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Envisioning AI-Powered Future of African Print Designs - A Systematic Review of Opportunities and Challenges

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Abstract

Purpose: The study aims to explore the integration of artificial intelligence in African print designs and its potential for innovation in the design thinking process while preserving culture.

Methodology/Design: A systematic review based on the PRISMA guidelines was used to select a total of 21 articles from the Scopus and Google Scholar databases after thoroughly screening articles on the present integration of AI in African textile design prints.

Findings: Although artificial intelligence (AI) has so far benefited textile industries worldwide by increasing productivity and decreasing errors, its use in African textile print designs is still relatively unexplored. Notable areas of artificial intelligence (AI) technology improvement related to designs include automated design systems, predictive textile design analytics, and pattern recognition. Although the use of artificial intelligence (AI) in African textile print designs is presently limited, concerns over cultural preservation are identified as a major barrier to seamless AI applications in African print designs.

Practical and Social Implications: The study highlights the need for an all-inclusive approach that uses AI innovations while maintaining the cultural significance of African prints. It provides guidelines for future research to address the ethical implications and practical challenges of this integration.

Originality: The study provides the first systematic review of how AI is influencing future narratives and the potential development of African print designs. The study will assist textile printing companies in understanding the opportunities and challenges presented by artificial intelligence (AI) in determining the future of African print designs, as well as the combined impact on creative innovation, sustainable commercial development, and cultural preservation.

Keywords
Artificial Intelligence, textile design, African prints, cultural heritage

1 | INTRODUCTION

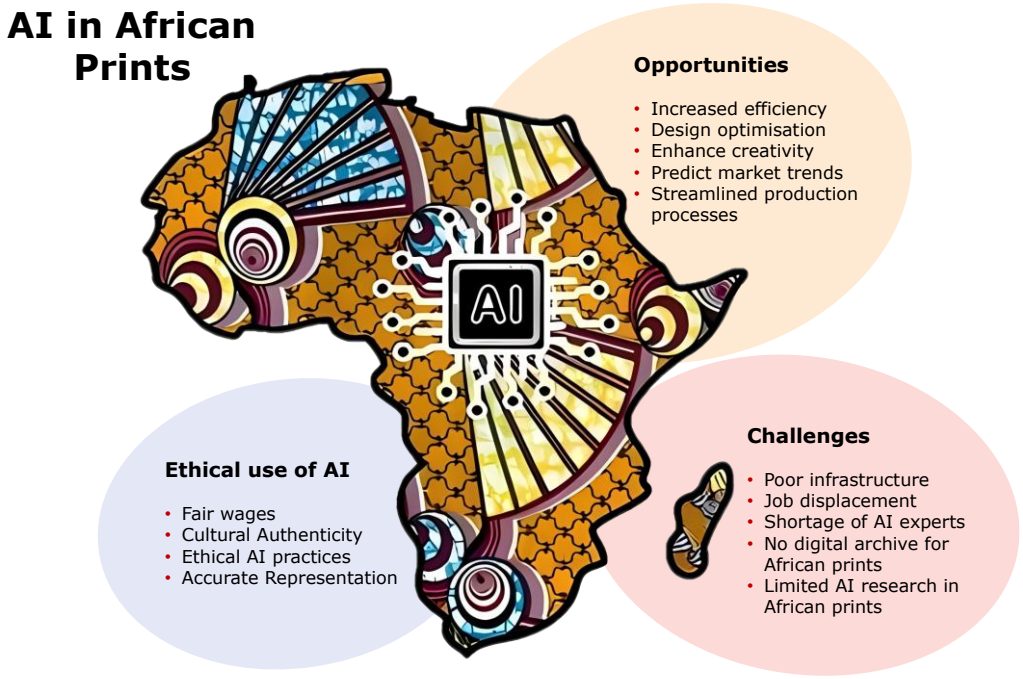
African print fabrics are known for their identifiable position within the continent's cultural and aesthetic traditions. According to Adeloye et al. (2023), African print fabrics are vibrantly coloured, machine-printed textiles that are widely worn across Africa. Although these fabrics have their origin in the Dutch wax-resist dyeing technique, they were accepted by African communities and became an essential part of their cultural expression (Sawyerr et al., 2023; Adeloye et al., 2023). African communities adopted these imported methods over time and also modified the motifs to reflect local mythology, symbols, and practices, resulting in the creation of African patterns that are now representative of African cultural reflection.

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Graphical Abstract



African prints serve as an important conveyor of cultural identity and heritage beyond their cultural aesthetic appeal. They are visual chronicles preserving collective memory, tradition, and social values, making them a significant cultural piece (Acquaye et al., 2024; Boamah et al., 2024; Seidu et al., 2022). Adeloye et al. (2023) affirmed that African prints represent identity, cultural pride and also act as a medium of resistance. Their use is seen as a type of "style activism" that reclaims cultural narratives and upholds identity. African prints, made either by hand weaving or printing, have been handed down to generations by utilising complex techniques. Because of their colour vibrancy and the rich tradition attached to African prints, these classic patterns have come back in today's fashion market. However, the production, distribution and usage of these fabrics are being redefined due to globalisation and technology. Artificial intelligence (AI) has become a disruptive feature in a number of creative industries, including textiles and fashion. Artificial Intelligence (AI) technologies are changing narratives on how fabrics are used, created, and consumed, from trend prediction and generative design tools to digital twin simulations and virtual fitting systems (Rizzi & Casciani, 2025). The use of AI in African print design, however, remains underexplored both technologically and culturally, despite its global momentum. This gap raises important questions about how AI can support ethical integration of cultural heritage, the preservation of artisanal identities, and the avoidance of cultural appropriation, in addition to design efficiency and commercial innovation (Mohiuddin Babu et al., 2024). This study evaluates the opportunities and challenges of integrating AI into African print designs by conducting a systematic review of the literature from 2014 to 2024. The review critically aims to analyse how AI might be used in African prints to foster creative innovation, advance sustainability, and protect cultural integrity by using empirical research, theoretical viewpoints and technological trends.

2 | METHODOLOGY

2.1| Review Method

Envisioning the AI-powered future of African print designs, a systematic review of opportunities and challenges was done using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) technique, developed by Liberia et al in 2009, according to Badaru (2024). This method was

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used to ensure a clear and well-organised procedure for locating, assessing, and gathering relevant information. Identification, screening, eligibility verification, and inclusion of relevant research are the four capital components of a systematic review process. Google Scholar and Scopus databases were used to perform this systematic review. The idea behind selecting these databases for the study is that they offer an extensive selection of peer-reviewed journal articles, conference papers, and book chapters on artificial intelligence, AI in textiles, African prints, and cultural studies that are accessible on these platforms. The usage of Scopus was very helpful in that it assures that only relevant and high-quality research is included with its enormous collection of citation data from major academic publishers. Google Scholar also provided more coverage, which Scopus might not have covered, including grey literature.

