

**A STUDY ON ANALYZING THE EMPLOYEE PERCEPTIONS AND
IMPACT TOWARDS THE INTEGRATION OF ARTIFICIAL
INTELLIGENCE IN TRANSFORMING TEXTILE INDUSTRIES WITH
SPECIAL REFERENCE TO COIMBATORE DISTRICT**

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ABSTRACT:

The textile industry transformed significantly by integrating Artificial Intelligence (AI) technologies, reshaping manufacturing processes, product design, and sustainability practices. This study explores the role of AI in revolutionizing textile production by enhancing automation, improving quality control, and enabling personalized designs. AI's ability to analyse large datasets and predict market trends has proven crucial in optimizing inventory management and responding to shifts in consumer demands. Additionally, AI supports sustainable practices in textile production by reducing waste, improving energy efficiency, and facilitating circular economy initiatives. However, the adoption of AI also raises challenges, including concerns over workforce displacement, data privacy, and algorithmic biases. This study provides an in-depth analysis of the opportunities and challenges AI presents to the textile industry. It concludes with a call for continued innovation while addressing the ethical implications of AI adoption in textiles, aiming for a future where technological advancements drive both industry growth and social responsibility. Textile industries utilize automation and AI in spinning, weaving, dyeing, and printing. These processes are made further simple and efficient through AI tools. My study helps to analyse the perspective of the employees towards the integration of AI in Textile Industry and how significantly these transformations contribute towards the rise of Textile Industries.

Keywords: Artificial intelligence, Textile industry, Automation, Sustainability

INTRODUCTION OF THE STUDY:

The textile industry has undergone significant transformations over the centuries, evolving from traditional handcrafting techniques to highly mechanized and automated production processes. From the invention of the spinning wheel to the industrialization of textile production during the 18th century, advancements in technology have continuously shaped the industry's growth. In recent decades, the sector has faced new challenges, including global competition, sustainability concerns, and the need for greater customization. To meet these challenges, the textile industry has embraced innovative technologies such as Artificial Intelligence (AI) to enhance production efficiency, quality, and design capabilities.

The rise of AI in manufacturing has revolutionized not only the textile sector but many industries. With the integration of machine learning, predictive analytics, and automation, AI has introduced new levels of precision, efficiency, and adaptability. In textile production, AI technologies are being used to automate processes, improve fabric quality, predict market trends, and create innovative, sustainable designs. These advancements are shaping the future of textiles by enabling smarter, more efficient, and more customized production methods.

The primary objectives of this study are to explore the impact of AI on the textile industry, focusing on its role in improving manufacturing processes, enhancing product design, and driving sustainability efforts. The paper also aims to analyse the potential challenges and ethical considerations of AI adoption in textiles, providing insights into how the industry can balance innovation with responsibility. By examining the opinion of textile industrialists, this study will highlight the transformative potential of AI and its long-term implications for the future of textiles.

STATEMENT OF PROBLEM:

The integration of Artificial Intelligence (AI) in the textile industry has garnered significant attention in recent years due to its transformative potential in enhancing manufacturing processes, improving product quality, and promoting sustainability. This has been significantly evolved towards the global growth and development. In this regard various industries have transformed towards AI driven workplace. This adoption has significantly reflected the efficiency in the work and minimizing wastage. Though the current trends paves way for significant transformations and the industries is also flexible enough to adopt the

significant transformation, there are few challenges as well possible opportunities. Further there are still need for understanding and learning for the effective utilization of AI tool in industry. This study provides an in-depth analysis on key themes related to AI's role in textile production, including automation, predictive analytics, design innovation, and sustainability, as well as the challenges and ethical considerations associated with its adoption. Further explores on transforming Textile industry towards AI driven industry by analyzing the possible pros and cons based on the opinion of the employers and employees of various textile industries.

OBJECTIVE OF THE STUDY:

- ❖ To identify the possible opportunities employee, perceive in integrating AI in textile industry.
- ❖ To Understand the relationship between total year of experience and their concern towards potential job displacement caused by AI in textile industry
- ❖ To analyse the possible challenges that may act as a barrier from employee perspective.

