A STUDY ON IMPACT OF ARTIFICIAL INTELLIGENCE IN GARMENT INDUSTRY OPERATIONAL MODERNIZATION WITH SPECIAL REFERENCE TO COIMBATORE REGION

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ABSTRACT

"Manchester of South India," the Coimbatore region is the location of a booming textile manufacturing sector. As a result of technological advancements, notably in artificial intelligence (AI), the industry is ready for dramatic changes. This study evaluates how the Coimbatore apparel sector might be affected by AI integration and how it might enhance output, quality, and global competitiveness. A mixed-methods strategy is used in the study, which includes literature studies, questionnaires, interviews, and on-site observations. The paper sheds light on the present applications, problems, and prospects by examining the deployment of AI throughout fabric production, design, manufacturing, and supply chain management. The study underlines the significance of closing knowledge gaps and promoting an innovative culture. The successful application of AI in the Coimbatore garment sector has the potential to transform production methods, improve product quality, streamline supply networks, and promote sustainability. It is crucial for the sector to adopt strategic measures to address issues if it is to reap the benefits of AI and maintain its competitiveness in the global market. This report helps the sector get ready for an AI-driven future as AI continues to transform businesses throughout the world.

Keywords : Artificial Intelligence (AI), AI Application, Automation, Garment Industry, Technological Advancement,

I. INTRODUCTION

Machines may now do tasks akin to those performed by humans, learn from past errors, and adapt to new inputs thanks to artificial intelligence (AI). Artificial intelligence is fundamentally altering a wide range of industries,

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transforming how businesses are operated, and leading to significant advancements. AI can automate complex processes, cut downtime, and anticipate the need for repair. Better accuracy and decision-making: AI boosts employee decisions' originality and accuracy by fusing human intelligence with robust analytics and pattern-prediction tools. AI has transformative implications in a number of industrial, intellectual, and social applications that go far beyond the effects of prior industrial revolutions. Additionally, AI has occasionally performed better than human judgment. AI can automate complex processes, cut downtime, and anticipate the need for repair. Better precision and judgment are possible thanks to AI, which blends human intellect with robust analytics.Using pattern-prediction technologies to improve the originality and accuracy of staff decisions. Automating monotonous tasks like cutting and sewing in the production of garments is becoming more and more common thanks to the usage of AI-powered robotics and technology. A business called Cut and Sew Manufacturer employs cutting-edge technology to boost output and reduce labor expenses in the apparel sector. Artificial intelligence (AI) is used to develop patterns, choose colors and patterns, and even 3D print apparel in the textile business. AI is also being utilized to develop fibers and fabrics for the textile industry that are stronger, more resilient, and more distinctive.

The clothing sector, which produces supplies and apparel to meet the wide range of consumer demands, has made a significant contribution to the global economy. the speed of technological advancement in particular Numerous industries are being transformed by artificial intelligence (AI).industry sectors. The Coimbatore region, famed for its strong textile and apparel industry, sits at the nexus of tradition and innovation. This study intends to look into the use of AI in the Coimbatore region's apparel industry and analyze its impact on various aspects of the sector.

Background

Coimbatore, frequently referred to as the "Manchester of South India," has a long history of producing textiles and clothing. Spinning, weaving, processing, and garment production are some of the processes in the textile and apparel supply chain where the region thrives. Businesses in the clothing sector are looking at new potential for increased efficiency, quality, and market competitiveness as a result of the development of new technologies.

II. STATEMENT OF THE PROBLEM

The Coimbatore region's garment sector may not be fully aware of or understand AI technology, which makes it difficult to identify appropriate applications and potential advantages across different industrial segments. The region may not have the same level of access to the latest technological infrastructure, including the gear and software needed for AI integration. The adoption of AI-driven technologies and their seamless integration into current systems could be hampered as a result. Data Quality and Accessibility: AI depends on data to function, so the apparel industry may have trouble obtaining the clear, pertinent, and varied information required for developing AI models. The reliability and efficacy of AI systems might be hampered by poor data quality and availability. The operations of the garment industry may encounter resistance when implementing new AI-driven procedures due to strongly ingrained traditional habits. The successful application of AI technologies may be hampered by resistance from the labor or management. The incorporation of AI necessitates a workforce with expertise in data analytics, machine learning, and programming. Lack of such qualified workers can make it difficult for business to fully use AI's potential. Some firms, particularly smaller ones, may view the cost of hiring people, obtaining new technologies, and executing changes as prohibitive. Regarding data privacy, potential biases in AI systems, and the replacement of human occupations, the integration of AI presents ethical questions. Keeping stakeholder trust requires addressing these issues in a morally and openly. Integrating AI technologies into current processes and workflows is a difficult process. During implementation, issues with process redesign, change management, and system integration may come up. It might be difficult to develop AI solutions that are flexible and efficient over time due to the dynamic nature of the global apparel sector, which is driven by fast shifting customer preferences, market trends, and geopolitical concerns.

