the rivers. [2] Wastewater of denim production contains toxic substances such as lead, mercury, and arsenic, among others. The contamination also reaches the sea and eventually spreads around the globe. According to a study that deals with the environmental impact of effluents released by denim garment washing factories in Bangladesh, only 40% showed evidence of improved filtration systems and produced clear wastewater. The study exposes the technical limitations of effluent treatment practices of the examined denim garment washing factories. [3] 20% of industrial water pollution comes from textile treatment and dyeing especially denim. 200 000 tons of dyes are lost

to effluents every year, while 90% of wastewaters in developing countries are discharged into rivers without treatment. [1] (Fig 2)



Figure 2: Visualization of the facts about the wastewater pollution

Cotton crops grown today consume a lot of chemicals: 16 percent of all insecticides are used on the plant, and many of these pose significant health risks to farmers and those living in the area. Today, large amounts of petroleum and toxic substances such as formaldehyde and cyanide are used to produce the fashionable colors of Blue Denim. These compounds are washed out in the washing phase of denim clothing resulting in a significant ecological impact on the surrounding environment; vast amounts of wastewater generated by the manufacturers are drained into the rivers without proper treatment. The environmental issues and the consequences of washing denim clothing are growing, which poses a challenge to the sustainability of the denim industry. Vast amounts of waste from jeans laundries must be treated appropriately; otherwise, the actual impact will be more severe and critical for the environment. Many denim producers are still unable to maintain environmental safety. Consequently, strict regulation, valuable frameworks, and monitoring systems, a strategic action plan with measurable outcomes are needed to ensure sustainable denim production in terms of finishing. In this regard, the government, consumers, and industry professionals need to act more responsibly wherever necessary. [3] The ground-breaking documentary RIVERBLUE examines the destruction of our rivers, its impact on humanity, and the prospect of a sustainable future. The film draws attention to the destruction of one of the world's most important rivers by manufacturing our clothing. It also demands a significant change in the textile industry from the best fashion brands that can make a difference. [4] (Fig 3)



Figure 3: Intro image of the Riverblue project

Further sustainability and ethical issues to be put on the scales

Additional matters to be placed on the scales are:

- **The importance of soil pollution matters:** The agricultural system and local vegetation are affected by wastewater, which causes chronic health problems as the soil becomes contaminated upon contact with the wastewater.
- **Low wages and unethical treatment of the workers:** The issue of unethical treatment of the workers and bad working conditions. The worldwide introduction of fashion requires fashion companies to apply fair and equitable living wages to their employees as a global standard.
- **Fabric waste management and vast quantities of unsold goods cause global impact:** Better waste management, application of new solutions, better stock management, and production planning can solve the current problem.
- **Lack of transparency in the supply chain:** Many fashion companies acknowledged that a lousy reputation costs more than investments. Transparency of the textile supply chains should become a universal objective maintained by highly detailed sustainability reporting. In achieving this goal, training, education, networking, and associations play a crucial role.

NOVEL ASPIRATIONS ON DENIM AND RENEWED TECHNOLOGIES

Making the blue jeans' lifespan more sustainable is a new spirit driving all the denim industry innovators, inspiring them to join the forces that present innovative, new sustainable denim manufacturing and finishing methods almost daily. Designers and manufacturers are introducing new methods and techniques resulting from worldwide programs, collaboration, and interaction of denim mills, producers, technologists, and designers. [7] [8] Wide environmental awareness has made companies aware that reputation, transparency, and environmentally friendly manufacturing are the new "state-of-art" of the industry. Consumers encourage brands to make a change in how they manufacture their clothing and are aware of choosing:

- Clothes made in countries with stricter environmental regulations for factories
- Organic and natural fibers that do not require for their production
- Products created under conscious and sustainable manufacturing processes
- Extended producer responsibility
- Transparent supply chain

Manufacturers, brands, and designers collaborate to deliver industry-wide sustainable solutions. Some companies are introducing new technologies that significantly reduce water use, while others strive for sustainability by supplying their factories with renewable energy and recycling water.

Levi's: Better Clothes and Better Choices For Better Planet

The world's iconic denim producer, Levi's, focuses on the innovations that make jeans as durable as ever. Materials are crafted with thoughtful quality from sourcing to finishing. With innovations in *Cottonized Hemp*, *Levi's® WellThread*, *Water<Less®* technology, the company uses fewer resources and makes less waste. The Levi's® products *made to be worn and designed to get better with age* on philosophy that durability extends beyond just everyday use. (Fig 4, next page)



Figure 4: Levi's campaign images 2021

The company has sustainable practices and methods that help make their products stand the test of time, and everything they make is rigorously tested for durability. They have a Tailor Shop can for repairing or redesigning clothing on demand. They also introduced their *SecondHand project* in 2020 to further demonstrate their commitment to longevity by extending the life of their products even further and offering customers the vintage styles they love. [5]