2.2| Search strategy

The transdisciplinary nature of the AI-powered future of African print designs was captured by carefully selecting the appropriate search terms and keywords. These were "AI in design", "machine learning", "artificial Intelligence", "African prints", "AI in the textile/fashion industry", "cultural studies in AI", along with "computational creativity." Abbreviations such as "AI" and "ML" were included with their full versions to provide comprehensive coverage. The three main search blocks used to locate pertinent papers on the subject of this study are displayed in Table 1.

Table 1. Search Blocks and Keywords

	BLOCK	KEYWORDS
1.	AI Technology	"machine learning" OR "ML" OR "neural networks" OR "NN" OR "artificial intelligence" OR "AI"
2.	Design and Industry	"garment industry" OR "fashion industry" OR "apparel industry" OR "textile industry" OR "design"
3.	African Print and Culture	"African prints" OR "African textiles" OR "African fashion" OR "cultural studies" OR "computational creativity" OR "traditional designs"

Effectively combining these search blocks involved the use of the Boolean operators "AND" and "OR". The Scopus and Google Scholar databases were searched using this thorough approach. The first search produced 271 documents, which included review papers, conferences, research articles, and books written in a variety of languages and covered a wide range of academic subjects from 2014 to 2024. After that, these materials were vetted for relevance to the goals of the study. Publications that empirically looked at AI's impact on design with a particular focus on African cultural patterns were selected for screening.

2.3| Eligibility and Exclusion Criteria

Publications in English only were used, and the period was limited to 2014-2024. The ten (10) year gap was selected to gain control for both theoretical studies and new practical applications of AI in African print design. This period enabled the analysis of AI's gradual impact, from its early developments to its current innovations in textile and fashion technology. Additionally, limiting the timeline guaranteed that only the most relevant and current research which reflects the latest developments in AI-driven textile design is reviewed. Understanding the wider context of AI's impact on African print design is very important; therefore, a combination of pertinent foundational theoretical studies in design and practical research was included. As shown in this instance, where 71 duplicate articles were eliminated, it is vital

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to eliminate duplicate data following the first search to reduce the overall number of possible sources for screening, as shown in Figure 1. The total number of studies was reduced for further review after duplicates were eliminated. To make sure they matched the goals of the study, titles and abstracts were vetted. Records unrelated to the intersection of cultural heritage, textile design, and artificial intelligence were excluded from the study. 41 out of 200 studies were left for eligibility evaluation, and 159 were eliminated for being irrelevant. To keep the study's emphasis on real-world AI applications in the textile sector, the eligibility criteria at this point are essential. This stage made sure that only papers that satisfied certain requirements, only articles that contained textile/fashion design and artificial intelligence, were taken into account. A total of 21 studies were considered, offering thorough insights into how AI affects African print design while striking a balance between technical innovation and cultural preservation.

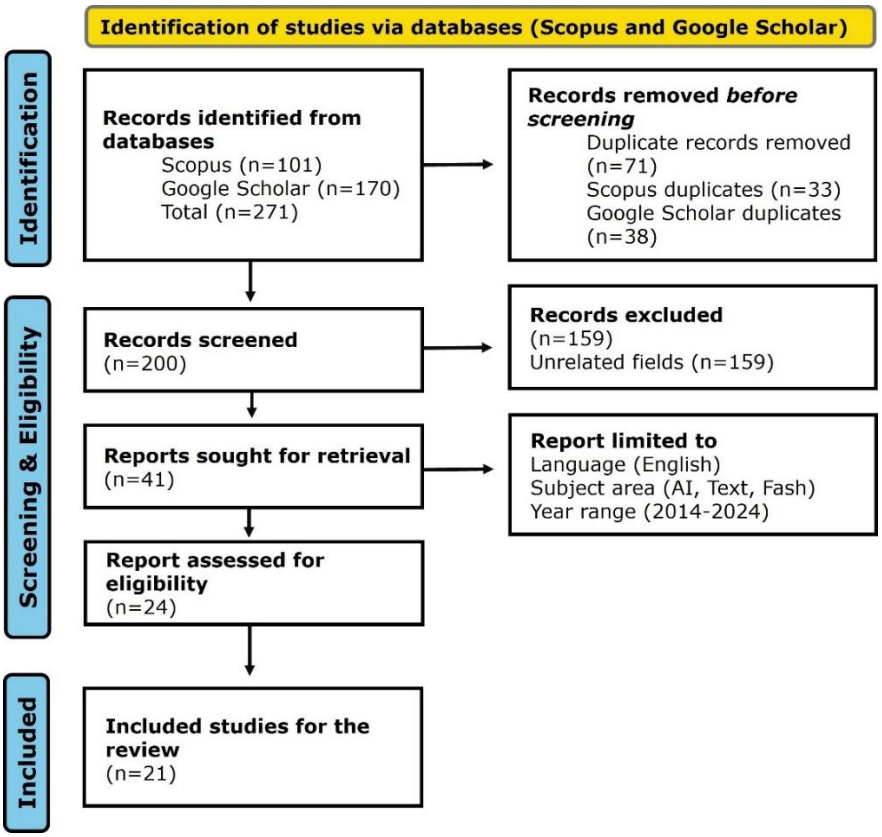


Figure 2. PRISMA flowchart showing the selection process.

3 | RESULTS AND DISCUSSION

Table 2 shows the summary of findings from the articles included in this study featuring AI-powered technology applications in textile design and some instances, fashion design with their sustainability contributions, and related challenges.

3.1| AI-powered design in textiles and fashion

Artificial intelligence (AI) is revolutionising the textile and apparel industries because it increases creative originality, boosts production efficiency, and allows for the customisation of customer experiences. Deep Convolution GANs (DC-GANs) and Generative Adversarial Networks (GANs) are two of the most influential AI technologies capable of analysing and imitating complex patterns to enable the automatic creation of creative output. For instance, they are frequently used to create original textile designs and reinvent cultural elements such as African prints. This method promotes co-creation between designers

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and AI through pattern-making. With the use of machine learning algorithms, designers can forecast colour and pattern trends to stay ahead of their customers' needs. This improves product development precision and avoids overproduction. However, the deployment of such sophisticated AI systems necessitates large datasets and a strong computational infrastructure (Rahman, 2021). Another AI essential tool called Multimodal Unsupervised Image-to-Image Translation (MUNIT) with pattern recognition software automates the recognition and replication of traditional and cultural themes that can mimic and modify complex designs (Anuyah et al., 2023). Deng and Chen (2023) affirm that MUNIT has been used to create a variety of fashionable designs, enhancing the uniqueness of ethnic clothing by fusing traditional artisan techniques with contemporary technical advancements. This facilitates the production of varied and culturally rich fabrics while also speeding up the design process. However, there are issues with cultural sensitivity because AI systems might not completely comprehend the symbolic meanings of patterns, which could result in oversimplifications or misinterpretations (Anuyah et al., 2023). AI has also opened up opportunities for customisable textiles and fashion by enabling the creation of customised apparel (Mohiuddin Babu et al., 2024; Rathore, 2023) through machine learning algorithms. AI makes it possible to create fitted clothing, including clothing with African prints, on demand by evaluating customer preferences and dimensions. This method improves customer satisfaction, encourages sustainability, and decreases inventory waste. Even while AI systems offer many advantages, their high implementation costs make them difficult to deploy widely, especially in small and medium-sized enterprises (Mohiuddin Babu et al., 2024; Deng and Chen, 2023). Table 2 summarises some typical studies on AI-powered creative design processes in textiles and fashion.

