

**INTELLECTUAL PROPERTY IN SUSTAINABLE TEXTILE INDUSTRY:
NAVIGATING, INNOVATION, BRANDING, AND ETHICS IN
SUSTAINABLE FASHION**

By Prof. (Dr.) Ashok Kumar & Pallavi***

ABSTRACT

Over the past couple of years, the fashion industry has experienced a massive shift as consumers have become more sensitive to the issue of sustainability. Corresponding to this drastic change in the fashion or textile industry, a high concern is placed on the environment friendly business as far as the source material, production and supply chain is concerned. In this regard, Intellectual property rights (IPR) can be critical in shaping the journey of the sustainable textile and fashion industry. The paper will focus on the close association of Intellectual property rights with the sustainable textile industry and how these laws promote innovation, branding and ethical aspects in the industry. This paper will address how patents safeguard innovative materials and processes using eco-friendly solutions to ensure the most innovative approaches to sustainability are getting the accolades and compensation. Also, trademarks are a powerful tool that contributes to positioning sustainable fashion brands in the massively developed market to position themselves in a favourable position through the commitment to social and environmental sustainability. However, there are some difficulties with combining IPR and sustainable fashion. Counterfeited information constantly jeopardises the integrity of a sustainable fashion or textile brand and under-deceives the consumer. In addition to the evil of greenwashing or companies posing as environmentally friendly when they may not be, the importance of IP protection and consumer protection shines through. Finally, the paper will attempt to chart a way between fad and strategic aptness and antidotes of ethical responsibility by resorting to case studies, legal discussion, and industry knowledge. This cross can lead to a more sustainable and fairer future for the fashion industry.

Keywords – Intellectual Property, Sustainable fashion, Textile industry, Consumer, sustainability, Eco-Friendly.

* Professor, Head & Dean, School of Law & Governance, Central University of South Bihar, Gaya.

** Research Scholar, School of Law & Governance, Central University of South Bihar, Gaya.

I. INTRODUCTION

The textile business comprises the nucleus of the fashion world as it earns trillions of dollars and employs millions of people worldwide. Nevertheless, it is one of the most environmentally and socially problematic industries. Conventional manufacturing of textiles leads to significant pollution, high water usage levels, and dangerous chemicals and can be accompanied by abusive labour work conditions. Faced with this, the industry is quickly moving towards sustainability- a model that minimizes the environmental impact and fosters social responsibility along the supply chain.

The trend of sustainability is driven by a swell of consumer awareness, regulatory push and a pressing need to deal with climate change and social equity. Intellectual property rights (IPR) are essential legal structures that affect the creation and spread of sustainable textile innovations. IPR has both a supportive and an enabling role to play: it supports innovation in protecting the developer's new eco-friendly materials and production processes, and it enables differentiation of brand strategies to help differentiate products built with eco-friendly and ethical standards.

The paper dives into the cross-section of intellectual property law and sustainable textiles and examines the role of patents and trademarks within this business environment. The discussion explores how patents can secure first-time sustainable fibre technology, waterless dyeing, and recycling technologies, and how trademarks can build confidence in the market by preventing counterfeit products. It also presents some of the key barriers, such as small players' accessibility issues, enforcement problems, and greenwash claims that pose threats to the sustainability of textile or fashion claims.

Through case studies, legal provisions, and research, this work will provide strategic future vision and moral concerns to policymakers, industry owners, and academicians. The final aim is to show how intellectual property can be reengineered by aligning with sustainability agendas to support a more ethical and fairer future in the textile and fashion sectors.

II. Background and Literature Review

2.1. Sustainability in the Textile Industry

Sustainability in the textile industry means thinking about the lifecycle of products, i.e. raw materials, production, supply chain, usage and disposal or reuse. Traditional textile

manufacturing is toxic and resource-consuming; synthetic fibres are made of petroleum, and cotton requires lots of water and pesticides. Besides, techniques such as dyeing and finishing release hazardous chemicals into the ecosystem.

