

ACHIEVING SUSTAINABLE BUSINESS EFFICIENCY IN EVER-GROWING FASHION INDUSTRY

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ABSTRACT

The World fashion industry is around the clock, driven by new technologies, changing consumer preferences, and other factors such as social and cultural touch, globalization, lifestyle modification, trendsetters, and a massive increase in online fashion shopping caused by the pandemic and what more to reach high. Though the growth prospects are substantially high, it is one of the world's most polluting industries as it has vast energy consumption, chemicals, water, and generates mountains of waste. Global economies are now stressing the point of pollution to climate change with landfills generated by the textile industry and the robust legal framework was devised where every business in the value chain is responsible for communicating to the consumers or market how far they travel in not impacting the environment and helping it to go green.

The present study contributes to the circular economy using a self-reflective approach and a business model for achieving sustainable business efficiency in the fast-growing fashion industry. Adopted Convenient sampling method, data was collected from the manufacturers in various parts of Tamilnadu using a well-structured questionnaire. With the results obtained a sustainable business model is being framed. Data was analysed using frequency distribution, descriptives, chi square, T-test and Garret Ranking method. Findings include; manufacturers are highly aware of ESG goals with their major implementation of sustainable practices in post-production phases. They look forward for more of collaboration with stakeholders to carry forward with their sustainable vision.

Keywords: Global Economies, Sustainable Business, ESG Goals, Circular Economy, Fast and Ultra-Fast Fashion.

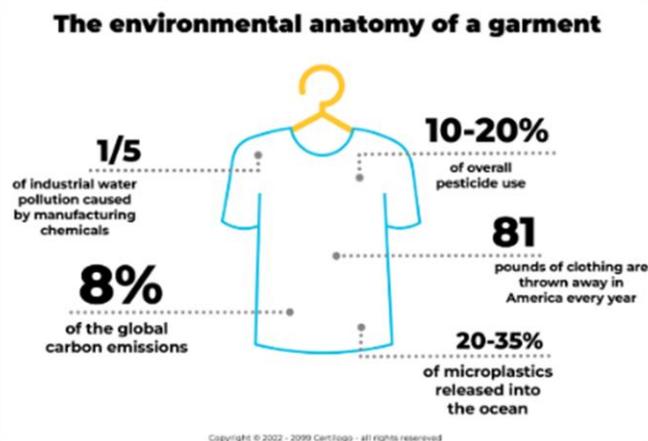
1.0 INTRODUCTION

The World fashion industry is around the clock, driven by new technologies, changing consumer preferences, and other factors such as social and cultural touch, globalization, lifestyle modification, trendsetters, and a massive increase in online fashion shopping caused by the pandemic and what more to reach high. Though the growth prospects are substantially high, it is one of the world's most polluting industries as it has vast energy consumption, chemicals, and water, and generates mountains of waste.

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business in the value chain is responsible for communicating to the consumers or market how far they travel in not impacting the environment and helping it to go green.

Fast fashion refers to the specific fashion brands that sell low-quality and low-priced products, just replicas of luxury branded products. These firms bring multifaceted products to the market every week. Cheap or low-quality raw materials lead to less durability and recycling opportunities are also very minimal. Ultra-fast fashion is the evolution of fast fashion, where the products are offered on a day-to-day basis and the trend churn is also rapid.



2.0 LITERATURE SURVEY

As this sector approximately contributes 10% of worldwide carbon emissions, it is vital to monitor the global production trends, consumer choices, and post-purchase behavior, and to impose stricter compliance standards with vendors. Meanwhile, legal systems should play a major role in the regulation of textile production and distribution across the globe (Philomena Mayer and Derya Tama Birkocak, 2024).¹

Samitha and Vidushi (2024)² in their study proposed the Development of Zero waste patterns in the Fashion industry in two ways: pre-consumer zero waste (elimination of waste during manufacture) and post-consumer zero waste (more possibility to reuse and recycle).