In conclusion, the issue is lies in figuring out ways to successfully address the issues preventing the successful integration of AI technologies inside the Coimbatore apparel sector. To fully realize the potential benefits of AI, improve the industry's competitiveness, and ensure continuous growth in a technical environment that is rapidly changing, it is imperative to address these difficulties.essential for applications of AI.

III. SCOPE OF THE STUDY

The study's scope spans a variety of topics that provide a complete understanding of the current position, challenges, opportunities, and potential implications of AI integration in the region's textile industry in Coimbatore. The following are the primary topics that fall under the study's purview: The investigation will focus on the various facets of the Coimbatore region's garment industry, such as fabric production, design, manufacturing, quality control, and supply chain management. It will examine how AI is enhancing efficiency, production, and quality in each industry. The study will evaluate the Coimbatore region's current technological infrastructure in order to promote AI integration. Assessing the availability of gear, software, and connectivity is part of this.The study will identify companies and groups in Coimbatore's apparel sector that have already embraced AI technologies. It will go into the particular AI techniques being applied and the results they have produced. The project will examine the effects of AI on several aspects of clothing production, including pattern creation, cutting, sewing, and finishing. The effectiveness of AI in enhancing precision, speed, and resource optimization will be evaluated. The study will look at how AI-driven quality control techniques are affecting product quality and lowering flaws in the garment manufacturing process. Examples include computer vision systems and defect detection algorithms. The study will look at how artificial intelligence (AI) technologies are operations related to the supply chain, such as demand forecasting, inventory control, and logistics. It will evaluate if AI is allowing supply chains to be more

responsive and effective. The study will examine the difficulties organizations in the apparel industry encounter in deploying AI. These difficulties may include integration difficulties, workforce training requirements, privacy issues, and technical obstacles. The study will emphasize the growth potential that AI offers the Coimbatore apparel industry, including the ability to access new markets, provide customized products, and develop new business models. The study will examine how AI will affect the workforce, including how employment responsibilities and skill needs will change and whether initiatives for retraining and upskilling will be necessary. Implementation Suggestions: In light of the findings, the study will offer Practical suggestions for successfully implementing and integrating AI technology are provided for the Coimbatore region's apparel companies. These suggestions might relate to change management, investment choices, and strategy creation, to find best practices and lessons that can be learned, the study may compare the deployment of AI in the Coimbatore garment sector with similar industries in other locations. The study might discuss the moral aspects of AI, such as worries about prejudice and the privacy of user data, and how companies are resolving these problems in their AI implementations. Taking into account developing technology and market trends, the study may speculatively project the trajectory of the Coimbatore apparel sector with more AI integration.

Essentially, the study's scope is a comprehensive investigation of the impact of AI on the apparel sector in the Coimbatore region, covering technological, operational, economic, social, and ethical dimensions. The study's conclusions can act as a road map for organizations, decision-makers, and other parties interested in maximizing the potential of AI in the apparel industry.

IV. SIGNIFICANCE OF THE STUDY

The importance of this study rests in its ability to offer researchers, policymakers, and manufacturers of clothing with insightful information. Stakeholders may make wise choices about investments in AI technologies, workforce upskilling, and the industry's sustainable development by having a thorough awareness of the AI ecosystem in the Coimbatore region. The garment industry makes a significant contribution to the economy of the Coimbatore region. The area can find chances to improve its worldwide competitiveness by researching the use of AI in this industry. By putting AI-driven ideas into practice, companies may raise production efficiency, cut costs, and improve product quality, which will ultimately increase exports and draw in more investment. The study can provide insight into how artificial intelligence (AI) technologies are being integrated into conventional garment production procedures. Innovation and Technological Progress. With this information, the industry may innovate more and enterprises can adopt cutting-edge technology. By implementing AI-driven innovations, Coimbatore's position as a textile center can be enhanced. A workforce with new skill sets, such as data analysis, machine learning, and AI programming, will be needed to implement AI in the apparel sector. A trained workforce prepared for the industry's shifting landscape can be ensured by educational institutions and training centers in Coimbatore aligning their programs to respond to the changing job market by understanding these skill requirements. AI can help the apparel business adopt more environmentally friendly procedures. Businesses can lessen their environmental impact by streamlining supply chains, cutting waste, and optimizing production processes. This is consistent with global movements toward ethical and responsible production, which can improve the region's reputation and attract customers who care about the environment. Coimbatore is home to both huge manufacturing and SMEs in garment sector. Studying the effects of AI can assist SMEs in understanding how to use AI solutions efficiently, allowing them to compete on an equal footing with larger organizations. A more inclusive and diverse industry ecosystem may result from this. Policy Development: The study's findings can help government agencies and policymakers create policies that encourage the use of AI in the apparel industry. Incentives for companies to invest in AI, regulatory frameworks, and infrastructure development to speed up technology integration can all be part of this. International organizations, AI research organizations, and technology corporations may be interested in and/or take notice of the study's findings. Collaboration can result in information exchange, group projects, and collaborations that help hasten the growth of AI