The world's cleanest denim factory

Saitex is a game-changing denim factory located in Vietnam. Unlike typical manufacturers, their LEED-certified facility recycles 98% of its water, relies on alternative energy sources, and repurposes by products to create premium jeans minus the waste. 98% of the recycled water is clean enough to drink! Until standard denim manufacturers waste thousands of gallons of water in the washing process, Saitex's unique closed system recycles 98% of all water used. When it comes out the other side, it is so clean that it is drinkable. Thus they advertise themselves as the world's cleaned denim factory. (Fig 5)



Figure 5: Banner image from the company website: the super-efficient jet washing machine

While 1500 liters of water are used in the standard production process of a single pair of jeans until Saitex produces the garment using 0.4 liters of water after recycling. The new technology allows a more efficient wash process, avoiding using the "belly" washing machines still widely used by standard denim manufacturers. Thanks to a closed water system and super-efficient jet washing machines, only 0.4 liters of water are lost due to natural evaporation. [6]

This denim manufacturer has reduced its energy usage by 5.3 million kilowatt-hours of power per year and reduced CO₂ emissions by nearly 80% through its commitment to renewable energy resources like solar power. The factory's energy-saving production process is highlighted by 85% of air-dried products using air recycled from hot factory machinery. After drying on the conveyor, every pair of jeans is briefly finished in a commercial machine. (Fig 6)

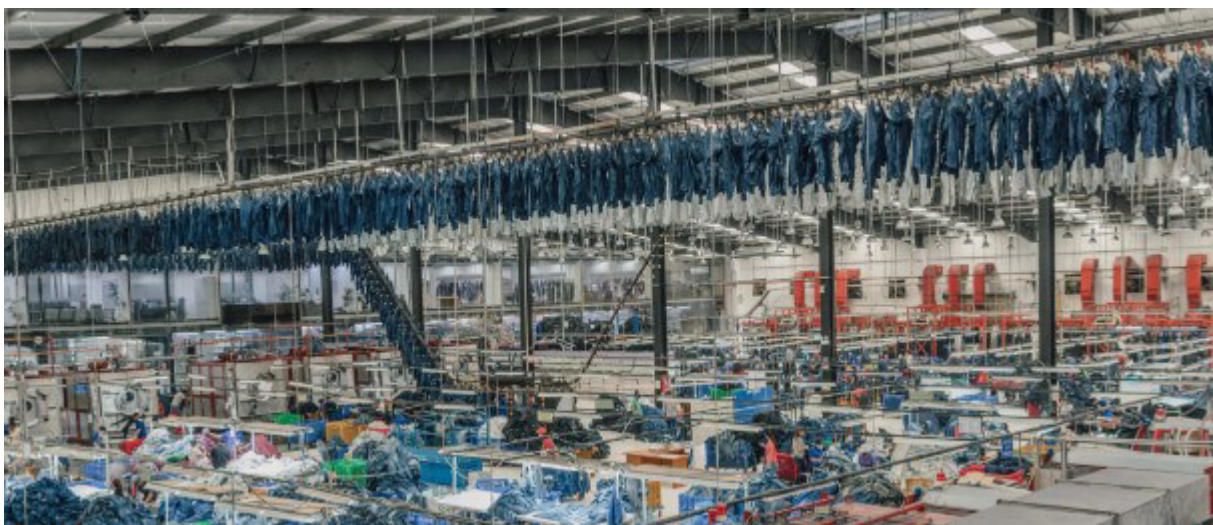


Figure 6: Air drying method for the denim products using air recycled from hot factory machinery

The goal of the denim industry is to create a closed-loop in the Sustainable Circular Economy system. This goal is satisfied by the company brick by brick by the production of bricks. Since all denim makes a toxic product called sludge, the company extracts and ships it to a nearby brick factory; when mixed with concrete, the poisonous the substance can no longer leach into the environment. The bricks are used to build inexpensive homes; so far, the factory has built ten. (Fig 7)



Figure 7: Bricks created by mixing the sludge, the toxic waste of the denim process

The methodology applied by the denim supplier proves that it is possible to produce exceptional quality within a supply chain of ethical factories, maintaining radical transparency of all the actors.

Developments in Fabric Composition: Traditional Cotton vs. Recycled, Organic, and Synthetic Fibres, and Advanced Dyeing Technologies

In the denim industry, developments in fabric composition, new fibers, and structures such as recycled cotton, organic cotton, hemp, and recycled synthetic fibers are the most advanced field. The industry has continually renewed perspectives. Biotech firm Tinctorium (US) is one of the companies working to replace harsh chemicals with bioengineered organisms. [7] Instead of using petroleum as the raw material, some other processes use renewable carbon, such as agricultural waste transformed by micro-organisms instead of corrosive chemicals. The future is open for biodegradable paints; the denim industry strives to create beautiful colors without toxic chemicals. [8] Most garment suppliers today apply recycled cotton or polyester in their product range. Often, all the cotton used in the product range should be recycled or sustainably sourced. Organic cotton, recycled cotton, or cotton are sourced through the Better Cotton Initiative (BCI). Another critical trend is moving away from cotton and looking into new ways to incorporate recycled fibers as a substitute for cotton. [9]