The adoption of eco-friendly waste reduction practices in clothing retail was made with the identification of waste generation points due to fast fashion practices and insufficient recycling systems. Thus, an improved retail cycle model was formulated based on sustainable raw material sourcing, build-up recycling initiatives, and rigid vendor compliance measures (Sweta Patnaik and Asis Patnaik 2024).³

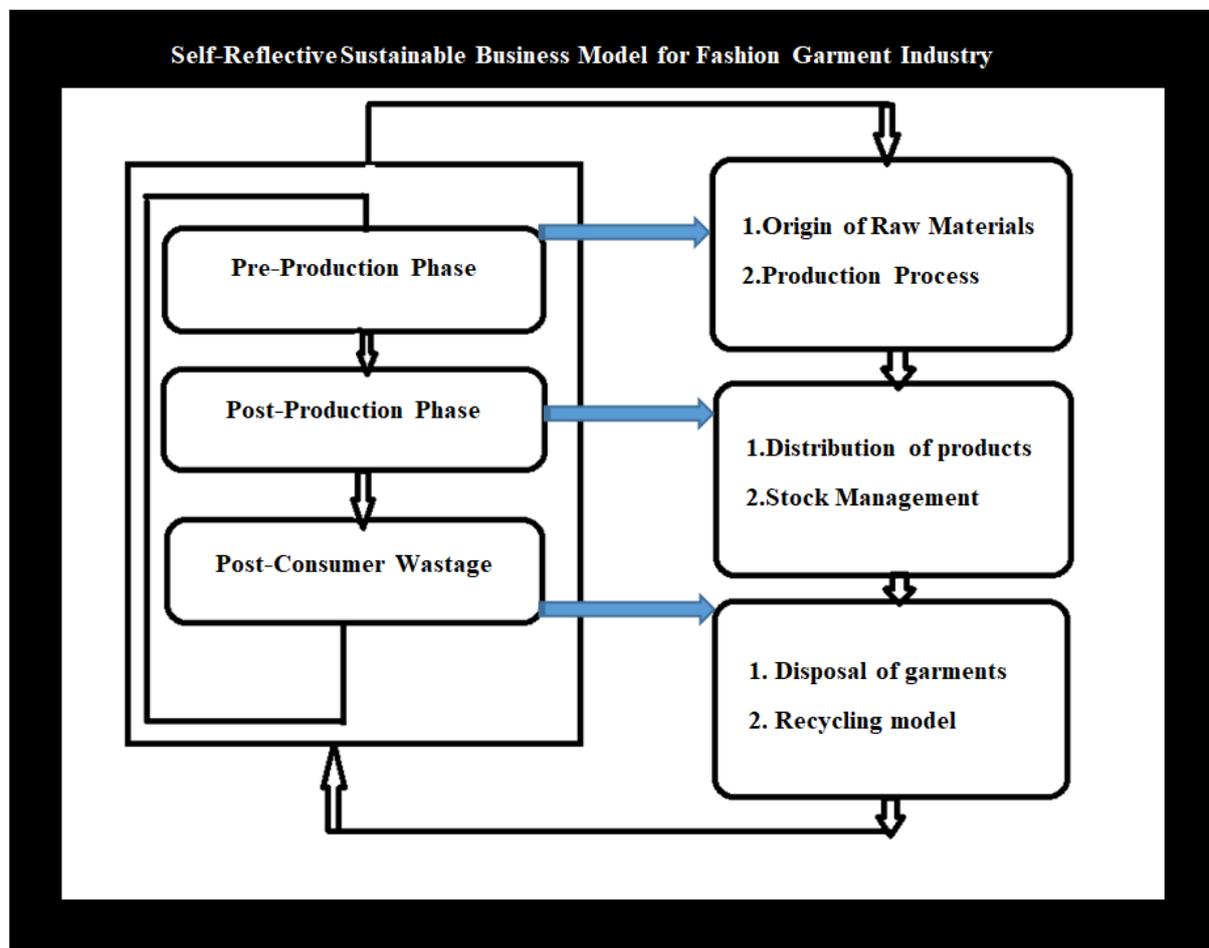
Md Abdus Shahid et al (2024)⁴, In their study, quoted the need and importance of garment recycling, the latest technologies in garment recycling, reusing models, circular supply chain initiatives, bioenergy generation, and new business opportunities. The ground-breaking technologies help in the pyrolysis of garment waste to produce bio-oil and with nanofibers, the filtration and protective cloths can be generated.

Tamanna Mohapatra, and Gautam Agrawal (2024)⁵, in their book chapter, share the escalated importance of Environmental concerns, where the key stakeholders are increasingly searching for innovative technology-based solutions to diminish the ecological impact. Today, artificial intelligence (AI) tools – both basic & generative – have emerged as potential tools, with which the fashion industry can undergo a transformation and become sustainable.