in the area. By comprehending the risks, difficulties, and long-term effects of AI, the study can help organizations make wise judgments. By ensuring that the advantages of AI integration are experienced over the long term, this helps to ensure the industry's viability. In conclusion, the study's importance rests in its ability to alter the course of the Coimbatore garment sector and make it more inventive, competitive, and in line with worldwide technology trends. The knowledge obtained has the potential to boost employment possibilities, propel economic growth, and establish Coimbatore as a technology powerhouse for the apparel industry.

V. OBJECTIVES OF THE STUDY

•   To identify the present applications of AI in several facets of the Coimbatore region's clothing sector.

•   To evaluate how AI will affect supply chain management, product quality, production procedures, and overall business success.

•   To evaluate the difficulties and chances faced by the apparel industry in adopting and integrating AI technologies.

•   To offer suggestions for the successful application of AI and its long-term use in the clothing business.

VI. REVIEW OF LITERATURE

•   ˛ Abdel Kader, E. A. S., Mohamed, R. H., & Ali, R. (2022) [1]: The creation of a clothing (Dataset) to inventory patterns and attributes and formulate them in a novel way through the algorithm of (GANS) to obtain creative patterns, the use of artificial intelligence applications in factories to keep up with the future trend of fashion design Paying attention to the analysis and forecasting of the trend or any aspect of clothing as in (Google Cloud), and bridging the gap between the designer's vision and the needs of the client by developing customized files that include the client's feedback on the clothing, whether it is admired or in need of modifications or preferences.

•   Amani Mustafa Abed Hassanein, Rasha Ali, Hafez Yousef (2022) [2]: The goal of the study is to determine whether garment companies can enhance their business operations by utilizing big data and artificial intelligence (AI), and by doing so, seek out major data management

opportunities. This study's methodology uses a descriptive-analytical approach, Discussion: In order to establish whether clothes manufacturers could enhance business operations using big data and (AI), as well as provide opportunities with broad data management using AI, the study underlines the significance of big data and AI in the garment supply chain. With the apparel industry as its main focus, it also reviews the body of literature on supply chains, big data, artificial intelligence, and organizational theories in the context of big data.

•   Abd Jelil, R. (2018) [3]: Presents a thorough analysis of recent research articles on the use of AI techniques in the textile industry. Production planning, control, and scheduling; garment quality control and inspection; and garment quality evaluation are the three groups into which the study concerns are divided. The implementation of AI technology in the apparel business has some difficulties, which are highlighted.

DATA AND PROFILE

Percentage Analysis with the demographic factors is included in table no: 1 such as Age, Gender, Income, Marital Status, Years of Experience.

TABLE NO: 1

Sl.no	Factors	Options	Respondents	Percentage (%)
1.	Age	18-25	25	20.83
		26-30	26	21.66
		31-35	37	30.83
		Above 35	32	26.66
2.	Gender	Male	46	38.33
		Female	74	61.66
3.	Yearly Income	Below 100000	10	8.33
		100001-200000	16	13.3
		200001-300000	20	16.6
		300001-400000	45	37.5
		Above 400000	29	24.16
4.	Marital Status	Married	96	80
		Un Married	24	20
5.	Years of Experience	0-3	20	16.6
		4-7	17	14.16
		8-10	16	13.33
		Above 10	67	55.83

Among the Demographic profile, we can understand that the majority 55.83% of the respondents have above 10 years of experience with the garment industry [4]. The respondents

are married and age wise experienced also to know about the garment industry and how to improve the business in strategic was as with modern technical adoption also.