IKONIKA: ASPIRATIONS AND METHODS FOR MAKING ETHICAL DENIM

Implementation of above mentioned is aspirations and methods highlights the work of fashion designers. Remarkable tendencies widespread in fashion most of the time spread from independent research, influencing the art of contemporary designers. Such experiments co-occurring would boost global trends; when the same motivation inspires many designers simultaneously, shortly, a movement will arise from the separate and isolated trend germs. Such simultaneously occurring individual manifests created the basis of denim's sustainable and ethical trend and made an identifiable shift to a new paradigm in the last decade.

Developing a Sustainable Denim Collection

The autonomous denim brand IKONIKA has been created to embody the spirit of the arising trends. After its introduction in 2016, a limited series collection was born in eco-design, drawing attention to a particular matter inspiring sustainable fashion. The collections and the artworks manifested the ideas that arose from them. The first in the series was the IKONIKA ORGANIKA (2016) collection, which aimed to join and draw attention to the rising organic trend. Selected items of global brands were remade into crafted, hand-painted pieces. (Fig 8)



Figure 8: A piece from series IKONIKA ORGANIKA – Mini skirt remade from a Cheap Monday jeans

Book of organic denim-flax collection IKONIKA SS17 (2016) was followed by collection IKONIKA HERMETIKA (2017). Both in the series were inspired by esoteric traditions, integrating symbolic and

hermetic details for design inspiration. These were followed by the collection CBJ IKONIKA (2018), a collection made in international cooperation of 3 designers and three companies from 2 countries. The collection aimed to integrate the trend of international collaboration of brands and designers by involving a Serbian denim manufacturer, a small Serbian enterprise, and a Hungarian design company in an integrated project.



Figure 9: Runway images of the CBJ IKONIKA SS18 collection (selection) – Edit Csanák (2017)

The CBJ IKONIKA SS18 (2017) project attempted to integrate expertise in the region as an international multi-brand trend: products were created in collaboration with Eastern European family-run companies. The CBJ IKONIKA SS18 denim collection satisfied the emerging trend of sustainable denim. (Fig 9) The products using quality raw materials from traceable sources were made in combination with customized pieces made from unsellable denim stock and waste. They were treated by environmentally friendly manufacturing technologies. The limited series collection met the customer demand for stylish designer products different from mass-produced items. The pieces in the collection were produced in a limited series, keeping in mind the ethical and sustainability guidelines of the fashion market trends of our time, and were sold concerning fair trade. A manifest IKONIKA DENIFESTO: THE BLACK BOX (2019) followed it. The installation was made of 61 disassembled and destroyed trousers returned to the manufacturer as an example of the speculative methods applied in the fashion industry. The Black Box that was part of the installation contained the removed trademarks of an unethical brand. The protest was worded as a sonnet. Both projects strived to draw attention to sustainability and ethical issues in the denim industry and the emerging trends that arose from the matters concerned.

Semi Couture category, urban-denim style, thematic capsule collection IKONIKA LUMENIKA (2020) was inspired by György Kepes' gnostic view of the world and the timeless and obsessed passion for the lights of the Universe. Outfits were carried out in advanced trends of redesign and eco-design from recycled fabrics. The collection was exhibited at Kepes Institute in Eger (Hungary). (Fig 10, next page)



Figure 10: Sustainable, recycled denim collection IKONIKA LUMENIKA – Edit Csanák (2020)

The mural textile artwork carpet (wall textile) IKONIKA FLUIDIKA (2021) was carried out under theme “Flow” (from the Hungarian word "sodrás") for Hungary's VII International Triennial of Textile Art. The monumental mural "Blue Drift" portrays drifting with jeans as a specialty and art. The wall textile weaves together fragments and textures, memories of the twenty years of designing and work for sustainable and ethical denim manufacturing into one giant wave. (Fig 11)



Figure 11: IKONIKA FLUIDIKA: BLUE DRIFT (160 x 13 cm, details) – Edit Csanák (2021)

CONCLUSION

The article presented some aspects of sustainability and ethical behavior in the farm sector and the innovative methods and renewed technologies used in the farm industry in recent years. The social results and environmental benefits of their implementation were analyzed. The article analyzed the development of the use of fabric composition, cotton / recycled cotton / organic cotton and synthetic fibers, and presented an example of the possibility of recycling by-products from the manufacture of jeans. The methodology of developing a sustainable jeans collection is presented in the examples of the

collections of the IKONIKA designer brand. It sought answers to what methods have gained ground in the last decade to make the women's sector of the fashion industry sustainable, and what aspirations are currently driving the ethical farmers sector, and how these are inspiring individual artistic aspirations.

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