3.0 SUSTAINABLE FASHION BUSINESS MODEL

In India, textile waste is the third-largest pollutant category but the legal policies remain vastly undeveloped. Consequently, most of the waste ends up in landfills or is exported without addressing the growing environmental concerns in the homeland. A self-reflective approach is needed in textile waste management to align with global sustainability practices.

Figure: 2



The world's leading ethical brands are working with innovative fabrics made from recycled materials such as plastic bottles, sustainable fibres, etc. It is also highly concerned with the waste management methods of disposing scrap and offcuts from manufacturing units.

During the production process, the appropriate use of technology by manufacturers can reduce water consumption or the use of labour can be reduced by robotic machines. They also replace

dyes and chemicals in finishing with other substances of natural origin. Moreover, textile designers can also ideate products that are more durable and have low impact along their life cycle.

The post-Production Phase renders immediate attention to the proper distribution/collection of defective and surplus goods. With regard to distribution, businesses can reduce their carbon footprint by optimizing transportation routes, reducing the number of vehicles, and using fuel-efficient models. A Transportation Management System can help the business optimize deliveries using the least fuel, and driver time, consolidating shipments, and using shared transportation vehicles so that the cost can be minimized.

Effective Cargo Management can be achieved using renewable energy sources by installing solar panels, and wind turbines, installing high-efficiency HVAC systems with a SEER rating of 13 or more. Replacing old and inefficient material handling equipment with energy-efficient versions.

The Post-Consumer Waste phase concerns the proper disposal of throw-away garments and fabrics from consumers. The manufacturers can collaborate with various sectors like retailers, designers, recyclers, and consumers to streamline textile waste management.

Figure: 3



Not only manufacturers, this cycle can be started with retailers showing attention towards collecting the used decomposable and non-decomposable units which in turn can be supplied as input to the recycling units. Manufacturers can be recyclers also. So the once loved and used products doesn't become a land fill after its life cycle as they obtain the new shape that are reusable. Ethical brands make 20% of their turnover come from reselling second hand garments. With Purchase becoming a lifestyle, consumers look for varieties and make choices

with affordability. On this angle, the consumers increasingly choose for rent rather than buying them. Many fashion brands have come up with exclusive repair programs in case of minor damage, where the consumers can send back to the manufacturers for repairing and so the life cycle of the product is lengthened.

Sustainable Fashion wants to create a relationship with customers based on trust. Digitalization and block chain can improve transparency about the entire supply chain while **Sustainable Fashion Model** of the company shows people the company's commitment even after selling the product. The business should provide transparency to their clients by sharing detailed product data, create initiative, user friendly and highly impactful digital experiences. The users will also be informed about each link in the chain involved in the creation of their high quality, cruelty free products. The **digital Passport** being the digital twin of the company's product makes conscious consumers to follow the entire life journey of an ethical or greener product. The **green index** tag on the garment will ensure the company's responsibility to the earth, its creatures, and human beings.

The present study contributes to the circular economy using a self-reflective approach and a business model for achieving sustainable business efficiency in the fast-growing fashion industry. The main objective of the study is to find the adoption of sustainable business practices by manufacturers in three different phases: Pre-Production, Post-Production and Post-Consumer Wastage. Also to assess the challenges faced by them in adopting those practices. Using a convenient sampling method, data was collected virtually from the manufacturers in various parts of Tirupur and Coimbatore in Tamilnadu using a well-structured questionnaire. With the results obtained a sustainable business model is being framed.

3.1 Demographic Variables of the Respondents

Location	Counts	% of Total
Tirupur	26	47.30%
Coimbatore	29	52.70%
Nature	Counts	% of Total
Start-up	14	25.50%
Established	23	41.80%
Heritage	18	32.70%
Experience	Counts	% of Total
Less than 5 yrs	6	10.90%
5 to 10 yrs	26	47.30%
More than 5 yrs	23	41.80%
Turnover	Counts	% of Total
Less than 20 L	13	23.60%

20 L to 40 L	23	41.80%
More than 40 L	19	34.50%

Source: Primary Source

The above frequency distribution table depicts that the majority (52.7%) of the respondents are from Coimbatore followed by the rest (47.3%) from Tirupur. Our responses were from Established companies (41.8%), followed by heritage companies (32.7%) where the business is carried out through generations after generations. The lowest number of responses were from Start-up companies (25.5%). Manufacturers with more experience in the same field between 5 to 10 years were the majority (47.3%) followed by (41.8%) manufacturers with more than 5 years of experience. A Turnover of 20 Lakhs to 40 Lakhs (41.8%) was made by majority of the manufacturers in Coimbatore and Tirupur.