Sustainable textile conversion strategies take steps to alleviate these effects by using organic or recycled materials, clean production methods, water saving and ethical wages. Take the example of organic cotton, which lessens the use of pesticides, or innovations such as bio-based fibres made of agricultural waste (pineapple leaves, hemp) that replace synthetics with a renewable raw material. New recycling processes are being developed to establish circular production, using fewer virgin materials and minimising landfill load.

There is also an industry-wide shift toward sustainability, which has been mirrored in various global certification schemes, such as the Global Organic Textile Standard (GOTS) and OEKO-TEX(r), which provide guidelines on the conduct of materials and processes. The desire of consumers to consume transparent products that do not damage the environment is increasing, and pressure is being put on brands and textile manufacturers to adopt sustainable innovations.

2.2. Intellectual Property Rights and Their Role

Intellectual property rights (IPR) are patents, trademarks, copyrights and trade secrets that safeguard inventions and brand names. IPR can stimulate research and development, including textiles, where the inventor is given exclusive rights to commercialise their innovation during a specific time to recover their investment.

Inventions like a US patent on a new eco-friendly fibre material, the invention of new finishing processes and methods and the recycling of textiles can be patented. Trademarks secure the brand, writers, and approval marks conveying integrity and identification of a product with a green agenda.

The academic literature emphasises that IPR can be a facilitator of Sustainable innovation and a hindrance. Although protection encourages green-technological advances, restrictive licensing and aggressive patenting inhibit technology transfer, especially of SMEs and developing-country enterprises.

This article extends this literature by examining the unique operational and legal issues faced in the textile industry, with special attention to collaborative practices and policies that support sustainability without jeopardising access to the technologies needed.

III. Patent and Technological Innovation in Sustainable Textiles

Patents form one of the basic sections of intellectual property rights that grant inventors exclusive rights over their innovation within a specified timeframe, encouraging investment into research and development. Patents have further gained prominence in the textile industry, which tends to pose immense environmental and social issues, ensuring that sustainable material and manufacturing processes are developed. This chapter discusses how patents can be used to achieve green innovation in the textile industry, presenting some case studies and the challenges that should be addressed to maximise their importance in the context of green innovation in the textile industry and the policy options.

3.1. The use of Patents in safeguarding Environmentally-Friendly Advances in the Textile Industry

Patents defend new inventions relevant to sustainability objectives because they provide a basis to enjoy exclusive exploitation rights, allowing innovators to recover their investment. In the textile arena, patented technologies are diverse and include bio-based fibres made out of renewable or waste resources, dyeing and finishing techniques that significantly reduce the amount of water and chemicals used, and advanced recycling technologies to achieve circular economy targets.

For example, several companies have patented fibres from agricultural byproducts of pineapple leaves, hemp, or fungal mycelium. Such materials have a high biodegradability and much less environmental impact than synthetic or cotton fibres. Patenting laws in these areas stimulate inventions and increase capital inflow by assuring potential investors of exclusive commercial rewards.

Patent protection is also expected to be enhanced in manufacturing processes. The patented waterless dyeing technologies save a significant amount of water that is usually used during traditional dyeing. Enzyme finishing methods are used instead of chemicals during the finishing processes, which are harmful. Both varieties of processes cut back pollution and resource intensity, overcoming the critical sustainability dilemma in making textiles.

3.2. Illustrative Case Studies of Patented Innovations

A good example is the cultivation of mushroom leather substitutes. Another aspect is the patented special cultivating and processing methods that change mycelium- the mushrooms' root system- into strong, lasting, leather-like materials. The patented approaches have received significant investment and collaboration with established fashion players and initiated commercial uptake.

The final example is the fibres derived from algae, where it has been possible to extract and process fibres in a patented manner to produce biodegradable textile fibres. This patent has helped startups raise venture capital and place their products in the competitive market of sustainable textiles.

With recycling, a complex polyester-cotton blend can be separated using patented chemical recycling processes to reutilise pure fibres. Innovation is vital in closing the loop on the issue of textile waste, and it has been supported by strong patent protection that has led to further technological sophistication.

