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EXPLORING THE APPLICATION OF ARTIFICIAL INTELLIGENCE (AI) TECHNOLOGIES IN THE FASHION INDUSTRY: A CASE OF GARMENT CONSTRUCTION IN KUMASI, GHANA

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Abstract

This study explores the use of artificial intelligence (AI) technologies in the fashion industry, specifically focusing on garment construction in Ghana. Again, it examines how AI impacts key stages of garment production, including style development, body measurements, pattern making, lay planning, cutting, assembling, and packaging. It employed both quantitative data from surveys and qualitative insights from interviews with fashion designers, manufacturers, and industry experts. The findings indicate that AI technologies are most widely adopted in style development and pattern making, where they significantly enhance design efficiency and precision. However, adoption rates are lower in cutting, assembling, and packaging due to high initial costs and technical complexity. The study also identifies significant barriers to AI adoption, such as financial constraints, lack of technical expertise, and cultural resistance to change. The implications of these findings suggest that AI technologies have the potential to transform garment construction processes, improve efficiency, reduce waste, and increase competitiveness in the fashion industry. This study contributes to the existing literature by providing empirical data on AI adoption in the Ghanaian fashion industry, and clearly indicates the need for future study to explore regional differences, long-term impacts, and strategies to integrate AI technologies while preserving traditional craftsmanship in garment making.

Keywords: Garment, Artificial Intelligence, Fashion Industry, Lay Planning, AI-driven Body Measurements.

INTRODUCTION

The fashion industry, an essential foundation of cultural expression and economic activity, is experiencing a paradigm shift with the advent of artificial intelligence (AI) technologies. AI's integration into garment construction is revolutionizing traditional processes, offering unprecedented precision, efficiency, and innovation (Mohinddin et al., 2022 and Tushar, 2020). This research intends to look at the application of AI technologies pertaining to garment construction within the context of Ghana, a country with a rich textile heritage and a burgeoning fashion scene.

Vannuccini and Prytkova, (2023) believe that AI technologies present a myriad of potential benefits for garment construction. Automated design systems can generate complex patterns and designs that can be labour-intensive and time-consuming for human designers. Additionally, AI-driven production methods can optimize fabric cutting and sewing, reducing waste and enhancing the sustainability of fashion practices (Ross, 2022).

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Furthermore, these technologies can assist in inventory management and demand forecasting, helping designers and manufacturers align production with market needs (Donmezer et al., 2023).

Despite the global advancements in AI for garment construction, there is little studies on its application and effectsas in the Ghanaian fashion industry. This novelty makes the study relevant as it seeks to explore how AI technologies can be practically implemented in Ghana's garment sector and what challenges might arise. Understanding these dynamics is crucial, given Ghana's unique cultural and economic landscape, where traditional craftsmanship coexists with modern fashion trends. The objectives of the study are to evaluate the current state of AI technology adoption in garment construction in Ghana, assess the potential benefits and efficiencies introduced by AI technologies in Ghana's fashion industry and identify the challenges and barriers to implementing AI technologies in garment construction.

Below were the research questions formulated to guide the study:

1. What is the current level of AI technology adoption in the garment construction industry in Ghana?
2. What are the perceived benefits and efficiencies of AI technologies among Ghanaian fashion designers and manufacturers?
3. What challenges do stakeholders face in integrating AI technologies into garment construction in Ghana?

Through this exploration, the research seeks to provide an understanding of the practical implications of AI technologies in Ghana's fashion industry, contributing to the broader discourse on technological innovation in garment construction.

LITERATURE REVIEW

AI Technology Adoption in Garment Construction

The adoption of AI technologies in garment construction has been a topic of increasing interest among researchers and industry professionals. Guo et al. (2023) are of the view that AI applications in fashion design are enhancing creativity and efficiency, particularly through automated design systems and pattern generation tools. These technologies allow designers to create intricate and unique designs with greater speed and accuracy compared to traditional methods.

An and Park (2023) emphasize the role of AI in optimizing production processes, such as fabric cutting and sewing. They highlight that AI-driven machines can perform these tasks with higher precision, reducing material waste and labor costs. This view is supported by Ross (2022), who believes that AI's ability to predict market trends and manage inventory can significantly streamline operations in garment manufacturing.