Awareness level of Manufacturers towards ESG in sustainable business practices

Traditional business goals are far more different from ESG goals where they extend one step beyond the pursuit of profit-making and shareholder value. ESG is a framework used to assess how far the organization is effectively working towards the sustainability and ethical issues, and how far the organisation is transparent and accountable for it.

3.2 Awareness level of Manufacturers towards ESG in sustainable business practices

Descriptives	Environment	Social	Governance
Mean	3.98	3.8	3.62
Standard deviation	0.85	0.911	0.871
Variance	0.722	0.83	0.759
Skewness	-0.529	-0.348	-0.203

Source: Primary Source

From the above table it is evident, the mean of ESG sustainability factors are 3.98, 3.8 and 3.62 respectively with the standard deviation of 0.85, 0.9, 0.87 respectively. Both the mean and the standard deviation values prove that the values are normally distributed.

Three Manufacturing Phases in Adopting Sustainability Business Practices

A manufacturer should be very conscious about the impact of their business to the Environment, Society and the way in which the Legal Systems Govern it. Logically, based on operations we could map three phases in which a manufacturer can initiate or participate in adopting Sustainable Business Practices: Pre-Production Phase, Post-Production Phase and Post-Consumer Wastage Phase.

3.3 Descriptive statistics of three Manufacturing Phases in adopting Sustainability Business Practices

Descriptives	Pre-Production	Post-Production	Post-Consumer Wastage
Mean	27.6	31.6	17.4
Median	28	32	17
Standard deviation	2.5	2.89	2.64
Variance	6.27	8.36	6.99
Minimum	23	26	13
Maximum	33	37	23
Skewness	0.365	-0.31	0.274

Source: Primary Source

The highest Mean value (31.6) is observed in the Post-Production Phase with a Standard Deviation of 2.89 and the Lowest Mean Value (17.4) in Post-Consumer Wastage with a Standard Deviation 2.64 in accounts of adopting Sustainable Practices in Business. The result shows majority of the manufacturing units focus on sustainable business ideas in their post-production phase which includes: Packaging, Stocking/warehousing, transportation activities and making effective deliveries. Whereas, they also pointed out only least effort can be laid on recollecting and recycling on regular basis.

3.4 Input values for a Normal Distribution Curve

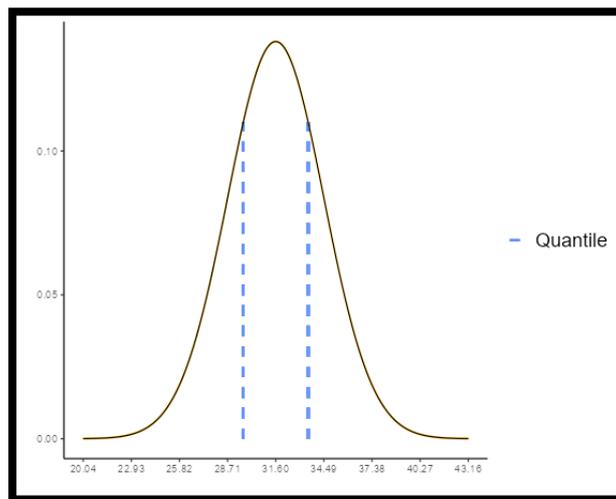
Parameters	'Compute probability'	'Compute quantile(s)'
Mean = 31.6	$x1 = 0$	$p = 0.5$
SD = 2.89	Mode: $P(X \leq x1)$	central mode

1.5 Results

	Quantiles	
Probability	x1	x2
0	29.7	33.5

Normal Distribution Curve for the highest mean value (31.6) and its Standard Deviation (2.89)

Figure: 4



Source: Primary Source

The above figure depicts the samples are normally distributed.

Relationship between the turnover of the company, the Nature of the company, and its decision to adopt Sustainable Business Practices

Using Chi-square analysis, we could understand the relationship between the nature and turnover of the company in adopting sustainable business practices.