3.3. Challenges in Patent Accessibility and Enforcement

Although they have advantages, patents burden the sustainable textile industry. Licensing fees may limit the usage of patented green technologies, and SMEs and makers in developing countries will have limited access to them. This obstacle makes it challenging to scale sustainable production in various industry sectors.

In textiles, patent enforcement is complicated because many innovative improvements are incremental and effective identification of infringement may be challenging due to the complexity of the modern supply chain and the fact that it is often global and opaque. The mesh of patents (the ownership of which may be split up between individuals and firms) can present a fragmented ownership, inhibit collaboration and thwart the dissemination of innovation.

3.4. Policy Recommendations for Equitable Impact

Policy measures to deal with these challenges ought to embrace the creation of patent pools or consortium licensing platforms centered on sustainable methods of textile technology.

This type of mechanism has the potential to make licensing more efficient, reduce transaction costs, and increase access to firms that can implement eco-friendly innovations.

Governments and intergovernmental organizations can also encourage the use of patent pledges or even voluntary licensing schemes where the emphasis is put on the need to achieve the sustainability objectives rather than exclusivity in their realization. The openness of innovation and interconnected sharing networks, with the help of public-private partnerships, can partially address the gap between patent rights and the necessity of spreading green technologies.

Patents should become drivers of change in the textile industry, moving toward sustainability and providing environmental improvements and economic possibilities, bearing in mind that we should also innovate and promote the right to equitable access to technology.

IV. Trademarks and Branding for Sustainable Textile Products

Trademarks are one of the most important ways to ensure a viable, long-term, sustainable textile industry because they act as a means of distinguishing between brands and building customer confidence in a market flooded by products and environmental conscious messages. Sustainable textile manufacturers and fashion brands use trademarks to indicate authenticity and credibility to consumers that they are of a certain quality of ecological and ethically aware standards. This chapter argues that trademarks play an essential role in the branding of sustainability in the textile industry, the importance of eco-certification marks, consumers' perceptions about sustainability marks, the problem of enforcement and rising technological innovations that can help enhance the authenticity and protection of the textile brands.

4.1. Trademarks as Differentiators in Sustainable Textile Markets

The textile industry is very competitive, requiring brands to develop transparent and credible identities to win and maintain customers. Trademarks can legally protect logos, brand names, and eco-labels, and are powerful identifiers attached to sustainability promises. Goods with registered marks against trademarks or certified marks tend to attract consumer confidence due to a specific verification of social and environmental standards adherence.

Similarly, a trademark in sustainable textiles can include generic brand marks and unique, environmentally related certification marks. Labels such as the Global Organic Textile Standard (GOTS), OEKO-TEX and the Recycled Claim Standard, to name a few, have become widely used certifications for organic content, non-toxic substances, or recycled material usage. The mark certified textiles produced under responsible sources and lifted textiles to compete with standard products, creating an added competitive advantage for producers who adopted sustainability.

4.2. Consumer Trust and Market Influence

According to consumer research in the textile and apparel industries, trademarks associated with sustainability greatly influence purchasing decisions. Customers will be more willing to buy products that have tattoos of well-established eco-labels, connected in their minds with transparency, quality and ethical manufacturing. This confidence can be converted into loyal customers and enable the companies to obtain high prices for sustainable textile products.

Further, environmentally conscious consumers are becoming more aware of environmental concerns, making the sustainable trademarks a learning tool that lets buyers know where to find genuine eco-sustainable textiles in greenwashing. This corporate job is critical because textile production is also intangible, and consumers have little direct contact with the production process.

4.3. Enforcement Challenges and Counterfeiting Risks

Due to various enforcement issues, trademarks have received stiff competition in the globalised textile market. The problem of counterfeiting sustainable labels and counterfeit sustainable textile products is extreme, which endangers the brand image and misinforms customers. Fake sustainable products not only do not prove to be environmentally adequate but also challenge the confidence of consumers and harm the reputation of authentic brands.

Enforcement of trademark violations in multi-engined international supply lines is very challenging. Various legal frameworks, minimal enforcement capabilities in most textile-producing nations, and ambiguous subcontracting relationships make it challenging to provide reasonable protection.