In the context of Ghana, however, the adoption of these technologies remains limited. A study by Mensah and Osei (2022) indicates that while there is growing awareness of AI's potential, actual implementation is hindered by factors such as high costs, a lack of technical expertise, and inadequate infrastructure. This suggests a significant gap between global

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advancements in AI and their application in Ghana's garment industry, underscoring the need for targeted efforts to manage this phenomenon.

Potential Benefits and Efficiencies of AI Technologies

The integration of AI into garment construction offers numerous benefits, ranging from enhanced design capabilities to improved production efficiencies. Abd (2018), Nayak (2018), and Padhye (2018) assert that AI-driven design tools can democratize fashion design, enabling even novice designers to create professional-grade garments. This transformation is particularly important in regions where access to advanced design training and resources may be limited.

Jimeno-Morenilla (2021) and Jhanj (2018) are of the view that the efficiency gains from AI in production processes are enormous. They further point out that AI can optimize resource use, reducing fabric waste and energy consumption. This not only lowers production costs but also contributes to more sustainable fashion practices. Additionally, AI's predictive analytics can help manufacturers better align production with consumer demand, reducing overproduction and inventory surplus (Mahi, 2024; Tahri, 2024; and Frank and Henry, 2024).

In Ghana, the potential benefits of AI are substantial but underutilized. From the perspective of Adekunle (2024) and Bertola and Teunissen (2018), local fashion designers and manufacturers could significantly enhance their productivity and competitiveness through AI adoption. However, the author also believes that the benefits are contingent upon overcoming barriers such as initial investment costs and the need for ongoing technical support. This highlights the dual-edged nature of AI adoption, where significant advantages are balanced by considerable implementation challenges.

Challenges and Barriers to Implementing AI Technologies

Despite the promising benefits, the implementation of AI technologies in garment construction faces several challenges. Cost is a primary barrier, as noted by Adekunle (2024), who argues that the high initial investment required for AI technology is prohibitive for many small and medium-sized enterprises (SMEs) in Ghana. This is compounded by the ongoing costs of maintenance and upgrades.

Another significant challenge is the lack of technical expertise. Segbenya et al. (2023) believe that many fashion professionals in Ghana lack the necessary skills to operate and maintain AI-driven machinery. This skills inadequacy or gap is a major impediment to the widespread adoption of AI technologies and underscores the need for targeted education and training programs.

Furthermore, there are concerns about the potential disruption to traditional garment-making practices. Segbenya et al. (2023) highlight the cultural importance of traditional craftsmanship in Ghana's fashion industry and caution that the indiscriminate adoption of AI could undermine these artisanal practices. They advocate for a balanced approach that integrates AI while preserving the cultural and artistic heritage of Ghanaian fashion.

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The literature on AI in garment construction reveals a consensus on the potential benefits of AI technologies, particularly in enhancing design and production efficiency. Jimeno-Morenilla (2021) and Jhanj (2018) provide comprehensive overviews of how AI can revolutionize garment construction through automation and optimization. However, the views diverge when it comes to the practical challenges of implementing AI. Jimeno-Morenilla (2021) and Jhanj (2018) focus on the financial and technical barriers, suggesting that while the benefits are clear, the pathway to achieving them is fraught with difficulties. In contrast, Frank and Henry (2024) are more optimistic, emphasizing the transformative potential of AI if these challenges can be addressed.

The debate around cultural impacts, as asserted by Segbenya et al. (2023), adds another layer to the discussion, emphasizing that technological adoption in fashion must be sensitive to local traditions and practices. This perspective is particularly relevant in the Ghanaian context, where fashion is deeply intertwined with cultural identity.

AI Technologies Applicable in the Fashion Industry

Numerous AI technologies are used in the clothing industry to improve different facets of design, production, marketing, and the customer experience. The integration of artificial intelligence (AI) in the garment industry has transformed the design process, enabling designers to enhance creativity, improve efficiency, and better predict trends (Yeo et al., 2022). AI-driven design tools leverage various technologies, involving machine learning, computer vision, and natural language processing, to transform traditional fashion design methodologies. The following are some important AI technologies utilized in the fashion industry:

Trend Prediction and Analysis

According to Hoyer et al. (2020) and Akram et al. (2022), one of AI's major contributions to fashion design is its capacity for trend prediction. To predict future fashion trends, artificial intelligence (AI) systems examine enormous volumes of data from social media, fashion shows, retail trends, and consumer behaviuor. For example, businesses such as Heuritech employs artificial intelligence (AI) to evaluate text and picture data from social media sites in order to forecast fashion trends and give designers useful information.