RESEARCH METHEDODOLOGY:

Research Design:

The research is based on the opinion of employers and employees from various textile industries in Coimbatore district. The data were collected through both primary and secondary data collection method and the final stage is to analyse, interpret and draw a conclusion from the data collected. And samples were collected through convenient sampling.

Primary data:

A set of questionnaires were prepared and distributed to 100 employers as well as employees from textile industry in and around Coimbatore district to analyse their opinion on Integrating AI in textile industry through the primary data collection method.

Secondary data:

The secondary data were collected through various sources like newspapers, magazines, journals, articles, and websites to analyse the how AI and IOT drives textile industry and further to analyse the possible opportunities and challenges in implementing AI in textile industry.

STATISTICAL TOOLS USED:

- Percentage Analysis
- Chi-square
- Rank correlation

LIMITATION OF THE STUDY:

- The study is based on the responses collected from 100 industrialists and it is limited to their opinion.
- The study has been conducted based on the opinion gathered from textile industries in Coimbatore district.
- Lack of responses from the industrialists during the survey.

SCOPE OF THE STUDY:

AI is driving significant advancements in sustainability and resource optimization within the textile industry, addressing critical challenges such as waste reduction and energy consumption. One of the most impactful applications is the use of AI-based material usage predictions. Machine learning algorithms analyse production data and design specifications to optimize fabric cutting patterns, significantly reducing material waste. By predicting demand more accurately, AI also helps prevent overproduction, ensuring that resources are utilized efficiently and minimizing unsold inventory.

Energy efficiency is another area where AI is making a substantial difference. Smart systems powered by AI monitor and control energy usage in production facilities, identifying inefficiencies and optimizing processes. For instance, AI can adjust machinery operations in real time to reduce power consumption during off-peak hours or suggest process modifications to lower overall energy usage. These innovations not only cut costs but also reduce the carbon footprint of textile production.

AI also facilitates the adoption of circular economy principles by enabling effective recycling and reuse of materials. Advanced sorting systems equipped with AI can classify textiles by fiber type and quality, improving the efficiency of recycling processes. Additionally, AI-powered tools assist designers in creating products with end-of-life considerations, ensuring that materials can be easily disassembled and repurposed. These technologies support a closed-loop system, reducing reliance on virgin materials and promoting sustainability throughout the textile lifecycle. By integrating AI into these practices, the textile industry is making strides toward a more sustainable future, balancing economic growth with environmental stewardship.

Hence my study addresses the significant opportunities and challenges in adopting AI in textile industries with special reference to Coimbatore district.

REVIEW OF LITERATURE:

- Alraja et al. (2022) examine “The relationship between technological innovation, sustainable green practices, and the performance of Small and Medium Enterprises (SMEs)” during crises like the COVID-19 pandemic. The study highlights how sustainable practices, supported by technological innovations, have enabled textile companies to adapt to disruptions and maintain performance, underlining the importance of resilience in times of crisis.
- Bailey (1993) focuses on organizational innovation in the apparel industry, providing insights into how firms in the sector adopt innovative practices to enhance competitiveness. Bailey’s work highlights the significant role that innovation plays in adapting to market trends and shifting consumer demands, especially in the fast-paced textile sector.
- Bhavani and Tendulkar (2001) explore “The determinants of firm-level export performance in the Indian textile garments and apparel industry.” Their research identifies key factors such as technological capabilities, managerial practices, and market strategies that influence the success of textile firms in international markets. The study contributes valuable insights into the export performance of textiles, underscoring the significance of innovation and technological advancement for global competitiveness.
- Chandran and Rasiah (2013) investigate “The impact of firm size, technological capability, and exports on economic performance, focusing on the electronics industry in Malaysia.” While not directly related to textiles, this study provides a useful framework for understanding how technological capabilities and firm size influence economic outcomes in manufacturing sectors, which can be applied to the textile industry.
- Cooper and Keating (1996) discuss the implications of emerging home system technologies for rehabilitation, focusing on medical engineering applications. While this work is more oriented toward healthcare, it provides valuable insights into the potential applications of emerging technologies in other sectors, including textiles,

where similar technological advancements, like wearable smart textiles, can have a significant impact.