4.4. Emerging Technological Solutions

Stakeholders in the industry are considering technological innovations to counter these issues—traceability systems based on blockchain offer traceable, auditable records across the textile supply chain. Integrating blockchain verification with trademark protection protects the sustainability certification of textiles by making them authentic and traceable, and it reinforces consumers' confidence.

Blockchain technology can also rapidly detect fake products due to the provenance records being read-only data that brands, governments, and consumers can access. These technologies are promising instruments to strengthen trademark protection and ensure the credibility of sustainable textile brands.

Trademarks and eco-certifications are essential to distinguish between sustainable textile products, consumer confidence and an authoritative green textile market. Nonetheless, to fight such phenomena as counterfeiting and protect trademarks, multiple efforts are required, including enforcing the legal frameworks and implementing digital traceability solutions. The industry can implement sustainable trademarks in the textile industry in ways that safeguard and augment sustainable production and help achieve sustainability objectives globally.

V. Challenges at the intersection of IPR and Sustainable Textile Industry

The interplay between intellectual property rights (IPR) and sustainability within the context of the textile industry poses some essential issues that pose unacceptable dangers to the viability of sustainable innovations and branding. This chapter examines the main barriers—counterfeiting, green washing, and enforcement complications. It highlights the importance of educational efforts to promote consumers' awareness about the authenticity of sustainable textile products. It is essential to become conversant with these challenges to develop relevant policies and strategies to ensure a balance between supporting IPR in textiles and human and environmental responsibility.

5.1. Counterfeiting and Its Impact on Sustainable Textile Brands

A company facing the challenge of counterfeiting can be seriously threatened to the sustainability of its textile brands. Leading with illegitimate products that claim to be green

or sustainability certified with false marks created, legitimate companies find themselves in a situation where the consumers are misled, and their profits cannot be maximised. These counterfeits tend to skip through the requirements of sustainable manufacturing, and because of this, they cause more harm to the environment and social injustice.

The issue of counterfeits in sustainable textiles undermines the brand equity, trust, and industry attainment of sustainability goals. Fraudsters use the price premium and increase the market share of environmentally related textiles because laws protecting intellectual property are not robust in most countries where textiles are produced.

5.2. Greenwashing: Ethical and Regulatory Challenges

There is also the issue of greenwashing, which is making unsubstantiated claims concerning the environmental benefits of products. Other companies inflate or lie about sustainability claims to take a market share in the green market and not invest in environmentally friendly innovations.

Greenwashing is a burgeoning threat to the credibility of sustainable messages and regulators and brand owners charged with enforcing intellectual property rights. Strict verification methods and robust regulations differentiate valid sustainability marketing arguments covered by trademarks and patents from false advertising.

5.3. Complexities of Enforcement Across Global Textile Supply Chains

The fact that the textile industry is a globalised venture increases the complexities in enforcing intellectual property. The extraction of raw materials, processing, dyeing, and manufacturing of finished products could occur in countries with different legal statutes and enforcement capabilities. This dispersion gives room to counterfeit manufacturing and impedes control. Some countries where textiles are produced are subject to resource limitations and corruption that can hamper exact tracking and legal actions to address intellectual property rights violations. The hundreds of small manufacturers and subcontractors make oversight even more difficult.

5.4. Consumer Education as a Critical Tool

It is essential to have knowledge of the consumers and explain the genuine sustainable textile products, as well as the importance of protecting intellectual properties. In a way,

informing the consumer about trademarks, patents, and eco-certifications can allow the consumer to make more informed choices regarding consumption, thus avoiding counterfeited and greenwashed products.

Through education programs that governments, NGOs, and industries drive, consumers get sensitised to the need to be aware of any sustainability mark and the dangers of counterfeit products. This consumer education props up market demand for legitimate sustainable textiles and strengthens the brand's incentives to be sustainable.