Design Automation and Creativity Enhancement

AI-driven design tools automate tedious chores and provide design recommendations based on data analysis, enabling designers to create new patterns and styles. These tools can generate thousands of design variations in a short time, allowing designers to experiment with different styles and patterns efficiently. An example of this is IBM's Watson, which has been used by designers like Marchesa to create innovative designs by analyzing fashion data and generating creative suggestions (IBM, 2016).

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Virtual Prototyping and Sampling

AI-driven tools also enable virtual prototyping, allowing designers to create digital samples of their designs. This technology reduces the time and cost associated with physical sampling. CLO 3D is a notable tool in this area, providing designers with the ability to create accurate 3D garment simulations that help in visualizing the final product and making necessary adjustments before production (Linfante and Pompa, 2021; Minh and Noan, 2021).

Personalized Fashion and Customization

AI facilitates personalized fashion by analyzing consumer preferences and providing tailored design recommendations. This customization is achieved through algorithms that learn from individual customer data, leading to more personalized shopping experiences. Stitch Fix, for instance, uses AI to offer personalized styling services by analyzing client feedback and preferences to curate personalized clothing selections (Linfante and Pompa, 2021; Minh and Noan, 2021).

Sustainable Fashion Design

Sustainability is another area where AI-driven tools make a tremendous impact. AI helps in optimizing fabric usage, reducing waste, and selecting eco-friendly materials. Companies like H&M use AI to improve supply chain efficiency and minimize environmental impact by predicting demand more accurately and reducing overproduction (Linfante and Pompa, 2021; Minh and Noan, 2021).

Automated Sewing Systems

Automated sewing systems have significantly transformed the fashion production landscape. These systems use robotics and AI to perform intricate sewing tasks that traditionally required skilled human labour. Companies such as Sewbot and SoftWear Automation have developed robotic sewing systems capable of performing precise and consistent stitches at high speeds. These systems can handle various materials, including delicate fabrics, and adjust to different sewing patterns, significantly improving productivity and reducing production time (SoftWear Automation, 2018).

Computerized Cutting Machines

Computerized cutting machines are another crucial component of automated fashion production. These machines use computer-aided design (CAD) and computer-aided manufacturing (CAM) systems to cut fabric with high precision and minimal waste. Gerber Technology, for instance, offers cutting-edge automated cutting solutions that integrate seamlessly with CAD systems, allowing for precise fabric cutting based on digital designs. This technology not only enhances accuracy but also reduces fabric waste and accelerates the cutting process (Linfante and Pompa, 2021; Minh and Noan, 2021).

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AI and Machine Learning in Cutting and Sewing

AI and machine learning play a critical role in optimizing automated sewing and cutting processes. Machine learning algorithms analyze production data to predict potential issues and optimize machine settings for different types of fabrics and designs. This predictive capability ensures consistent quality and minimizes downtime caused by machine errors or fabric inconsistencies. For example, AI-driven systems can adjust cutting patterns in real-time to account for fabric variations, ensuring optimal material usage and consistent product quality ((Linfante and Pompa, 2021).

Augmented Reality (AR) and Virtual Reality (VR) in the Fashion Industry

The fashion industry is increasingly adopting augmented reality (AR) and virtual reality (VR) technologies to boost the customer experience, streamline design processes, and improve retail operations. These immersive technologies offer innovative ways for consumers to interact with fashion products and for designers to create and visualize their work.

Augmented Reality (AR) in Fashion

By superimposing digital data over the real world, augmented reality creates a more engaging and immersive experience. Virtual try-ons, marketing, and interactive retail displays are the main applications of augmented reality in the fashion business. Virtual Try-Ons AR technology allows customers to virtually try on clothes and accessories using their smartphones or in-store AR mirrors. This technology enhances the shopping experience by enabling customers to see how items look on them without physically trying them on. Companies like Warby Parker and Gucci have implemented AR in their mobile apps to offer virtual try-ons for glasses and shoes, respectively, improving customer engagement and reducing return rates.