Table 2. AI-powered design in textile and fashion

AI Technology/ Approach	Key Contributions	Application in Textiles/ Fashion	Impact on Design Process	Challenges	Ref.
Generative Adversarial Networks (GAN) & Deep Convolution GAN (DC-GAN)	Increases creativity by producing innovative outputs and human-like pattern recognition.	Used to create automated fashion and textile designs and African print patterns.	Encourages automatic co-creation and boosts creativity in intricate pattern designs.	Originality issues; reliance on superior datasets	(Lee, 2022; Chakraborty & Biswas, 2020)
Artificial intelligence in trend forecasting	Anticipates future fashion and textile trends and changes in customer preferences with accuracy.	Used to inform African print designs by predicting fashion and textile trends.	Keeps overproduction at bay and increases design precision.	High computational demands and large dataset needs	(Rahman, 2021)
AI-based pattern recognition systems	Automated identification of customary and traditional patterns, enabling a variety of textile and clothing designs.	Identifies and creates textile designs with cultural significance in African prints.	It accelerates the design process and allows the creation of print variations automatically.	Issues with cultural sensitivity while interpreting AI	(Anuyah et al., 2023)
AI in digital textile printing	Uses AI-assisted technologies to make it easier to create accurate, customisable textile patterns.	Used in the creation of intricate fabric and textile designs and digital textile printing.	Minimises material waste and promotes the design process.	Restricted use in areas of highly conceptual design	(Kistamah, 2024; Sikka et al., 2024)
AI in a customisable	Uses machine learning techniques to	Uses personal preferences to customise	Encourages customisation	Implementation expenses for broad usage	(Rathore, 2023)

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fashion and textiles	Enable the production of personalised, on-demand African print clothing and textile patterns.	clothing and textile fibres.	and avoids overproduction

3.2| Sustainability and AI in textile design

Artificial Intelligence (AI) technologies are making a substantial contribution to textile design sustainability through process-optimised performance, waste reduction, and energy efficiency promotion (Kumar et al., 2024). To reduce the number of design iterations needed throughout the creative process, GANs are essential. Fabric and materials wastage is reduced, especially in the initial stage of design and production, because designers can build a virtual version of clothing and fabrics by utilising AI tools like digital twin technology, which does away with the necessity for actual samples at the prototyping stage. By reducing physical prototypes, carbon emissions are reduced, and the design process becomes more sustainable. However, the environmental benefits of GAN models are somewhat negated by the resource-intensive nature of their development and training, which frequently calls for significant amounts of energy and computing capacity (Lee, 2022). Moreover, additive manufacturing, which layers materials precisely without cutting or throwing away extra fabric, promotes resource-efficient production. However, the textile industry still faces barriers to implementation, particularly for small and medium-sized enterprises, due to limited scalability and high costs (Kistamah, 2024; Mohiuddin Babu et al., 2024; Deng & Chen, 2023).

Table 3. Sustainability and AI in textile design

AI Technology/ Approach	Sustainability Contributions	Environmental Impact /Business Sustainability and Ethics	Challenges to Sustainable Practices	Ref.
Generative Adversarial Networks (GAN)	Minimises the quantity of design iterations, therefore optimising energy use.	Lowers carbon emissions by reducing the need for tangible prototypes in fashion and textiles.	Training and developing models with a lot of resources	(Lee, 2022; Chakraborty & Biswas, 2020)
Digital Twins (DT) in Prototyping	Creates digital counterparts to do away with the requirement for actual samples.	Minimises wastage of fabric and materials during the textile and clothing design and manufacturing stages.	Making sure that virtual prototypes accurately depict the texture and feel of fabrics	(Lee, 2022)
3D Printing & Additive Manufacturing	Encourages textiles to be produced with zero waste, allowing for on-demand manufacturing.	Keeps waste down by printing clothing and textiles as needed.	In the textile industry, 3D printing has high prices and limited scalability	(Chakraborty & Biswas, 2020; Rahman, 2021)

3.3| AI-driven digitalisation of print designs

AI-driven digitalisation is revolutionising textile print design processes by increasing productivity, sustainability, and innovation (Kumar et al., 2024; Sikka et al., 2024; Rahman, 2021). This change is mostly due to technologies like AI-powered 3D printing, machine learning, and digital twins (DT). According to Lee (2022), digital twins reduce material waste and eliminate the need for physical samples of fabric by producing lifelike virtual prototypes. This supports customisation and helps prevent overproduction (Rathore, 2023; Nayak & Padhye, 2018). Deng and Chen (2023) state that design variations produced by machine learning algorithms enable the automation of the creation of designs

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with cultural inspiration. These algorithms reduce manual labour, promote creativity, and preserve cultural elements while producing a large number of textile patterns, which expedites the design process (Deng & Chen, 2023; Rahman, 2021). Furthermore, on-demand manufacturing is made possible by AI-powered 3D printing, which minimises overproduction and permits contemporary modifications of classical prints (Kistamah, 2024). Notwithstanding these advantages, barriers to broad adoption still exist, including restricted access to cutting-edge technology and maintaining cultural sensitivity. A further summary of AI-driven digitalisation of print design is shown in Table 4.

