International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

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ARTICLE TITLE	PRINT-ON-DEMAND FASHION MODELS FOR REDUCING OVERPRODUCTION AND ENVIRONMENTAL WASTE IN THE FASHION INDUSTRY
ARTICLE INFO	Mizanur Rahman. (2024) Print-On-Demand Fashion Models for Reducing Overproduction and Environmental Waste in The Fashion Industry. *International Journal of Innovative Technologies in Social Science*. 4(44). doi: 10.31435/ijitss.4(44).2024.3161
DOI	https://doi.org/10.31435/ijitss.4(44).2024.3161
RECEIVED	14 November 2024
ACCEPTED	23 December 2024
PUBLISHED	30 December 2024
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PRINT-ON-DEMAND FASHION MODELS FOR REDUCING OVERPRODUCTION AND ENVIRONMENTAL WASTE IN THE FASHION INDUSTRY

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ABSTRACT

The fashion industry significantly contributes to environmental waste and overproduction which result in substantial fabric waste and excess inventories. Print-on-Demand (POD) fashion models have appeared as a solution to these challenges by manufacturing items when receiving of an order. This strategy follow sustainability principles by utilizing digital printing technology to enhance production efficiency, minimize resource consumption and increase consumer preference for customization. This study evaluates the efficacy of POD models based on academic literature in mitigating overproduction and environmental waste in the fashion industry.The results of this study highlights that POD minimizes waste and underscores that POD models are an essential step in transforming the fashion industry into a more sustainable and ethical company, capable of balancing responsibility for the environment with economic feasibility.

KEYWORDS

Print-on-Demand, POD, Fashion Industry, Overproduction, Sustainability, Textile Waste

CITATION

Mizanur Rahman. (2024) Print-On-Demand Fashion Models for Reducing Overproduction and Environmental Waste in The Fashion Industry. *International Journal of Innovative Technologies in Social Science*. 4(44). doi: 10.31435/ijitss.4(44).2024.3161

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Introduction

The fashion industry's overproduction results in huge textile waste, which often ends up as deadstock or unsold inventory that create an environmental burden (Long & Gui, 2023). In fashion industry, overproduction happens because of the fast fashion model which is all about rapid production and frequent style changes (Tkachenko et al., 2021). Print on demand (POD) came up with a solution for this problem of overproduction and waste. The traditional production model leads to inventory and fabric waste while 15% of the fabric is discarded during production (Mulyadi, 2022). POD produces garments only when ordered and there is no need for extensive inventory which reduces waste. This approach aligns with the broader trend towards sustainable and green development in the textile industry as seen in adopting digital printing technologies, which enhance production efficiency and quality while lowering costs (Wang & Memon, 2023). This model addresses environmental concerns and responds to the growing demand for personalized high-quality products and rapid response to consumer preferences (Wang & Memon, 2023).

The aim of this study is to explore the effectiveness of print-on-demand (POD) models and how can it help to reducing overproduction and environmental waste for more sustainable textile production.

Background Study

Fashion industry produces more than what can be consumed leading to oversupply (Neethu & Bhuvaneswari, 2024).Inventory waste from this oversupplied clothes end up in landfills and contribute to environmental degradation (Ragab et al., 2024). Also, the resource intensive production process consumes huge amount of water, energy and raw materials which further add to resource depletion and pollution (Ragab et al., 2024; Garg & Bhardwaj, 2023). To mitigate these impacts the industry need to adopt sustainable

practices like circular fashion, sustainable materials and transparent supply chain (Siddhartha, 2024; Sawant et al., 2024).

Recent developments and technological advancements in fashion industry has been helping in sustainability, addressing both environmental and social issues. The shift towards sustainable fashion is marked by initiatives like circular fashion and consumer behavior shift towards eco-friendly choices to combat greenwashing and circular economy (Siddhartha, 2024). Environmental sustainability in fashion means reducing water usage, packaging waste and carbon footprint and circular economy plays a big role in minimizing waste (El-Den et al., 2024). This will not only benefit the planet but also will encourage brands to innovate and adopt more responsible practices and ultimately a more resilient and ethical industry.

Print-On-Demand (POD) in fashion is a game changer that allows production of clothing only after an order is placed thus minimizing waste and inventory cost. This model works by using digital printing technology to print designs onto garments so customization without extra cost regardless of the batch size (Greenstein, 2022). The popularity of POD in fashion is increasing because it offers personalized products, reduces logistics cost and can adapt to market trends quickly which is very crucial in fast fashion industry (Nadeem, 2024). Moreover, POD is being seen as a sustainable business model. It aligns with the principles of sustainable fashion by reducing overproduction and waste which are big environmental issue in traditional fashion industry (Jha et al., 2022).

Methodology

This study follow qualitative method and only uses secondary data sources to look at the effectiveness of Print-On-Demand (POD) models in reducing overproduction and waste in the fashion industry.