AR Marketing and Retail Displays AR is also used for marketing and creating immersive retail displays. For example, Burberry has employed AR to create interactive store windows and marketing campaigns that engage customers and enhance brand visibility. Customers can use their smartphones to interact with AR content, such as 3D animations and videos, providing a unique and memorable shopping experience (Linfante and Pompa, 2021).

Virtual Reality (VR) in Fashion

Virtual reality creates a fully immersive digital environment, allowing users to experience and interact with a virtual world. In fashion, VR is utilized in virtual fashion shows, design visualization, and virtual retail spaces. Virtual Fashion Shows VR enables brands to host virtual fashion shows, allowing audiences from around the world to experience the event in an immersive environment. This technology became particularly relevant during the COVID-19 pandemic, when physical events were restricted. Brands like Balenciaga and Dior have successfully held VR fashion shows, providing an innovative

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platform for showcasing their collections and reaching a global audience. Design Visualization VR is a powerful tool for designers, allowing them to create and visualize their designs in a 3D environment. This capability helps designers experiment with different materials, colors, and patterns in a virtual space, reducing the need for physical samples and accelerating the design process. Tools like Browzwear and Virtuality. Fashion offers VR solutions for fashion design, enabling designers to create realistic 3D prototypes and make real-time adjustments (Linfante and Pompa, 2021; Minh and Noan, 2021).

Virtual Retail Spaces VR allows brands to create virtual retail spaces where customers can explore and shop for products in an immersive environment. These virtual stores offer a unique shopping experience that combines the convenience of online shopping with the engagement of physical stores. Tommy Hilfiger and Ralph Lauren have launched virtual stores that provide customers with an interactive and immersive shopping experience, allowing them to browse collections and make purchases within a virtual environment (Linfante and Pompa, 2021; Minh and Noan, 2021).

METHOD

This study employed a mixed-methods approach, integrating both quantitative and qualitative approaches, to comprehensively explore the application of AI technologies in garment construction in Ghana. The mixed-methods design allowed for a robust analysis by combining the strengths of both data types. The quantitative component involved a survey to gather broad data on the adoption and impact of AI technologies, while the qualitative component used in-depth interviews to provide detailed insights into the experiences and perspectives of key stakeholders in the Ghanaian fashion industry.

Fashion designers, garment manufacturers, industry experts, and technology providers constituted the study's participants. The participants were selected through purposive sampling to ensure they had relevant experience and knowledge about AI technologies in garment construction. A total of 100 participants were surveyed, and 15 participants were also chosen for in-depth interviews. The criteria for selection include fashion designers and manufacturers who have implemented or are considering implementing AI technologies, industry experts with knowledge of technological advancements in fashion, and technology providers who offer AI solutions for garment construction. A structured survey was administered to the 100 participants. The survey was designed to collect data on the extent of AI technology adoption, perceived benefits and efficiencies of AI technologies, and challenges and barriers to implementation. The survey involved a mix of closed-ended questions, using Likert scales to measure attitudes and perceptions, and multiple-choice questions to gather factual information about the use of AI technologies.

On the other hand, semi-structured interviews were conducted with 15 selected participants. These interviews aimed to delve deeper into personal experiences with AI technologies, provide detailed insights into the benefits and efficiencies observed, and identify specific challenges faced during implementation. The interviews were guided by an

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interview protocol but remained flexible to allow participants to express their views and experiences freely. Each interview lasted approximately 40 minutes and was recorded with the participants' consent for accurate transcription and analysis.

Descriptive and inferential statistics were used to analyze the quantitative data from the surveys. The data were summarized using descriptive statistics, which included mean, median, mode, and standard deviation. Regression analysis and chi-square tests are two examples of inferential statistics that were used to examine correlations between variables and pinpoint important variables affecting the adoption of AI technology.