VI. Strategies for Addressing Challenges

- Addressing the multifaceted challenges requires coordinated efforts:
- Harmonising international intellectual property laws and enforcement practices tailored to textile sustainability.
- Strengthening supply chain transparency through digital technologies such as blockchain.
- Developing robust verification and certification systems to curb greenwashing.
- Expanding consumer education programs to foster knowledgeable purchasing behaviour.
- Encouraging collaboration among policymakers, industry stakeholders, and enforcement agencies to allocate resources efficiently.

Although a significant aspect of intellectual property has been seen to improve textile, sustainable development and branding, several issues continue to arise within their intersection.

Counterfeiting and greenwashing are jeopardising the integrity of markets, and it is hard to enforce them along intricate global supply chains. It is necessary to tighten legal mechanisms, harness technology, and assuage consumer education to secure the future and the attainment of the goal of sustainability and environmental and social responsibility in the textile industry.

VII. Strategic and Ethical Considerations

The intersection of intellectual property rights (IPR) and sustainability within the textile industry can be challenging due to its many positive prospects and the intricate dilemmas dashing across the bridge. The key to overcoming this crossroad is designing mitigation measures that attract innovation and implementing just-in-time and consumer safety. This chapter suggests strategic principles and ethical factors essential to amplify IPR frameworks' contribution to sustainable textile innovation, credible branding, and fair-play marketplace

behaviour. It calls attention to policies, corporate governance systems, and technologies that would move together toward the transition to achieving sustainability.

7.1.Strategic Frameworks for Strengthening IPR in Sustainable Textiles

One strategic priority that would help modify the intellectual property rights framework to suit the sustainable textiles needs is the formulation of legal and institutional guidelines. Traditional patent and trademark regimes that have been developed to enforce economic profits have to change to accommodate environmental and social goals occurring in sustainability.

- **Patent Pooling and Collaborative Licensing:** Patent pooling or collaborative licensing, focusing on sustainable textile technologies, is a strategic means. The platforms compensate for the patent rights of several innovators who can be easily and more cheaply licensed by manufacturers who need to implement green technologies. Patent pools help lower transaction costs, limit litigation risks, and hasten technological diffusion, especially for SMEs and other industry players in developing areas who cannot afford proprietary innovations.
- **International Harmonisation of IPR Enforcement:** Under the international nature of the textile supply chains, it is paramount that trademarks and patent enforcement practices across borders have to be harmonised. Governments and organisations may cooperate to establish international conventions or principles to provide more uniformity of acceptance and enforcement of sustainability-related intellectual property. That harmonisation lowers enforcement costs, discourages infringers from taking advantage of loose corners of the law, and makes the trademarks sustainable in that they enjoy adequate protection no matter where the production is performed.
- **Incentivising Sustainable Textile Innovation with Policy Support:** Governments can boost a more sustainable range of textile innovation by offering select patent subsidies, faster patent examination procedures on green technologies or tax breaks for companies that focus more on sustainability patents. These policies will create incentives for research and development investments oriented toward environmental and social objectives without undermining the incentive power of patent protection.

7.2. Ethical Dimensions of IPR in Sustainable Textiles

The administrative use of intellectual property has ethical implications within sustainability. In addition to legal compliance, IPR should facilitate truthful presentation, respect the environment, and promote social fairness.

Transparency and Greenwashing: Greenwashing, a significant ethical issue related to sustainable textiles, is the shocking state of greenwashing due to the use of exaggerated environmental claims on consumers. Intellectual property rights, especially the trademarks and certification marks, should be monitored closely so there is no marketing deception. A business has the moral responsibility to ensure its sustainability statements are substantiated and adequately communicated. Greenwashing risk can be reduced by establishing coordinated regulatory oversight, independent auditing, and clear labelling practices.

Fair Access to Sustainable Technologies: Ethical stewardship of IPR mechanisms fosters the realisation of the tension between the rights of innovators and those of society. As seen especially in the textile sector, fair access to technology translates into a wide distribution of environmental benefits, including historically disadvantaged suppliers and areas burdened disproportionately with ecological costs. Voluntary license, open innovation platforms or patent pledges with sustainability principles can be used to advance inclusivity.