- Chaudhary, Kumar, and Johri (2020) investigate “The role of Computer-Aided Design (CAD) adoption in maximizing performance in the apparel manufacturing industry.” Their research emphasizes how CAD technologies enhance the design process, improve efficiency, and foster innovation in textile production, leading to more streamlined operations and higher-quality products.
- Gopalakrishnan and Damanpour (1994) present a study on “Patterns of innovation generation and adoption within organizations, proposing contingency models of innovation attributes.” Their work offers a theoretical foundation for understanding how different organizational factors influence the rate and nature of innovation adoption, including in textile firms, where technological adoption can significantly improve competitiveness.
- Dana (2000) discusses the creation of entrepreneurs in India, focusing on small business management. The insights provided on entrepreneurship are relevant to textile firms, particularly SMEs, which are often at the forefront of innovation and technological adoption in the industry. The study emphasizes the need for entrepreneurs to leverage innovation for sustained growth.
- Dana and Dana (2005) expand the scope of methodologies used in entrepreneurship research, offering a broader perspective on the ways in which entrepreneurship can be studied across various sectors, including textiles. Their work can inform studies on how innovation and technology contribute to entrepreneurial success in the textile industry.
- Hoque et al. (2021) provide a comprehensive review of technology adoption in the apparel industry, focusing on the drivers and barriers to technology implementation. This literature review identifies key technologies, including automation and AI, that have reshaped the textile sector, highlighting the importance of technology adoption in driving performance improvements and sustainability.

OVERVIEW OF THE TOPIC:

AI is playing a pivotal role in transforming textile production by enhancing automation, improving quality control, and enabling more efficient market trend forecasting and design processes.

1. Automation in fabric manufacturing and quality control:

AI-powered machines have streamlined various fabric production processes, such as weaving, knitting, dyeing, and finishing, increasing speed and reducing manual labour. These systems can adjust settings in real time for different fabric types, ensuring consistency and precision throughout production. AI-driven quality control systems use advanced image recognition to detect defects, such as colour inconsistencies, fabric tears, or irregular patterns, with a level of accuracy far beyond manual inspection. Automated feedback loops correct any errors on the spot, minimizing waste and maintaining uniform product quality.

2. Predictive analytics for market trends and inventory management:

AI models analyze data from diverse sources, such as past sales, consumer preferences, and social media trends, to predict market shifts and emerging fashion demands. This allows manufacturers to adjust production schedules and introduce timely product lines based on real-time trend insights. Predictive analytics also optimize inventory management by forecasting demand with greater accuracy, reducing the risks of overproduction or stockouts. AI-driven inventory systems can align stock levels across various channels, ensuring efficient replenishment and minimizing waste. These systems also enable manufacturers to align their inventory with consumer purchasing cycles, maximizing sales opportunities.

3. Use of AI in design processes for personalized and innovative textile products:

AI is revolutionizing textile design by allowing for personalized products tailored to individual customer preferences. Generative design algorithms use consumer data, such as body measurements and style preferences, to create unique, custom designs, enabling customers to visualize and choose their ideal fabric patterns, colours, and fits. AI also fosters innovation in textile design by simulating combinations of materials and testing new textures or patterns, offering designers greater flexibility in creativity. This enables the creation of new fabric types or innovative functional materials, such as moisture-wicking sportswear or heat-insulating textiles. Furthermore, AI contributes to sustainable design by recommending resource-efficient techniques and materials, helping to reduce fabric waste and supporting the

adoption of circular economy practices. AI systems can also suggest ways to repurpose leftover materials into new products, further promoting sustainability in textile production. Incorporating AI into textile manufacturing enhances operational efficiency, fosters innovation, and enables personalized, sustainable products, positioning the industry for future growth while responding dynamically to consumer demands.