Qualitative data from the interviews was analyzed using thematic analysis. This involved transcribing the interviews verbatim, reading through the transcripts multiple times to become familiar with the data, coding the data to identify significant themes and patterns, and grouping the codes into broader themes that captured the key insights and experiences shared by the participants. All participants were provided with detailed information about the study's purpose, methods, and rights. Informed consent was obtained before participation. Participant confidentiality was strictly maintained. Data were anonymized to protect participants' identities, and for that reason, only aggregate data were reported.

RESULT AND DISCUSSION

This section presents the results and their findings from the study on the application of AI technologies in garment construction in Ghana. The data collected through surveys and interviews has been analyzed to understand the extent of AI adoption, its benefits, and the challenges faced by the industry. The key areas investigated include AI technologies in style development, body measurements, pattern making, lay planning, cutting, assembling, and packaging.

AI Technologies in Style Development

Table 1. Style Development

AI Adoption in Style Development	Percentage
Yes	45%
No	55%

The survey data indicate that 45% of the participants are using AI technologies in style development. These technologies include automated design tools and trend prediction algorithms. Among those using AI, 70% reported a significant increase in design efficiency and creativity. During the interview, participants revealed that AI tools enable faster creation of complex designs and offer valuable insights into fashion trends. One designer stated, "AI helps me to visualize and create designs that I could only dream of before."

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AI in Taking Body Measurements

Table 2. Body Measurements

AI Adoption in Body Measurements	Percentage
Yes	30%
No	70%

Table 2 indicates that AI-powered body measurement systems are adopted by 30% of the participants. These systems use 3D scanning and computer vision to provide precise measurements, reducing fitting errors and returns. Manufacturers noted that AI measurement systems improve accuracy and customer satisfaction. A manufacturer remarked, "The precision of AI measurements has significantly reduced our alteration costs."

AI in Pattern Making

Table 3. Pattern Making

AI Adoption in Pattern Making	Percentage
Yes	35%
No	65%

The results in Table 3 show that that about 35% of the respondents utilize AI technologies for pattern making. These tools automate the pattern-drafting process, ensuring consistency and reducing the time required for manual pattern-making. Interviewees emphasized the time-saving benefits of AI in pattern making. A participant mentioned, "With AI, what used to take days now takes hours, and the patterns are more accurate."

AI in Lay Planning

Table 4. Lay Planning

AI Adoption in Lay Planning	Percentage
Yes	25%
No	75%

Lay planning with AI is reported by 25% of the participants. AI tools optimize fabric usage, minimizing waste and maximizing efficiency. Participants shared that AI-driven lay planning has led to significant cost savings. One participant noted, "AI has optimized our fabric usage, leading to an estimation of a 15% reduction in waste."

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AI in the Cutting Process

Table 5. Cutting Process

AI Adoption in the Cutting Process	Percentage
Yes	20%
No	80%

Table 5 reveals that AI technologies in cutting are adopted by 20% of the respondents. These technologies include automated cutting machines that ensure precision and speed. Manufacturers asserted that the precision and efficiency gains from AI-cutting technologies. A manufacturer stated, "AI cutting machines have doubled our production speed and improved cutting accuracy."

AI in Assembling and Packaging

Table 6. Assembling and packaging

AI Adoption in Assembling and Packaging	Percentage
Yes	15%
No	85%

AI applications in assembling and packaging are the least adopted, with only 15% of participants using such technologies. These systems include automated sewing and packaging machines. Despite low adoption, those using AI in assembly and packaging reported improved workflow efficiency. One respondent noted, "AI has streamlined our assembly line, reducing labour costs and increasing output."

Statistical Analysis

To further analyze the data, chi-square tests were conducted to determine the significance of AI adoption across different garment construction stages. The results showed significant variation ($p < 0.05$) in AI adoption rates, with style development and pattern making having higher adoption rates compared to cutting and assembling.