Table 4. AI-driven digitalisation of print designs

AI Technology/ Approach	Key contributions	Possible areas of application in African textiles print and fashion	Sustainability Impact	Challenges	Ref.
Digital twin(DT)	Reduces the need for actual fabric samples by producing realistic digital copies of conventional textile printing.	Used in digital prototyping and creating clothing and fabrics with African prints.	Minimises energy and material waste at the design stage.	It's still challenging to accurately replicate the textures of traditional textiles.	(Rathore, 2023; Nayak & Padhye, 2018)
3D Virtual Garment and Textile Fitting Technologies	It makes it possible to suit African print clothing and fabrics virtually, improving the client experience.	Produces textile simulations and digital clothing for customers, allowing for virtual testing.	Prevents overproduction and eliminates the need for actual prototypes.	Technology accessibility for all customers	(Rathore, 2023; Nayak & Padhye, 2018)
Machine Learning for Textile and Garment Design Variations	AI creates several African print variations while preserving cultural significance.	Produces culturally sensitive versions of African print designs for textiles automatically.	Minimises manual labour and speeds up the design process	Ensuring cultural authenticity in machine-generated designs	(Deng & Chen, 2023; Rahman 2021)
AI-Driven 3D Printing in Textiles	Generates on-demand Minimal material waste in African print clothing and fabrics	Enables the fabrication of modernised textile variants and classic prints in micro-factories.	Reduces material waste and gets rid of overproduction in the clothing industry.	Low availability of advanced 3D printing technology	(Kistamah, 2024)

3.4| Artificial Intelligence in Cultural Textile Design

The incorporation of Artificial Intelligence (AI) in African print design is a key factor in the transformation of the fashion and textile industries. Despite the scarcity of research in this area, early contributions by scholars like Nayak and Padhye (2018) laid the foundation for AI in textile systems. Other researchers, such as Lee (2022), Rathore (2019) and Zhong et al. (2021) investigated digital customisation and the preservation of African Textile heritage. Research activity became intensified between 2022 and 2024, focusing on AI's role in cultural design and customisation. Sikka et al. (2024) and Rathore (2023) elaborated on AI-driven user experiences, whereas Anuyah et al. (2023) and Mohiuddin Babu et al. (2024) highlighted AI's potential in reinterpreting indigenous patterns. Acquaye et al. (2024) looked into how traditional West African textile designs can be digitally reimagined for contemporary commercial use while addressing authenticity concerns and appropriation.

Fashion and Textiles Review, **2025**, Volume 6, Pages 333-352, https://doi.org/10.35738/ftr.v6.2025.17

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Table 5. Publication trends in 2017 and 2024.

Year	Author(s)	Focus Area	Relevance to AI & African Prints
2018	Nayak and Padhye	Smart textiles, customisation technology	Gave foundational information on intelligent textile systems
2019	Lee; Rathore	Digital fashion and user-centric customisation	Early exploration of digital tools in design, relevant to AI integration
2020	Chakraborty and Biswas	Use of GANs in textile design	Applied AI techniques (GANs) for visual cultural representations
2021	Zhong, Wang and Zhang	Digital identity in African textiles	Focused on digitisation and cultural preservation relevant to AI system training
2021	Rahman	Dataset construction for textile systems	Supported the foundation for machine learning applications
2022	Sikka et al.	AI in fashion personalisation and user experience	Highlighted AI's role in adaptive and culture-aware design
2023	Rathore	AI-based textile customisation	Practical applications of AI in design and pattern personalisation
2023	Anuyah et al.	Culture-based textile design innovation	Emphasised AI' s use in encoding cultural motifs into digital fashion systems
2023	Adeloye et al.	Sustainability and innovation in African fashion	Addressed structural transformation via digital and intelligent systems
2023	Deng and Chen.	Ethnic clothing and computational fashion	Broader implications for AI-enhanced ethnic fashion recognition
2024	Mohiuddin Babu et al.	Integration of cultural designs through AI	Focused on indigenous design innovation using AI tools
2024	Acquaye et al.	Cataloguing and digital preservation of African prints	Central to building AI databases and machine-readable cultural design archives
2024	Kumar et al.; Kistamah	Structural design and AI pattern recognition	AI-enabled fashion production processes and global cultural adaptation
2024	Sikka et al.	AI implementation in contemporary fashion pipelines	Expanded on personalisation and production-level AI tools

The efforts of Kistamah (2024) and Kumar et al. (2024) have expanded the discourse on AI-enhanced user experiences and the integration of AI in fashion production pipelines, directly impacting African print design. However, a lot remains to be learnt in this field, particularly concerning culturally distinctive design elements and their suitability for the global market.

3.5| African Print Designs in Perspective

African prints, referred to as "Shweshwe" in Southern Africa, "Ankara" in West Africa, and "Kitenge" in East Africa, are more than just clothes; they are artefacts that symbolise the rich history of African societies (Acquaye et al., 2024; Adeloye et al., 2023). According to Adeloye et al. (2023), "African print fabric" refers to printed textiles with vivid colours that Africans frequently wear. They are created by machines utilising the wax-resist dyeing technique. These textiles are typically identified by African motifs, signs, and symbols intended to be understood silently (Acquaye et al., 2024; Adeloye et al., 2023). African print textiles are typically made entirely of cotton and have eye-catching patterns. They are typically quite colourful and are mostly connected to Africa because of their motifs and tribal-inspired designs, as well as the widespread acceptance of Africans. According to Adeloye et al. (2023), African print fabrics are eye-catching, colourful textiles that are used in many African countries as well as other countries. African print design history is deeply entwined with the continent's colonial and post-colonial histories. The mass-produced prints introduced by European and Asian manufacturers in the 19th and

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20th centuries had a huge impact on the African textile market, even though the indigenous methods of producing textiles have ancient roots (Adeloye et al., 2023). These fabrics took their inspiration from the Indonesian batik and were modified to suit African tastes and preferences. They are frequently referred to as "Dutch wax" designs (Acquaye et al., 2024). African societies adopted these prints over time, and they became essential to their cultural expression. African patterns were created as a result of the motifs being altered to represent local customs, myths, and symbols. As discussed by Anuyah et al. (2023), these prints, which blend traditional and contemporary features, are fully assimilated into African society despite their foreign origins. Traditional African printing processes have seen a rebirth in recent decades due to a desire to promote African identity and maintain cultural memory. Ijisakin (2021) similarly stated that printmakers are fusing traditional and modern elements in their works to capture the vibrant essence of Nigerian culture. This revival is seen in the rising desire for locally made textiles that highlight cultural value and authenticity.

Through symbolic patterns that reflect history and convey stories, African print designs exemplify cultural identity and expression. They help to convey cultural heritage and preserve indigenous knowledge. Depending on the sort of design, African print fabrics are given different names. African print designs are extremely important for fostering mutual association and communication between people and within groups (Acquaye et al., 2024; Adeloye et al., 2023). The metaphors and themes employed have a clear connection to historical sayings and occasions. They are an important means of communicating with a person, family, or wider social group. They are a type of storytelling that frequently replaces the written word. It is worth knowing that every design element seen in African prints, from colour selection to motif placement, has a purpose and supports cultural norms and values. For example, "Aso Ebi" custom in Nigerian culture refers to the wearing of identical garments made of the same cloth for family gatherings as a sign of solidarity and unity. Similarly, the "Kente" cloth of Ghana is worn during significant cultural rituals and is frequently linked with royalty due to its elaborate patterns and vivid colours. The global community makes extensive use of African print fabrics to honour the past and connect with ancestors. The rich patterns and colours of these textiles highlight the profound meaning that has been handed down through generations (Adeloye et al., 2023). African prints help people to stay connected to their culture, even though they may live far from the African continent. For example, at significant cultural festivals like Kwanzaa, a celebration celebrating African roots in African-American culture, many African Americans and Afro-Caribbeans dress in African-inspired attire. Traditional African textiles, such as Kente fabric, are used to honour African ancestors and uphold their traditions during Kwanzaa celebrations. The patterns and colour schemes of these textiles often symbolise prosperity, spirituality, and community. In a globalised world where cultural identities are sometimes misrepresented, people from the diaspora can express their identity and dispute misconceptions by wearing traditional African prints as a symbol of ethnic pride. For example, African Americans frequently wear African print clothing during Black History Month in the United States as a celebration of their cultural heritage. For example, African Americans frequently wear African print clothing during Black History Month in the United States as a celebration of their cultural heritage.