ANALYSIS AND INTERPRETATION:

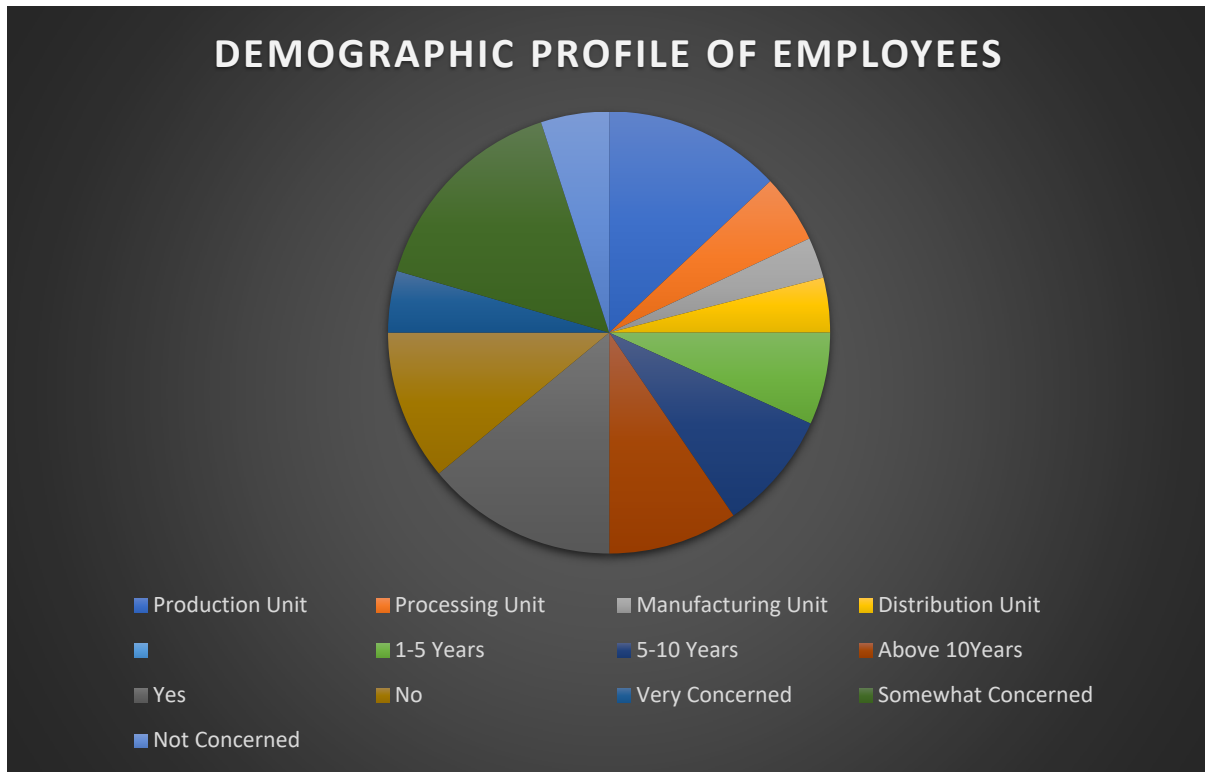
This part deals with the data collected from 100 employees of textile industry and their opinion towards the integration of AI in Textile industry.

TABLE: 1 DEMOGRAPHIC PROFILE OF RESPONDENTS

FACTORS	CATEGORIES	NO OF RESPONDENTS	PERCENTAGE
Job Role	Production Unit	52	52%
	Processing Unit	20	20%
	Manufacturing Unit	12	12%
	Distribution Unit	16	16%
Year of Experience	1-5 Years	27	27%
	5-10 Years	35	35%
	Above 10Years	38	38%
Use of AI in their Organization	Yes	56	56%
	No	44	44%
Employee Concern Towards Job displacement caused by the integration of AI in Textile industry	Very Concerned	18	18%
	Somewhat Concerned	62	62%
	Not Concerned	20	20%