TABLE NO: 2
RATE THE IMPACT ON PRESENT APPLICATIONS OF AI IN CLOTHING INDUSTRY [5,6]

Sl.no	Factors	Options	Respondents	Percentage (%)
1.	Sales Performance to predict sales	Most of the time	87	72.5
		Some of the time	12	10
		Seldom	21	17.5
		Never	-	-
2.	Decision on what and when to stock the materials	Almost always	99	82.5
		Often	10	8
		Sometimes	11	8.8
		Never	-	-
3.	Target the right customers and create impact on their advertising	Strongly Agree	100	83.33
		Agree	12	10
		Neutral	8	6.66
		Disagree	-	-
		Strongly Disagree	-	-
4.	Predicting trends and analysing customer preferences	To a great extent	101	84.16
		Somewhat	9	7.5
		Very little	10	8.33
		Not at all	-	-
5.	Have Target market and reduce risk of unwanted designs in garments	Definitely	80	66.66
		Probably	34	28.33
		Possibly	6	5
		Probably not	-	-
		Definitely not	-	-

Majority 72.5% of the respondents have opinion that the Application of AI makes most of the time impact on sales performance to predict the sales. 82.5% of the respondents have almost always AI helps to make right decision to stock the materials in appropriate time and place. 83.33% of the respondents have strongly agree that the target the right customers and create the impact on advertising to choose the right one. 84.16% of the respondents have opinion that AI makes a clear predicting trends and analyzing customer preferences. 66.66% of the respondents have definitely opinion that the target market and reduce the risk of avoiding unwanted designs in garments [7,8].

TABLE NO: 3
DIFFICULTIES AND CHANCES FACED BY THE APPAREL INDUSTRY IN ADOPTING AI TECHNOLOGIES

Sl.no	Factors	Options	Respondents	Percentage (%)
1.	Lack of understanding of implementation of AI	Always	20	16.66
		Usually	13	10.83
		Seldom	23	19.16
		Never	64	53.33
2.	Data quality issues	Always	56	46.66
		Frequently	16	13.33
		Occasionally	13	10.83
		Rarely	35	29.16
3.	Cost of Development	Always	97	80.83
		Very often	20	16.66
		Sometimes	3	2.5
		Rarely	-	-
		Never	-	-
4.	Lack of Data Strategy Implementation	Strongly Agree	80	66.66
		Agree	23	19.16
		Neutral	17	14.16
		Disagree	-	-
		Strongly Disagree	-	-
5.	Lack of Knowledge in handling of new system	Mostly Agree	79	65.83
		Slightly Agree	23	19.16
		Neutral	18	15
		Slightly Disagree	-	-
		Mostly Disagree	-	-

TABLE NO: 4
CHI-SQUARE TEST

H0: There is no significant relationship between Year of Experience and Understanding of Implementation of AI [9]

H1: There is significant relationship between Year of Experience and Understanding of Implementation of AI

Chi-Square = 197.31

Degrees of Freedom = 16

P = 21.026

Level of Significance = 0.05

From the table that the value of chi-square at 5% level of significance for 12 degrees of freedom is 21.026. The

calculated value of chi-square is 197.31 and which is greater than the table value, so the null hypothesis is rejected. So the two variables are dependent.

TABLE NO: 5
ANALYSIS OF VARIANCE (ANOVA)

H0: Predicting trends and analysing customer preferences and AI helps in decision making on stock materials are independent

H1 Predicting trends and analysing customer preferences and AI helps in decision making on stock materials are dependent

ANOVA

Predicting the trends

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	35.790	2	17.895	102.556	.000
Within Groups	25.650	147	.174		
Total	61.440	149			

INTERPRETATION

Anova: 102.556

Degrees of freedom: 2

P = 2.47

Level of Significance = 0.05

From the table that the value of Anova at 5% level of significance for 2 degrees of freedom is 2.47. The calculated value Anova is 102.556 and which is greater than the table value, so the hypothesis is rejected. So, the two variables are dependent [10].

VII. FINDINGS

1. Among the Demographic profile, we can understand that the majority 55.83% of the respondents have above 10 years of experience with the garment industry. The respondents are married and age wise experienced also to know about the garment industry and how to improve the business in strategic was as with modern technical adoption also.

2. Majority 72.5% of the respondents have opinion that the Application of AI makes most of the time impact on sales

performance to predict the sales. 82.5% of the respondents have almost always AI helps to make right decision to stock the materials in appropriate time and place. 83.33% of the respondents have strongly agree that the target the right customers and create the impact on advertising to choose the right one. 84.16% of the respondents have opinion that AI makes a clear predicting trends and analyzing customer preferences. 66.66% of the respondents have definitely opinion that the target market and reduce the risk of avoiding unwanted designs in garments.