Table 7. Chi-Square Test for AI Adoption in Different Stages

Stage	Adoption Rate (%)	Chi-Square Value	p-value
Style Development	45	15.3	0.001
Body Measurements	30	10.8	0.012
Pattern Making	35	12.6	0.008
Lay Planning	25	8.7	0.032
Cutting	20	7.1	0.048

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Assembling/Packaging	15	5.4	0.065

The results in Table 7 indicate varying levels of AI adoption across different stages of garment construction in Ghana. AI technologies in style development and pattern making are more widely adopted due to their direct impact on creativity and efficiency. However, the lower adoption rates in cutting, assembling, and packaging suggest challenges related to high costs and technical expertise. Participants generally recognize the benefits of AI, such as improved accuracy, efficiency, and reduced waste. However, setbacks such as initial investment costs, inadequate technical expertise, and cultural resistance to change limit broader adoption.

Discussion Of Findings

The purpose of the study was to explore the application of AI technologies in the Ghanaian fashion industry, specifically in key areas such as style development, body measurements, pattern making, lay planning, cutting, assembling, and packaging. The study revealed that AI technologies are most commonly adopted in style development (45%) and pattern making (35%), with lower adoption rates in body measurements (30%), lay planning (25%), cutting (20%), and assembling/packaging (15%). Participants reported significant benefits in terms of design efficiency, precision, and reduced waste, while high initial costs, a lack of technical expertise, and cultural resistance were found to be the major barriers to AI adoption.

AI adoption is higher in the initial stages of garment construction (style development and pattern making) compared to later stages (cutting, assembling, and packaging). This trend suggests that designers and manufacturers find AI more accessible and beneficial in the creative and planning phases. Across all stages, the primary benefits of AI are enhanced efficiency and precision, indicating a consistent value proposition of AI technologies in improving production processes.

The findings have relevant implications within the broader context of AI in the fashion industry in the sense that by adopting AI, Ghana's fashion industry can increase its competitiveness on a global scale through improved efficiency and innovation. Again, AI's potential to reduce material waste aligns with global sustainability goals, suggesting that AI adoption can contribute to more sustainable fashion practices.

An unpredicted finding was the notably low adoption rate of AI in assembly and packaging (15%). However, this may be due to the high cost and complexity. These stages often require huge investment in sophisticated machinery, which may be prohibitive for many local manufacturers. There may be a cultural preference for traditional methods in these later stages of garment construction, which are deeply rooted in local practices.

CONCLUSIONS

This study aimed to explore the application and effects of AI technologies in garment construction within the context of Ghana's fashion industry, focusing on key stages such as style development, body measurements, pattern making, lay planning, cutting, assembling, and packaging. The research objectives were to evaluate the extent of AI technology

adoption, assess the perceived benefits and efficiencies, and identify challenges and barriers to implementation.

The study successfully achieved its research objectives by revealing varying levels of AI adoption across different stages of garment construction, with higher adoption rates in style development and pattern making. The benefits of AI technologies, such as enhanced design efficiency, precision in body measurements, and reduced fabric waste, were consistently indicated by the participants. Key challenges identified include high costs, a lack of technical expertise, and cultural resistance to change.

The study's outcomes are important in advancing the understanding of AI's role in the fashion industry, particularly within a developing country context. By providing empirical data on AI adoption in Ghana, the research fills a critical gap in the literature and offers insights that are both region-specific and globally relevant. The results underscore the potential of artificial intelligence (AI) technology to revolutionize conventional garment manufacturing procedures, bolster industry competitiveness, and advance sustainability in the fashion sector.

However, the study recommends that fashion designers and manufacturers in Ghana should focus on adopting AI technologies in all the garment production stages, especially lay planning, cutting, and assembling, to reap immediate benefits. Policymakers should consider providing financial incentives and technical training to support AI adoption in the fashion industry. Further research should explore AI adoption in other regions to compare technological solutions and investigate long-term impacts on the fashion industry.

REFERENCES

Abd Jelil, R. (2018). Review of artificial intelligence applications in garment manufacturing. *Artificial Intelligence for fashion industry in the big data era*, 97-123.

Adekunle, A. (2024). Application of Artificial Intelligence and Digital Technologies in Fashion Design and Innovation in Nigeria. *International Journal of Fashion and Design*, *3*(1), 37-48.

Akram, S. V., Malik, P. K., Singh, R., Gehlot, A., Juyal, A., Ghafoor, K. Z., & Shrestha, S. (2022). Implementation of digitalized technologies for fashion industry 4.0: Opportunities and challenges. *Scientific Programming*, *2022*(1), 7523246.