Source: Primary Data

Figure: 1



INTERPRETATION

The above table and diagram represent the details of 100 respondents. From the table, it is very clear that out of 100 employees of textile industry 52 % of them work under production Unit, 20% of them are from processing Unit, 12% from manufacturing and 16% of them are from distribution unit. Further 27% of them holding 1-5 years of total work experience in textile industry, 35% of them holding 5-10 years of industry experience and 38% of them are experienced above 10 years. Further out of 100 only 56% of them vote that their industry is integrated with AI technology. This shows that still the industries have not adopted to AI. Further majority of employees are concerned towards job displacement due to the integration of AI in textile industry.

RANK CORRELATION:**TABLE: 2: TABLE SHOWING EMPLOYEES PERCEPTION TOWARDS THE OPPORTUNITY THAT AI COULD BRING TO THE TEXTILE INDUSTRY**

	Rank	1	2	3	4	5	Total	Rank score	Rank
	Score	5	4	3	2	1			
Rank of Quality control	No of response	34	22	17	15	12	100		
	Score	170	88	51	30	12	351	3.51	2
Rank of increased efficiency	No of response	38	25	15	19	3	100		
	Score	190	100	45	38	3	376	3.76	1
Rank of enhanced design	No of response	33	23	17	15	12	100		
	score	165	92	51	30	12	350	3.5	3
Rank of predictive maintenance	No of Response	20	28	19	20	13	100		
	Score	100	112	57	40	13	322	3.22	4
Rank of supply chain optimization	No of response	15	23	28	20	14	100		
	score	75	92	84	40	14	305	3.05	5

INTERPRETATION:

From the above table it is derives, the mindset of employees working in textile industries towards, the opportunities that AI can bring to the textile industry and derives that increased efficiency was ranked 1st, improved quality control was ranked 2nd, enhanced design capabilities was ranked 3rd, predictive maintenance was ranked 4th, and supply chain optimisation was ranked 5th. Hence forth majority of the employees feel that integration of AI in textile industry would provide high level efficiency in the textile industry.

CHI SQUARE TEST:

TABLE: 3: TABLE SHOWING THE RELATIONSHIP BETWEEN TOTAL YEAR OF EXPERIENCE AND THEIR CONCERN TOWARDS POTENTIAL JOB DISPLACEMENT CAUSED BY AI IN TEXTILE INDUSTRY

Chi-square test for the relationship between total year of experience and their concern towards potential job displacement caused by AI in textile industry

Ho: There is no significant relationship between total year of experience and their concern towards potential job displacement caused by AI in textile industry.

H1: There is significant relationship between total year of experience and their concern towards potential job displacement caused by AI in textile industry.

ROW LABELS	NOT CONCERNED	SOMEWHAT CONCERNED	VERY CONCERNED	GRAND TOTAL
1-5 years	-0.07407	0.015532	0.028807	-0.02973583
5-10 years	0.142857	-0.12442	0.269841	0.28827445
Above 10 years	-0.07895	0.103565	-0.26901	-0.24438785
GRAND TOTAL				0.014150769

Source: Primary Data

INTERPRETATION

CHI SQUARE VALUE = 0.014150769

CRITICAL VALUE = 9.487729

Since the calculated significance value $<$ critical value hence we accept the null hypothesis and reject the alternate hypothesis. Therefore, we may conclude that there is no significant relationship between total year of experience and their concern towards potential job displacement caused by AI in textile industry.

CHALLENGES AND ETHICAL CONSIDERATIONS

The adoption of AI in the textile industry brings several challenges and ethical considerations that need to be addressed to ensure balanced and equitable growth. One significant concern is workforce displacement due to automation. As AI-driven machines take over tasks like weaving, stitching, and quality control, traditional roles are becoming redundant, leaving workers, particularly those without advanced technical skills, at risk of unemployment. To mitigate this, companies and policymakers must prioritize reskilling programs and create policies that support workforce transitions, ensuring employees can adapt to emerging roles in AI maintenance and data analysis.