3.5 Relationship between the turnover of the company, the Nature of the company, and its decision to adopt Sustainable Business Practices

H₀ There is no significant relationship between the turnover of the company and its nature in adopting sustainable business practices

H₁ There is a significant relationship between the turnover of the company and its nature in adopting sustainable business practices

Chi-square	Turnover			
	Less than 20 L	20 L to 40 L	More than 40 L	Total
Nature				
Startup	3	7	4	14
Established	6	10	7	23
Heritage	4	6	8	18
Total	13	23	19	55

1.7 χ^2 Tests

	Value	df	p
χ^2	1.42	4	0.841
N	55		

Source: Primary Source

We accept the Null Hypothesis (H0) since P=0.841 is greater than 0.05. We could infer that there is no significant relationship between turnover and the nature of the company's adoption of sustainable business practices. It is majorly dependent on the legal restrictions imposed by the global organizations.

3.6 Manufacturers focus on Sustainable Business Practices in their Location

H₀ There is no significant difference between the location and the manufacturer's focus on adoption of Sustainable Business Practices

H₁ There is a significant difference between the location and the manufacturer's focus on adoption of Sustainable Business Practices

Independent Samples T-Test						95% Confidence Interval		
Manufacturers focus on sustainability	T Statistic	df	p	Mean difference	SE difference	Lower	Upper	Effect Size
Pre-Production Phase	2.932	53	0.005*	1.857	0.633	0.586	3.13	0.792
Post-Production Phase	-0.613	53	0.542	-0.481	0.785	-2.056	1.09	-0.166
Post-Consumer Wastage	1.515	53	0.136	1.069	0.706	-0.347	2.48	0.409

Source: Primary Source

The above table visualizes, that there is no significant difference between the manufacturers focusing on sustainability practices in the Post-Production (P=0.542)) and Post-Consumer Wastage (P=0.136)) phases of their manufacturing and the differences in the location of manufacturing units. However, there is a significant difference between the sustainability focus in the Pre-Production phase (P=.005) of manufacturing and the location of manufacturing units.

3.7 Descriptives based on the location and three different phases of Manufacturing, where sustainable business practices are adopted

Manufacturing Phases	Group	N	Mean	Median	SD
Pre-Production Phase	Tirupur	26	28.6	28	2.17
	Coimbatore	29	26.8	26	2.49
Post-Production Phase	Tirupur	26	31.3	32	3.06
	Coimbatore	29	31.8	33	2.77
Post-Consumer Wastage	Tirupur	26	18	17	2.53
	Coimbatore	29	16.9	17	2.69

Source: Primary Source

In the Pre-Production Phase, the highest mean (28.6) is obtained by Manufacturers in Tirupur followed by the mean value (31.8) of Coimbatore Manufacturing companies. In the last phase: Post-Consumer Wastage, the highest mean value (18) is obtained by Manufacturers in Tirupur. From the result it is inferred that out of three phases, Post-Production Phase gains more attention in adopting sustainable business practices. Among two locations, Coimbatore Manufacturers are little more concerned than Tirupur Manufacturers. Recently, in the last 5 years Manufacturers (Tirupur, Coimbatore) have shown their keen interest towards their Pre-Production Phase also which includes: Sourcing, supplier selection, procurement, inbound transportation and warehousing activities. Especially with Post-Consumer Wastage phase, Manufacturers can work on sustainable business practices only when they have full support from their clients who are the chain of retail stores in destination places, also Government initiative and support to collect back the used fashion garments instead of throw away wastage. This will probably help the Manufacturer to set up a unit on concern to close the loop and recycle the product which could be refurbished in the market place with regained value.

3.8 Challenges faced by manufacturing units in implementing Sustainable Business Practices (Garrett Ranking Method)

	1*73	2*56	3*44	4*27	Total	Avg Score	Rank
F1	1022	2240	1056	1404	5722	104.03	3
F2	0	1680	4356	756	5792	105.3	2
F3	511	2240	1848	1512	6111	111.1	1
F4	2482	0	0	2268	4750	86.36	4

Source: Primary Source

The above table visualizes; Manufacturers face huge difficulties with uncertain outcomes sometimes with the new models (F3 Avg Score:111.1) of sustainable business practices followed by Challenges in measuring and demonstrating the sustainability outcome (F2 Avg Score:105.3) after the implementation of sustainable business practices. There are certain well-

established companies being highly resistant to change (F1 Avg Score: 104.03) after adopting sustainable business practices in their manufacturing process. During high demand or peak season period of fashion garments in market, it is highly demanding for the company to follow ethical labour practices (F4 Avg Score:86.36).