A targeted academic literature used to find the challenges and benefits of POD models. A thorough search was conducted on online academic databases in Google Scholar and Science Direct to find relevant academic papers. Only sources that specifically talk about print-on-demand models, overproduction, sustainability and environmental waste in the fashion industry were included. This approach gives a full understanding of how POD can be a solution to the waste and resource management issues in current fashion practices.

Findings from different sources were compared to see if there were consistencies or contradictions in the data. This comparison helped to assess the overall effectiveness of POD models and their feasibility for the fashion industry. The results from the comparison were synthesized to give a full understanding of how Print-On-Demand models address overproduction and waste along with the practical challenges fashion brands will face when implementing such systems.

Results and Discussion

The POD model supports the wider trend of sustainable retailing in fashion which includes slow fashion and eco-labeling to reduce the environmental impact of fashion production and consumption (Yang et al., 2017; Prado et al., 2022). Integrating POD into omnichannel retailing is seen as a way to be more efficient and sustainable with a new growth opportunity for the fashion industry (Nadeem, 2024). The ability to mass customize is seen as a way to promote sustainability as it caters to the growing consumer demand for eco-friendly products while minimising environmental damage (Dissanayake, 2019).

Print on Demand (POD) in the textile industry faces operational challenges of cost in logistics and technological infrastructure. One of the biggest challenge is the high cost of digital textile printing technology which can deter wide adoption. The inks and media for digital printing are expensive and it's hard for potential customers to justify the investment (Hasan, 2023). Also the technological infrastructure for this model is complex and requires integration of multiple systems such as textile printers, cutters and computing devices to manage orders and reduce waste (Aminpour et al., 2017). Despite these challenges, POD in the textile industry offers many benefits including reduced inventory, waste minimisation and flexibility which are crucial in today's fast paced market. One of the main advantage of POD is the significant reduction in inventory levels. By producing only what's demanded, companies can minimise the cost of storing unsold goods and have a faster inventory turnover (Larsson et al., 2012). This is in line with the principles of lean manufacturing which is about waste elimination and continuous improvement, reduces rework waste and operational efficiency (Luna & Ríos, 2021). Moreover, PoD reduces waste by optimising material usage. For example, on-demand apparel manufacturing systems use textile printers and cutters to arrange panels in a way that minimises scrap and ensures the fabric is used efficiently (Aminpour et al., 2017).This is further supported by digital printing technologies such as inkjet printing which allows precise and on-demand production and reduces material waste compared to traditional methods (Ryall, 2010).POD in the textile industry not only makes operations

more efficient but also aligns with the growing consumer demand for sustainable and personalised products making it a compelling strategy for modern textile businesses (Robert & Thomas, 2007).

As the fashion industry moves to Print-On-Demand (POD) models, it also has to deal with consumer perception and education around sustainability. Many consumers are unsure about the environmental benefits of POD vs traditional production methods because they don't know how these systems work (Qu, 2024). While POD reduces overproduction, brands need to communicate their sustainability efforts transparently to avoid greenwashing. Communication can build trust and encourage consumers to make more eco-friendly purchasing decisions and ultimately a cultural shift to value sustainability in fashion choices.

Conclusions

Print-on-demand (POD) offers an innovative solution to solve the problems of overproduction and environmental waste of traditional process in the fashion industry. POD allows fast fashion garment producers to only respond to the actual consumer demand, thereby reducing drastically the amount of surplus inventory and associated waste found in traditional fast fashion practice. Especially in the progressing world of e-commerece, this model not only reflects all the sustainability principles which strives at minimizing resource uses and environmental impacts but also makes sense with the demand of consumers to personalize their products. Even though POD brings operational challenges throughout its implementation like technological cost and logistics, the benefits from reduced greenhouse gas emissions, resource efficiency and energy saving are huge which also make POD a promising sustainable solution. With the progressing fashion industry progressing, POD can help to be more responsible and consumer habits, which will shape the fashion business into a more sustainable and ethical business environment. The contribution of this study highlight the importance of integrating innovative business models like POD into the broader context of sustainable fashion, paving the way for a future that prioritizes environmental stewardship while meeting the dynamic needs of consumers.

Limitations

The study has not collected any primary data and instead has used interpretations of earlier sources published to draw its insights. The absence may limit how deep and how specific the findings can be. Additionally, the research is mostly limited to English language studies as the scope may exclude valuable information and viewpoints from non-English language content. The imposition of this limitation could lead to an oversimplification of what Print On Demand (POD) models are effective at in different cultural and market contexts. The quality and rigor of the secondary service can vary a lot and the data could become inconsistent. Robust methodologies and full analysis may not be used by some studies, which would then influence findings extracted from the research. The study enumerates some of the operational problems associated with POD models, but it may not have considered all the possible hurdles clothing brands might encounter when introducing these systems into practice, including market competition, supply chain complexity and technical integration.

These limitations highlight the need for further research, particularly involving primary data collection and a broader examination of global perspectives to enhance the understanding of POD models effectiveness in promoting sustainability in the fashion industry.

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