Another pressing issue is data privacy in IoT-connected textiles. Smart fabrics that monitor health metrics or track user activity collect sensitive personal data, which, if mismanaged, can lead to serious breaches of privacy. To address this, companies must adhere to stringent data protection regulations, employ robust encryption methods, and provide users with greater control over their data. Transparency in data collection and usage is crucial to maintaining consumer trust.

Additionally, biases in AI-driven decision-making present challenges in achieving fairness and inclusivity. For instance, AI systems trained on biased historical data may perpetuate stereotypes or neglect the preferences of underrepresented demographics, limiting innovation and market reach. To counteract this, organizations must ensure their data sets are diverse, conduct regular algorithm audits to identify biases, and involve multidisciplinary teams in AI development.

By tackling these challenges head-on, the textile industry can maximize AI's transformative potential while promoting ethical practices and minimizing unintended consequences.

FINDINGS:

- ❖ It has been identified that most of the employees perceive that integration of AI in textile industry would provide possible opportunities of increased efficiency in the terms of Production, Design, Logistics, and the other aspects of textile industry.
- ❖ Have analysed that there is no significant relationship between total year of experience and their concern towards potential job displacement caused by AI in textile industry.
- ❖ Further the study analysis that most of the employees are concerned towards job displacement in regard of the arrival of textile industry.
- ❖ Considering the ethical Challenges it has been derived that Data privacy is under risk after the integration of AI in Textile Industries.
- ❖ It has also been analysed that AI integration may lead to biased decision making as we depend on programmed machines for decisions.
- ❖ It has been identified that still the industry needs the awareness of AI tools in their workplace activities.

SUGGESTION:

The future of AI in the textile industry is marked by transformative trends that promise to revolutionize the sector. Emerging technologies such as advanced machine learning, generative AI, and edge computing are reshaping how textiles are designed, manufactured, and distributed. For instance, generative AI is being used to create innovative fabric designs, enabling personalized and on-demand fashion production. Smart textiles integrated with AI and IoT are evolving to include self-healing fabrics and garments capable of dynamic environmental adaptation. These advancements not only enhance functionality but also redefine the consumer experience by offering customizable, tech-enabled apparel.

AI also plays a pivotal role in advancing global textile sustainability goals, addressing critical issues such as resource efficiency, waste reduction, and carbon footprint minimization. Machine learning algorithms are increasingly being used to optimize material utilization, significantly reducing production waste. AI-driven predictive analytics enable more accurate

demand forecasting, preventing overproduction and lowering inventory excess. Additionally, AI-powered systems facilitate the adoption of circular economy practices by streamlining textile recycling processes and promoting the reuse of materials. Technologies like AI-based water treatment systems in dyeing processes further contribute to environmental sustainability by minimizing water pollution and chemical waste.

As the industry moves forward, embracing these AI-driven innovations will not only enhance operational efficiency and product quality but also position the textile sector as a leader in sustainable industrial practices. Collaboration between technology developers, manufacturers, and policymakers will be critical in fully realizing these future directions and ensuring that AI continues to drive progress in an ethical and sustainable manner.

CONCLUSION

Artificial Intelligence has emerged as a transformative force in the textile industry, revolutionizing every aspect from design and production to distribution and customer engagement. Its ability to enhance operational efficiency, enable personalization, and support sustainability initiatives underscores its profound impact on the sector. AI-driven innovations, such as predictive analytics, smart textiles, and automated manufacturing processes, have not only improved productivity but also paved the way for a more sustainable and resource-efficient future. However, as the industry continues to embrace AI, it is crucial to address challenges such as workforce displacement, data privacy concerns, and biases in AI-driven systems.

To harness the full potential of AI, the textile industry must prioritize continued innovation and adopt ethical integration strategies. Collaboration between stakeholders, including businesses, researchers, and policymakers, will play a vital role in shaping a future where AI-driven advancements are inclusive, sustainable, and aligned with societal goals. By striking a balance between technological progress and ethical responsibility, the textile industry can set a global standard for innovation and sustainability in the age of AI.

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