3. From the analyzing part, 80.83% of the respondents have major issue as cost of development of AI technologies in existing Apparel Industries. 66.66% of the respondents have issues on lack of data strategy implementation and lack of knowledge in handling of new system.

4. The value of chi-square at 5% level of significance for 12 degrees of freedom is 21.026. The calculated value of chi-square is 197.31 and which is greater than the table value, so the null hypothesis is rejected. So the two variables are dependent.

5. The value of Anova at 5% level of significance for 2 degrees of freedom is 2.47. The calculated value Anova is 102.556 and which is greater than the table value, so the hypothesis is rejected. So the two variables are dependent.

VIII. SUGGESTIONS

Here are some recommendations for enhancing the performance of the apparel sector through the strategic application of AI in light of the findings you've provided:

1. Consider forming cross-functional teams with the majority of respondents, who have an average of over ten years of experience in the apparel sector. They may be crucial in directing the incorporation of AI and contemporary technology into your corporate strategies. Their extensive industrial expertise can aid in bridging the gap between established procedures and cutting-edge technology.

2. Focus on AI-driven solutions for these areas because a sizable portion of respondents think that AI has a beneficial impact on inventory management and sales success. Invest in artificial intelligence (AI) solutions that can forecast sales trends, optimize inventory levels, and recommend the best times and locations to stock materials. Costs will go down and efficiency will increase as a result.

3. Invest in AI-powered customer segmentation and tailored advertising solutions since a significant portion of respondents believe that AI can target the correct consumers and increase advertising effect. These tools can assist in customizing your marketing initiatives, improving consumer engagement and boosting revenue.

4. Utilize the power of AI-powered data analytics technologies to study customer preferences and forecast trends. By doing so, you'll be able to anticipate market trends and create clothes that appeal to your target market, lowering the possibility of creating unintended designs.

5. Recognize that a sizeable percentage of respondents are worried about the implementation costs of AI technologies. To allay these worries, look at low-cost AI options like cloud-based AI services or open-source AI frameworks. To show the long-term benefits of adopting AI, perform a cost-benefit analysis.

6. Invest in training and education initiatives for your team to overcome difficulties with data strategy and knowledge gaps. Give employees the tools they need to properly manage emerging AI technologies and data initiatives. To create a solid data strategy that supports your business objectives, you should also think about working with AI specialists or consultants.

7. It's crucial to continuously track the association between AI deployment and different business results given the statistical importance of the chi-square and ANOVA tests. Continually evaluate how AI is affecting sales, inventory control, and customer pleasure. To get the most out of AI, modify your tactics in light of these assessments.

8. Think about partnering with other companies in the garment sector to exchange best practices and resources for AI adoption. Industry associations and forums can offer a place for information sharing and group problem-solving pertaining to implementation problems for AI.

9. Encourage an innovative environment within your company. Encourage staff members to investigate cutting-edge AI technologies and make creative suggestions. Encourage and reward creative solutions that advance company using AI.

IX. CONCLUSION

In conclusion, this article has clarified the crucial part artificial intelligence (AI) has played in transforming the clothing industry. The results of our study confirm that AI technologies have the potential to revolutionize this industry.First off, the respondents' demographic profile showed a workforce with a wealth of knowledge in the apparel sector. The sector is well-positioned for strategic advancements through AI because to this invaluable expertise and its willingness to absorb new technological advancements.The vast majority of the survey results show that AI significantly affects many aspects of the apparel industry. The majority of respondents recognize and value AI's benefits, which range from forecasting sales performance to improving inventory management, targeting the proper customers, forecasting trends, and lowering the risk of undesirable designs.It's crucial to recognize the difficulties the analysis identifies. The majority of responders are still quite concerned about how much it will cost to build new AI technology. This emphasizes the requirement for affordable AI solutions and a careful analysis of return on investment.Additionally, problems with data strategy and knowledge gaps show that continuing education and training are necessary to fully utilize AI. To ensure the efficient integration of AI into the apparel business, several issues must be resolved.The statistical tests, such as the chi-square and ANOVA tests, also give strong support for the fact that the variables evaluated in this study are in fact dependent, which helps to support the validity of our conclusions.In conclusion, the use of AI in the clothing business is not only a fad but a fundamental force for change.

The industry can fully embrace AI's promise to improve sales, inventory management, customer interaction, and overall competitiveness by utilizing the knowledge of an experienced workforce, addressing cost issues, and giving priority to education and training. As we advance, it will be crucial to maintain research, collaboration, and innovation in order to take advantage of all the benefits AI presents for the apparel sector.

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