Consumer Education and Empowerment: Equipping consumers with the information about intellectual property protections associated with sustainability strengthens the integrity of markets and ethical consumption. Open information regarding the importance of the sustainability trademarks and patents allows buyers to make informed decisions, brings popularity to authentic products, and disincentivises the use of counterfeited or greenwashed products.

7.3. Corporate Social Responsibility and IPR

Intellectual property management must be assimilated into wider sustainability and social responsibility-based corporate governance. Textile firms are urged to publicly report on their intellectual property assets in the context of sustainability innovations and the actions undertaken to safeguard and validate the eco-claims.

This level of integration generates some accountability and trust among the consumers. It also welcomes ethical patenting and branding policies that endeavour to consider the environment and social justice above all the profits of the businesses.

7.4.Leveraging Technological Innovation for Ethical IPR Management

Emerging technology improves ethical and strategic management of IPR in eco-friendly textiles. Blockchain, artificial intelligence and digital watermarking offer new methods of proving the authenticity of sustainable claims, identifying the provenance of the supply chain, and surveillance of improper use of intellectual property.

Blockchain systems allow open, unalterable documentation of possession and certification, allowing real-time authoritative check of textiles' green credentials. The AI-based surveillance can identify cases of possible trademark violations or false sustainability claims on the web and lead to faster regulatory action. Technologies will help the textile industry increase IPR enforcement effectiveness, strengthening ethical principles and consumer confidence.

7.5.Looking Ahead: Toward a Balanced and Sustainable Intellectual Property Ecosystem

Intellectual property in sustainable textiles can look quite different in the future, and it all comes down to supporting a healthy ecosystem, the value of innovation, inclusiveness, transparency, and responsibility. Actors in government, industry, academia, and civil society must work together to facilitate policies and practices that root IPR in sustainability goals.

Using multi-stakeholder platforms to enable consensus building on ethical standards, licensing models, and enforcement priorities may be innovative models that can support the development of moral standards, licensing approaches and enforcement priorities. Dialogue and continuous research are also needed so intellectual property laws can be dynamic regarding sustainability issues and technological changes.

In short, strategic legal changes, ethical corporate governance, consumer power and technological invention are the main pillars of an efficient approach to designing sustainable textiles. Combining these factors also ensures that intellectual property rights

stand as not only innovative factors but also the integrity, equity, and environmental stewardship of managers in the international textile industry.

VIII. Conclusion

Intellectual property rights (IPR) and sustainable textiles can be considered critical points in revealing the fashion industry's future. It has been observed that IPR frameworks, especially patents and trademarks, were found to be major drivers of innovation and branding in sustainable textile manufacturing. Yet, they present severe dilemmas that require some strategic and ethical considerations.

Patents stimulate the invention of ecologically neutral types of fibres, water- and chemical-saving production technologies, and textiles' recycling technologies. Patents promote investments and commercialization of more sustainable solutions, which are essential in reducing the massive ecological impact of the state of the textile industry. Trademarks and eco-certification labels help consumers differentiate between real sustainable textile products in a growing market, which creates consumer confidence and an incentive to produce on high environmental and social standards.

Nevertheless, IPR has been dogged by prohibitive licensing fees, the inability to enforce rights along complex global supply chains, copying of sustainable textile products and pervasive greenwashing. Such problems put the integrity of the brand and the trust of consumers at risk, which may slow the industry's shift toward sustainability. The solutions to this are teamwork across countries regarding patents, patent pooling, harmonisation of enforcement, technological innovation like the blockchain, and consumer education. The embarkation of adaptive legal frameworks, moral corporate governance, and clear communication will be critical in the Strategic alignment of IPR with sustainability objectives. Introducing intellectual property into corporate social responsibility programs, public-private partnerships, and digital tracking mechanisms can help increase regulation and fair access to sustainable innovation.

The textile industry is at a turning point, whether the intellectual right will fast-track or obstruct the process towards a sustainable and more morally sound industry. IPR practices that are innovative, inclusive, and responsible will help fashion industry stakeholders create an environment that rewards sustainability-driven innovation, safeguards the consumer, and otherwise supports establishing a more sustainable and equitable global fashion industry.

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