Wearing traditional African designs, such as dashikis or Ankara, is a way for people to fight cultural erasure and publicly express their pride in their African heritage. These fabrics served as a powerful instrument for both cultural erasure and pride. Ankara has changed from being a colonial instrument in Nigeria and Brazil to a celebration of African history that defies Western notions of beauty, as similarly stated by Maia (2023). One prominent instance of this is the "Black Panther" phenomenon, in which the 2018 Marvel film ignited an international campaign of African pride. African diaspora populations found great resonance in the movie's celebration of African culture, which included the incorporation of

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traditional African prints into the outfit design. African prints were widely used during the film's debut, particularly at premiere parties and public screenings, and thus served as a symbol of resistance to oppression, solidarity, and cultural pride. To make this argument concrete, Omanga and Mainye (2019) confirmed that the movie "Black Panther" created a lot of cultural controversy and symbolism, especially in Africa. The premiere of the movie in Kenya was marked by a significant cultural celebration, with audiences embracing and showcasing African print fabrics as an expression of national identity (Omanga & Mainye, 2019). African prints, which were featured in the movie and played a significant role, acted as a communicative tool for resistance to oppression and also acted as a cultural pride. African prints are used as a form of "style activism" across the diaspora, as stated by Acquaye et al. (2024). Adeloye et al. (2023) explained that wearing these prints daily and on special occasions enables people to engage in visual and sartorial dialogue about their origin, identities and positions in the world. In doing so, we can recover tales about African culture and challenge preconceived notions about African identities.

3.6| Current state of AI in African print designs

The study has shown that AI has started to make advances in African print design, even though its use is sporadic and mostly experimental. AI technologies have proven to enhance creative processes, automate repetitive tasks and create unique patterns for African print. AI tools such as Generative Adversarial Networks (GANs) are trained using existing African art and textiles to produce new patterns. Adeyokunnu et al. (2024) cited an example that researchers have used African masks as a motif to create interesting designs with the help of MaskGAN. Adeloye et al. (2023) affirmed that DeepArt enables users to build customised African print designs according to their preferences because of its ability to enrich images. With the help of machine learning algorithms, which can determine the most popular patterns, colours and themes (Sikka et al., 2024) among consumers, designers can produce prints that are both aesthetically pleasing and culturally appropriate. Below are the samples of African prints that Deepart produced in response to the prompt below.

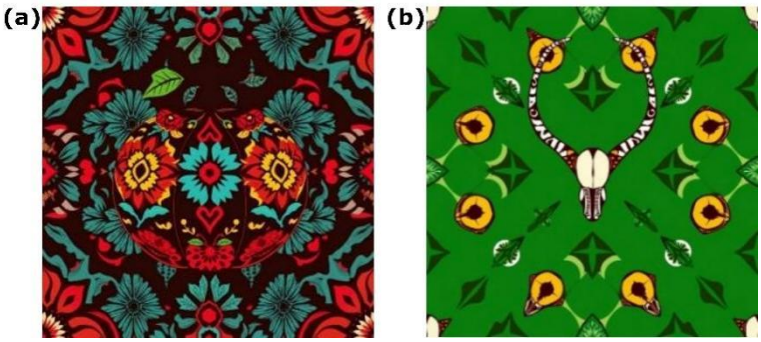


Figure 3. (a) AI floral-inspired design and (b) traditional symbol-inspired AI-generated design (*Prompt used:* A spectacular colour scheme of gold, red, and indigo combined with traditional Adinkra symbols to create African flower designs that reflect ideas of innovation, wholeness, and heritage).

Studies have revealed ongoing research into how traditional African prints can be catalogued and digitised to preserve them for future generations (Acquaye et al., 2024). AI can identify and classify African prints based on their cultural origins, historical periods, and stylistic elements (Deng & Chen, 2023). Designers and researchers can access and document prints by grouping them by region, tribe, or theme using machine learning algorithms, which are good at spotting patterns. This can be integrated into educational platforms to increase awareness of African art and ensure that knowledge is passed down to future generations by making traditional designs accessible to a global audience. Several scholars,

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including Mohiuddin Babu et al. (2024), Sikka et al. (2024), and Rathore (2023), have argued that AI expedites the design process by automating the creation of textile patterns and colour selection. Rathore (2019) explained that by looking at past trends, consumer preferences and local attractiveness, machine learning algorithms can recommend new print designs appropriate for specific markets. These technologies increase productivity and help close the gap between the large-scale textile industry and traditional artisans. However, the study revealed that integrating AI in this field poses several challenges because it is still in its infancy. African print designs are rarely documented digitally; they are rather passed down orally or visually across generations. AI technologies which depend on large-scale datasets to function may alter designs. AI requires large datasets to understand and replicate the complexity of patterns, textures, and colours that define African prints. Because datasets on African prints are insufficient, outputs may not be authentic or fully convey the cultural complexity of the designs. As a result, biased outputs that fail to capture the richness and cultural significance of African prints are frequently produced. Anuyah et al. (2023) stated that AI systems are not sufficiently sensitive to accurately understand cultural iconography, which puts African heritage at risk of misrepresentation in the designs produced. The understanding and decision-making processes of AI systems become limited, leading to homogenisation that minimises cultural differences due to the lack of comprehensive datasets on African prints (Anuyah et al., 2023).