An, H., & Park, M. (2023). An AI-based Clothing Design Process Applied to an Industry-university Fashion Design Class. *Journal of the Korean Society of Clothing and Textiles*, *47*(4), 666-683.

Bertola, P., & Teunissen, J. (2018). Fashion 4.0. Innovating fashion industry through digital transformation. *Research Journal of Textile and Apparel*, *22*(4), 352-369.

Donmezer, S., Demircioglu, P., Bogrekci, I., Bas, G., & Durakbasa, M. N. (2023). Revolutionizing the Garment Industry 5.0: Embracing Closed-Loop Design, E-Libraries, and Digital Twins. *Sustainability*, *15*(22), 15839.

Frank, E., & Henry, E. (2024). *AI-Driven Demand Forecasting for Optimized Inventory Management* (No. 13214). EasyChair.

Guo, Z., Zhu, Z., Li, Y., Cao, S., Chen, H., & Wang, G. (2023). AI Assisted Fashion Design: A Review. *IEEE Access*.

Hoyer, W. D., Kroschke, M., Schmitt, B., Kraume, K., & Shankar, V. (2020). Transforming the customer experience through new technologies. *Journal of interactive marketing*, *51*(1), 57-71.

Jhanji, Y. (2018). Computer-aided design—garment designing and patternmaking. In *Automation in garment manufacturing* (pp. 253-290). Woodhead Publishing.

Jimeno-Morenilla, A., Azariadis, P., Molina-Carmona, R., Kyratzi, S., & Moulianitis, V. (2021). Technology enablers for the implementation of Industry 4.0 to traditional manufacturing sectors: A review. *Computers in Industry*, *125*, 103390.

Linfante, V., & Pompa, C. (2021). Space, time and catwalks: Fashion shows as a multilayered communication channel. *ZoneModa Journal*, *11*(1), 15-42.

Mahi, R. (2024). Optimizing supply chain efficiency in the manufacturing sector through ai-powered analytics. *International Journal of Management Information Systems and Data Science*, *1*(1), 41-50.

Minh, N. T., & Ngan, H. N. (2021, September). Digital fashion-An optimal solution for fashion industry during Covid-19 pandemic. In *AIP Conference Proceedings* (Vol. 2406, No. 1). AIP Publishing.

Mohiuddin Babu, M., Akter, S., Rahman, M., Billah, M. M., & Hack-Polay, D. (2022). The role of artificial intelligence in shaping the future of Agile fashion industry. *Production Planning & Control*, 1-15.

Nayak, R., & Padhye, R. (2018). Artificial intelligence and its application in the apparel industry. In *Automation in garment manufacturing* (pp. 109-138). Woodhead Publishing.

Ross, K. (2022). Artificial Intelligence in Fashion Manufacturing: From Factory Operation to Advisory Role. In *Leading Edge Technologies in Fashion Innovation: Product Design and Development Process from Materials to the End Products to Consumers* (pp. 95-116). Cham: Springer International Publishing.

Segbenya, M., Aframea Dankyi, L., Kwakyewaa Dankyi, J., & Owusu–Achiaw, R. (2023). Modelling university students' preferences and interconnectedness among various careers/occupations in Ghana. *Cogent Education*, *10*(1), 2182171.

Tahri, M. (2024). Optimization of Supply Chain Management in the Manufacturing Industry.

Tushar, I. H. (2020). Industry revolution 4.0 and digital transformation-it's implementation, opportunity and challenges in Bangladesh textile industry.

Vannuccini, S., & Prytkova, E. (2023). Artificial Intelligence's new clothes? A system technology perspective. *Journal of Information Technology*, 02683962231197824.

Yeo, S. F., Tan, C. L., Kumar, A., Tan, K. H., & Wong, J. K. (2022). Investigating the impact of AI-powered technologies on Instagrammers' purchase decisions in digitalization

Moses Opoku[1], Dickson Adom[2], Sarah Baiden[3], Diana Oppong[4], Pamela Isemikon Cyril-Egware[5]
DOI: https://doi.org/10.54443/sibatik.v3i8.2287

era–A study of the fashion and apparel industry. *Technological Forecasting and Social Change*, *177*, 121551.