4.0 FINDINGS OF THE STUDY

- Majority of the Manufacturers are from Coimbatore (52.7%), with well established (41%) nature of business having 5 to 10 years (47.3%) of experience in the same field of manufacturing business, making a turnover of 20L to 30L (41.8%) in a financial year.
- Manufacturers of Fashion Garments are highly aware about ESG goals and sustainable business practices. Among the three different phases in a manufacturing process, respondents render focus on sustainable business ideas in their post-production phase which includes: Packaging, Stocking/warehousing, transportation activities and making effective deliveries. Whereas, they also pointed out only least effort can be laid on recollecting and recycling on regular basis.
- There is no significant relationship between turnover and the nature of the companies in adopting of sustainable business practices. It is majorly dependent on the legal restrictions imposed by the global organizations.
- There is no significant difference between the manufacturers focusing on sustainability practices in the Post-Production and Post-Consumer Wastage phases of their manufacturing and the differences in the location of manufacturing units. However, there is a significant difference between the sustainability focus in the Pre-Production phase of manufacturing and the location of manufacturing units.
- Post-Production Phase gains more attention in adopting sustainable business practices. Among two locations, Coimbatore Manufacturers are little more concerned than Tirupur Manufacturers.
- Recently, in the last 5 years Manufacturers (Tirupur, Coimbatore) have shown their keen interest towards their Pre-Production Phase which includes: Sourcing, supplier selection, procurement, inbound transportation and warehousing activities.
- Especially with Post-Consumer Wastage phase, Manufacturers can work on sustainable business practices only when they have full support from their clients who are the chain of retail stores in destination places, also Government initiative and support to collect back the used fashion garments instead of throw away wastage. This will probably help the Manufacturer to set up a unit on concern to close the loop and recycle the product which could be refurbished in the market place with regained value.
- Majority of the Manufacturers faces difficulties with uncertain outcomes sometimes with the new sustainable models, undergo challenges in identifying and measuring the outcome after the implementation of sustainable practices, entrenched companies faces hurdles in adapting to new policies and practices, Ethical labour practices cannot be followed during robust demand for the product in the market.

5.0 SUMMARY AND DISCUSSION

The sustainable fashion model is not just a trend but a necessary shift towards a more ethical and environmentally-friendly industry. In the study area, fashion brand manufacturers have

more awareness towards sustainable business practices and especially in post-production phase they have implemented. In Post-Consumer Wastage phase, only with the support of retailers down the lane sustainable business practices can be implemented full-fledged.

Manufacturers seem to face challenges with uncertain outcomes sometimes with the new models, unable to measure the sustainability outcome through years of practice, following ethical labour laws during robust market demand, entrenched companies face hurdles in adapting to new policies and practices during the initial period of implementation.

By adopting practices that prioritize sustainability, fashion brands can significantly reduce their ecological footprint and promote social equity. Consumers also play a crucial role by supporting brands that align with these values and making mindful choices. Collaboration among all stakeholders—brands, governments, NGOs, and consumers is essential to drive the industry towards a truly sustainable future. Together, we can transform fashion into a force for positive change, ensuring that style and sustainability go hand in hand.

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CONSENT TO PUBLISH DECLARATION

The author declares that there is no conflict of interest regarding the publication of this article.

CONSENT TO PARTICIPATE DECLARATION

Informed consent was obtained from all individual participants involved in the study. Participants were briefed about the purpose, procedures, and voluntary nature of their involvement, and their confidentiality and anonymity were assured.

ETHICS DECLARATION

Ethical approval was not required for this study as it did not involve any procedures falling under the scope of formal ethical review.

DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author, Dr. Parimala.G, upon reasonable request. The dataset comprises primary responses collected from 55 textile manufacturing companies in Tirupur and Coimbatore regions of Tamilnadu using structured questionnaires. Due to confidentiality agreements and the sensitive nature of firm-level sustainable strategy data, the dataset is not publicly archived. Access to the data may be granted upon request and subject to ethical considerations and institutional approval.