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SUSTAINABLE RESOURCE EFFICIENCY AND CIRCULAR ECONOMY IN GLOBAL TEXTILE INDUSTRY

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Abstract

This study examines sustainable resource efficiency and circular economy practices in the global textile industry. The study focuses on reducing material waste, optimizing water and energy consumption, and implementing recycling-based production systems. In recent years, environmental sustainability has become a key priority for textile manufacturers due to increasing regulatory pressure and rising production costs. The research is based on international reports and academic studies from organizations such as the European Environment Agency, Ellen MacArthur Foundation, and World Economic Forum. The findings indicate that sustainable production models significantly improve both environmental and economic performance.

Keywords: Sustainability, textile industry, circular economy, resource efficiency, green manufacturing, waste reduction, energy optimization, environmental management

Introduction

The global textile industry is one of the most resource-intensive sectors of the world economy, consuming large amounts of water, energy, and raw materials. According to the European Environment Agency, textile production significantly contributes to environmental pollution and waste generation. As a result, sustainability has become a critical issue for industrial development. In recent



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years, the concept of circular economy has gained importance as an alternative to traditional linear production models. This approach focuses on reducing waste, reusing materials, and extending product life cycles. At the same time, global consumers and regulatory institutions are increasingly demanding environmentally responsible production. Therefore, textile companies are under pressure to adopt sustainable technologies and improve resource efficiency. Understanding these processes is essential for analyzing the future development of the global textile industry.

Main part

Sustainable resource management in the textile industry involves optimizing the use of raw materials, energy, and water while minimizing environmental impact. One of the most important approaches is the circular economy model, which replaces the traditional “take-make-dispose” system with a regenerative production cycle.

In this model, materials are reused, recycled, or repurposed, reducing waste generation and resource consumption. For example, textile waste can be transformed into new fibers, significantly reducing the need for virgin raw materials.

Digital technologies play an important role in supporting sustainability. Automated fabric cutting systems optimize material usage by reducing offcuts and improving pattern efficiency. Smart dyeing technologies reduce water consumption and chemical waste, which is a major environmental issue in textile production.

According to the Ellen MacArthur Foundation, transitioning to a circular textile economy could reduce global waste by more than 20% in the long term. This demonstrates that sustainability is not only an environmental goal but also an economic opportunity.



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Energy efficiency is another important aspect. Modern textile factories increasingly use energy-efficient machinery and renewable energy sources. This reduces operational costs and decreases carbon emissions.

Furthermore, sustainability improves long-term competitiveness. Companies that adopt green production strategies are better positioned in international markets due to increasing consumer demand for environmentally friendly products.

Table 1. Environmental and Economic Effects of Sustainable Textile Production

Indicator	Traditional production	Sustainable production
Material waste	High	Low
Water consumption	High	Reduced
Energy usage	High	Optimized
Production cost	High	Lower

The table demonstrates that sustainable production systems outperform traditional systems across all key indicators. The most significant improvement is observed in material waste reduction and energy efficiency, which directly contribute to lower production costs. This confirms that environmental sustainability and economic efficiency are closely interconnected in the textile industry.

Overall, the integration of circular economy principles and digital technologies creates a more efficient and environmentally responsible production system.

Conclusion

The study highlights that sustainable resource management and circular economy principles enhance efficiency in the global textile industry. Eco-friendly technologies help reduce waste, energy consumption, and costs, while improving competitiveness by meeting environmental standards and consumer demand.



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Digital technologies also support sustainability by optimizing resource use and improving production efficiency. However, successful adoption requires investment in technology and changes in management practices. Overall, sustainability is both an environmental and economic strategy for the long-term growth of the textile industry.

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