3.6.1| Case study: Ghana Textile Printing

Tex Style Ghana Limited, formerly known as Ghana Textiles Printing Company (GTP), has strategically adopted AI to expand its market reach and enhance its product offerings, both locally and internationally. Tex Style Ghana Limited has utilised AI to identify consumer preferences and developed African print designs that appeal to both local consumers and the African diaspora in nations such as the US, UK, and Europe (Pardie et al., 2023). Tex Style Ghana Limited can now accommodate cultural and national preferences through AI integration into its design processes (Pardie et al., 2023). By analysing consumer trends, cultural icons and fashion preferences, the company can create designs that are both culturally relevant and trendy. It can be stated that they have used this strategy to create collections like "Adepa Dumas" and the "Day Borns", which blend traditional Ghanaian patterns with contemporary elements. The company uses AI to predict trends and create limited-edition prints and new collections that meet customer needs (Pardie et al., 2023). Tex Style Ghana Limited may employ AI-driven marketing tools to evaluate local trends and align its advertising efforts. The company also make sure that the right people see their products both locally and internationally through the use of AI marketing tools (Pardie et al., 2023). For instance, they can target diaspora populations in foreign markets where African prints are increasingly seen as a sign of cultural identity and ethnic pride. Though Ghanaian textile companies are confronted with lots of threats from foreign companies with the influx of cheap pirated and second-hand fabrics (Amankwah-Amoah, 2015), there is a significant development in Ghana's textile industry, especially Tex Style Ghana Limited, due to the inclusion of AI systems in e-commerce platforms as far as marketing is concerned. This development can help the company expand its global reach, tap into untapped markets, and still maintain cultural relevance. However, despite employing AI techniques, Tex Style Ghana Limited still faces constraints like a lack of technical skills, high implementation costs, and limited datasets (Yusuf et al., 2024), which are common in the reviewed literature.

3.7| Opportunities for AI in African Print Designs

The reviewed literature indicates growing interest in integrating AI-powered generative design tools into the textile industry. The textile industry uses AI to create customised, appealing designs that enhance

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customer satisfaction. AI has entirely changed how designers approach user experience by enabling real-time analysis of user behaviour and preferences. This analysis can then inform design decisions that have a deeper impact on the target audience (Sikka et al., 2024). AI is pivotal to African print design because it solves practical production and design problems, as well as makes it possible to customise designs to suit client tastes and cultural differences. According to scholars such as Kistamah (2024) and Rathore (2023), the development and evolution of the textile industry have been greatly aided by AI capabilities. With the availability of advanced tools and procedures, current industrial approaches have significantly improved. Thus, there has been a notable improvement in the overall efficiency of industrial processes. Mohiuddin Babu et al (2024) and Sikka et al. (2024) also asserted that Artificial intelligence (AI) is transforming the textile manufacturing industry through various applications such as automation, quality assurance, and process optimisation. Ahmad et al. (2020) explained that expert systems help textile designers in identifying eco-friendly solutions and are used to improve customer experiences through fashion shopping recommendation tools. AI has revolutionised conventional procedures in a variety of industries by acting as an innovator and a facilitator of invention, as the study revealed. By combining human creativity with AI's analytical powers, companies create and introduce goods that are not only highly responsive to user needs but also technologically advanced. These smart products are solutions that enhance people's lives, streamline processes, and open the door to an endlessly creative future.

A survey by Chaudhary et al. (2020) disclosed that 70% of designers waste time on repetitive tasks such as formatting. At the same time, Sketch Smart also spaces out objects in design tools like Canva, simplifying the text and resizing. Design tools like Figma, Sketch, and Adobe XD use AI to automate these various design tasks. For instance, Rathore (2023) posits that Figma automatically changes the layouts of design elements by making it easily accessible to even non-designers. AI-based generative design tools can be integrated into African print designs to create intricate patterns with minimal manual input. By analysing existing designs, these tools can generate new variations and offer recommendations on colour schemes and motif placement. This automation can accelerate production, reduce costs, and enhance design consistency in African print designs. Chakraborty and Biswas (2020) further explained AI's ability to support the entire design cycle, from ideation and prototyping to quick manufacturing. Their findings suggest that AI-powered systems reduce time-to-market and improve responsiveness to customer demands. Lee (2022) highlighted the efficiency improvements enabled by AI-driven prototype tools, which allow designers to receive real-time feedback and make quick iterations in response to market feedback. Below is a diagram illustrating innovative product development (Figure 4).

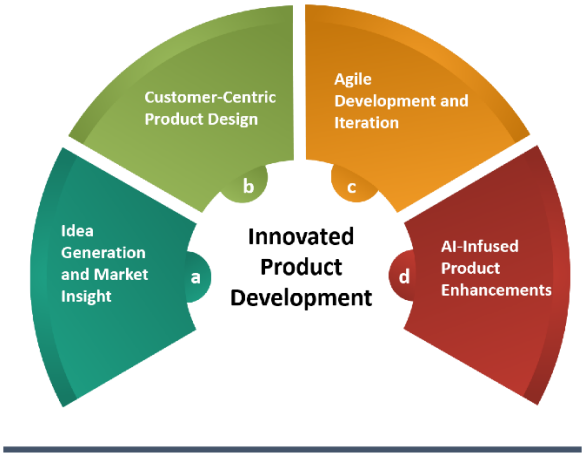


Figure 4. Innovative product design (Aldoseri et al., 2024) (This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license)

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Businesses can swiftly create and assess product prototypes (Lee, 2022), gather user feedback, and improve designs. This innovative technique reduces time-to-market while ensuring products fulfil client expectations. Businesses gain real-time insights into their products' performance through AI-powered analytics that continuously monitor user behaviour and comments. According to Rathore (2023), businesses utilise AI technologies to assess consumer behaviour patterns on social media platforms. This enables businesses to identify trends and consumer feedback at scale using machine learning algorithms and text analytics (Chakraborty & Biswas, 2020). This can facilitate improvements in usability, functionality, and user experience. It can be stated that future commodities will shift from static tools to adaptive solutions as digital tools and artificial intelligence become more predominant. Mohiuddin Babu et al. (2024) stated that these devices give a personalised user experience by utilising real-time analysis by gaining experience from user behaviour and making changes to suit individual preferences. Based on the studies, it can be established that designers can leverage AI to produce prints that appeal to a wide range of consumers by understanding and accommodating the tastes of various cultures. Moreover, AI-driven marketing technologies can support targeted advertising efforts that introduce African prints into untapped markets by analysing consumer behaviour across geographical regions, as asserted by Mohiuddin Babu et al. (2024).

3.8| Challenges of AI in African Print Designs

Despite the opportunities AI presents, integrating AI into African print designs poses challenges. One of the most urgent issues confronting it is the risk of cultural appropriation and loss of authenticity. African print features beautiful, bold patterns with significant cultural and historical value (Acquaye et al., 2024; Adeloye et al., 2023). These textiles act as historical vehicles and represent cultural tales and symbols. Anuyah et al. (2023) argue that AI-generated designs risk lacking the cultural context and symbolic value that traditional prints possess, even when they are pleasing to the eye. This may threaten Africa's rich cultural heritage in traditional storytelling and symbolism, as designs are more likely to be produced economically. Another revelation by Mohiuddin Babu et al. (2024) is that cultural appropriation problems may worsen as non-African companies start selling AI-generated prints with African themes. Most international textile businesses have long copied African prints, often without crediting the original designers. Given this, it can be stated that African artists risk being further marginalised by the application of AI, which could prevent them from reaping the rewards of their cultural creations. Amankwah-Amoah (2015) also stated that another major challenge confronting the African textile industry is the flood of lower-priced imports, especially those from China and the Western market. The findings of Amankwah-Amoah (2015) revealed that the import of these pirated fabrics threatens local industries by providing more affordable substitutes to domestically produced fabrics and garments. Several textile companies in Africa have collapsed due to the influx of these cheap imported fabrics. According to Osondu-Oti (2021), Nigeria Textile Mills (NTM) was once Nigeria’s top textile manufacturer, founded in 1962. However, the company collapsed as a result of the influx of cheap textile imports, especially from China.

Through design automation and rapid production processes, Al has the potential to decrease human labour (Kumar et al., 2024). Mohiuddin Babu et al. (2024) point out that People who rely on traditional African printing methods stand the risk of losing their jobs and exhibiting less artisanal skills as a result of AI adoption. Similarly, Sikka et al (2024) claimed that in industries where automation may replace repetitive or manual tasks, there is a significant loss of jobs due to AI adoption. The Textile Future Factory (TFF), which is a renowned European textile company, is a typical example of companies which have used

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AI to replace human labour. TFF was established in 2018 with a focus on smart textiles and luxury fashion materials to combine innovation with sustainability. The company's report in 2022 revealed that there was a significant change in the company's workforce since the adoption of AI. According to the report, there were approximately 400 workers at TFF, including machine operators, weavers, quality control inspectors, and designers, and the workforce has been cut down to 120 after the full implementation of AI technologies. This aligns with wider patterns seen in several industries, where AI-driven automation has resulted in job losses as robots outperform people in terms of efficacy and cost. When their abilities do not align with the needs of an increasingly computerised industry, displaced individuals frequently struggle to find new jobs. Another predominant challenge the study revealed is data-related limitations and infrastructure constraints. In order to handle the large amounts of data required for algorithm training and intelligent decision-making, artificial intelligence (AI) systems need high-speed internet, advanced data processing capabilities, and significant computational power. However, Danso and Hanson (2023) mentioned that many African countries, such as Ghana, Uganda, Kenya, and Zambia, struggle to provide access to high-quality, context-specific datasets necessary for culturally informed AI applications.

Moreover, a shortage of skilled personnel to oversee and maintain AI systems poses a challenge. According to Yusuf et al. (2024), there is a severe shortage of professionals with experience in artificial intelligence, machine learning, and data science across several African nations, including Ghana and South Africa. Even with the necessary technological infrastructure in place, a shortage of skilled personnel often prevents businesses from fully leveraging AI technologies. Financial constraints further intensify the challenges of AI adoption. As Danso and Hanson (2023) observe, small and medium-sized enterprises (SMEs) in the textile industry usually lack the capital needed to invest in AI technologies. The high costs of acquiring hardware, software, data storage solutions, and system maintenance pose significant challenges, especially for individual artisans and rural producers. These concerns are resonated by Sikka et al. (2024), Mohiuddin Babu et al. (2024), and Rathore (2023), who collectively affirm that the economic demands of AI implementation are often beyond the reach of most small-scale textile producers in Africa. An example can be seen among the smock-weaving industries in the northern regions of Ghana. Small weavers in rural areas continue to face challenges in integrating artificial intelligence into their production processes.

3.9| Balancing Culture with innovation in African Print Design

It is very important to preserve cultural heritage while embracing technology and innovation. AI's ability to analyse data efficaciously and recognise patterns allows for the development of techniques without impediment (Sikka et al., 2024). AI can maintain cultural significance and integrate it into contemporary design processes because of digitalisation and analysis. Through the usage of collaborative development strategies, AI systems that are meant to assist communities can be developed with cultural sensitivity and local values. To make sure that technology complements rather than replaces craftsmanship, designers and AI developers must work together to create AI-powered tools for African print designs. Deng and Chen (2023) noted that Traditional arts, textiles, and cultural artefacts can be digitally preserved using AI technologies. Digitalisation can help preserve the visual and structural characteristics of artefacts for future generations. AI enables the analysis and archiving of digital recordings through the preservation of intangible cultural elements like music, rituals and storytelling (Rahman, 2021). This will help maintain the authenticity of traditional practices while promoting the continued use of technological advancements.

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AI systems can examine traditional African textile designs, such as Adinkra or Kente and make sure that they maintain their original shape even after modification, as asserted by Acquaye et al. (2024). Modernising ancient designs using AI allows artisans to reach international markets while maintaining the cultural identity of their creations. Scholars such as Pardie et al. (2023) and Deng and Chen (2023) argue that Policymakers and cultural institutions must set rule and regulations that governs the application of AI in culture. Such mechanisms would help cultural institutions to keep authority and control over their legacy and also serve as a guide to compensate those traditional communities whose knowledge is exploited for financial gain by others.

Most of the literature reviewed points out that there is potential loss of jobs and cultural erosion since artisans often lack the resources and training needed to successfully integrate AI into their traditional craft productions. Yusuf et al. (2024) reported that most craftsmen have minimal to no formal training in AI technology, especially in developing nations such as South Asia and Africa. Their skill is hand craftsmanship that has been inherited through the years. This mismatch may cause missed opportunities as artisans fight to stay competitive in a global market where artificial intelligence is quickly taking the stage (Yusuf et al., 2024). Considering how quickly AI can produce designs, there is a risk that this will lead to "cultural homogenisation," in which unique ethnic or national designs are abandoned in favour of general appeal. To guarantee that AI-generated designs take cultural quirks into account, human oversight is essential. Rather than depending solely on AI, designers can utilise technology as a tool to augment their creativity. Case studies have demonstrated that Tex Style Ghana Limited utilises AI tools in its design process; however, it ensures that all productions are reviewed by skilled designers who are familiar with African customs and symbols (Pardie et al., 2023). Similarly, Maxhosa Africa in South Africa produces designs based on traditional Xhosa beading using AI-driven techniques. The AI generates several design alternatives after designers input culturally relevant themes. Artisans then evaluate and modify these products to ensure cultural authenticity is maintained and the design aligns with the brand's identity (Deng and Chen, 2023). Amankwah-Amoah (2015) also proposed that to assist artisans overcome this challenge, there is a great need to organise and implement training programmes to help artisans stay abreast of the use of these AI tools. According to Nayak and Padhye (2018), these strategies will ensure the preservation of cultural narratives, foster creativity, and enhance efficiency. In the broader discussion of digital transformation, organisational culture plays a crucial role in shaping the adoption and use of AI. According to Nayak and Padhye (2018), developing an inquiry-driven culture that integrates design thinking can improve flexibility and user experience across AI initiatives. Youvan (2024) added that ensuring mental wellness and building curiosity in design teams encourages experimentation and challenges traditional wisdom, which in turn spurs creativity. Although AI's transformational potential in textile design has been well recognised in the literature, its application to African print design remains unexplored, particularly in terms of cultural preservation, artisan involvement, and ethical AI use. The need for an AI-human collaborative approach that integrates machine learning capabilities with cultural knowledge is a key area of convergence to ensure that AI-generated African prints maintain their authenticity and cultural relevance. Policy changes are also required to protect traditional knowledge and guarantee fair benefits for traditional craftsmen. By addressing these gaps, this study will promote a more culturally aware and sustainable use of AI in African print design.

4 | IMPLICATIONS OF FINDINGS

The results of this study reveal that although AI can significantly change African print design, incorporating it comes with complex workforce, cultural, ethical, and policy-related challenges.

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Recognising these ramifications is crucial for ensuring that AI adoption does not destroy cultural heritage. This section methodically examines the multi-dimensional implications of the study's findings. It first considers the economic impacts, such as market inequality and competition. The implications for the workforce are also discussed, highlighting the need for reskilling and potential job displacement. It also explores the cultural implications of authenticity, appropriation, and identity loss. The section concludes with theoretical implications that call for further research on AI's role in cultural preservation. It then continues with ethical and policy considerations, underscoring the pressing need for legislative protections. These analyses provide a comprehensive framework for understanding how to incorporate responsibly into Africa's textile industry.

4.1| Economic Implications

One major economic concern is the possible increasing disparity between large-scale textile industries and small-scale manufacturers. Companies such as Tex Style Ghana Limited have successfully used AI to analyse customer preferences, optimise inventory, and broaden their market reach. Also, an entrepreneur in Tanzania, called Sarah Kimani, uses AI-powered logistics optimisation to ensure reliable deliveries despite a challenging transportation system. By planning delivery schedules, the AI system predicts potential delays and suggests alternatives, thereby enhancing the company's supply chain resilience (Tseng et al., 2022). However, some researchers, such as Danso & Hanson (2023) and Amankwah-Amoah (2015), have found that small-scale textile companies are unable to implement AI due to technological and financial constraints, resulting in a two-tiered market in which larger companies with more advanced technology prosper, while smaller producers struggle to compete. According to the findings of Danso and Hanson (2023), the digital gap is becoming a bigger problem in Africa as many textile companies do not have access to the infrastructure needed to implement AI. Local textile industries may be more vulnerable to competition from imports if small-scale businesses are not able to integrate AI, which could lead to business closure and reduce employment opportunities.

4.2| Workforce Implications

The African textile industry is at risk of job displacement because of AI-powered automation. By automating operations that are currently completed by artisans, AI could decrease the need for manual textile design and production. Research conducted revealed that, in South Africa, the textile industry has seen varied impacts from automation. Findings from most scholars, such as Sikka et al. (2024), Mohiuddin Babu et al. (2024), and Parschau and Hauge (2020), revealed that although some firms have seen an increase in productivity without a major loss of jobs, there are still concerns that automation could displace low-skilled workers, especially in labour-intensive industries. Given this, Yusuf et al. (2024) proposed that, to prevent designers and artisans from being replaced by AI-enhanced industrial production processes, it is very prudent that workforce reskilling initiatives are implemented to assist artisans and designers to become abreast with the system.

4.3| Cultural implications

The cultural significance of traditional African textiles cannot be underestimated. Cultural identity and storytelling are closely linked to patterns such as Kente (Ghana), Ankara (West Africa), and Shweshwe (South Africa). Cultural dilution may occur because AI-generated designs may lack the authenticity and contextual knowledge inherent in these traditional patterns. Moreover, the ease with which AI can

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replicate designs raises concerns about cultural appropriation, where traditional patterns are commercialised without proper acknowledgement or compensation to the original designers. Eglash et al. (2020) emphasised that the commercialisation of African prints by foreign companies without due credit to their origins is a revealing issue, and AI may further quicken this unethical practice if left unregulated.

4.4| Ethical and Policy Implications

The use of AI in African print design urgently calls for robust ethical guidelines and legislative measures to protect cultural heritage. The study revealed that African prints have limited legal protection, which makes it easier for multinational companies to commercialise traditional designs without consent. In view of this, government and industry regulators should strengthen policies to protect African prints from unauthorised AI-generated replicas.

4.5| Theoretical Implications

The study expands the theoretical knowledge of AI's function in cultural preservation. Existing research often focuses on AI's capacity for efficiency and customisation; however, this study emphasises the relationship between AI and cultural heritage. Novel approaches for understanding how technology can sustain indigenous artistry are suggested by AI's capacity to classify, digitise, and reproduce traditional African prints. Nevertheless, there are still concerns about whether machines can fully understand the deeper symbolic meanings in traditional textiles, emphasising the need for further study of AI-human collaboration that maintains cultural integrity (Eglash et al., 2020).

5 | LIMITATIONS OF THE STUDY

The systematic review methodology was employed in accordance with PRISMA guidelines. Although these databases are recognised for their credibility and academic rigour, limiting the study to these two databases introduces several limitations that may affect the comprehensiveness of the findings. Scopus and Google Scholar are noted for indexing peer-reviewed academic publications and high-impact journals. AI applications in African print designs, however, have not gained much attention and are still in their infancy stage in terms of academic research. As a result, these databases may contain fewer scholarly articles than those in other fields, such as healthcare. The study may overlook recent innovations and practical applications of AI in African print design by excluding industry reports and unpublished (grey) literature. For instance, textile industries in countries like Ghana, South Africa, and Nigeria may be using AI-powered design software, but these advancements may be reported in industry white papers, trade reports, or unpublished theses rather than indexed academic databases. A thorough search could have captured such practical applications. The study was limited to English-language publications, excluding relevant studies in languages such as French, Portuguese, and indigenous African languages, which could have been highly informative. Expanding the literature search in these languages would have made the findings more representative of AI adoption across different African regions.

Moreover, manually reviewing non-indexed sources would have been challenging, as expanding the search to industry reports, grey literature, and multiple databases would require more time and additional screening to ensure the study's quality and relevance. It can also be established that information in industry reports, blogs, and grey literature is less reliable and may lack credibility because it is not peer-reviewed. The PRISMA methodology constrained the study by requiring a rigorous, transparent approach to article selection and by ensuring a clear, well-organised procedure for locating, assessing, and

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gathering relevant information. The study was limited to Scopus and Google Scholar because Scopus is the largest abstract and citation database for peer-reviewed articles, which ensures that all articles meet high academic standards, and Google Scholar provides widely cited and relevant academic sources.

6 | CONCLUSION AND FUTURE STUDIES

The use of artificial intelligence (AI) in African print design signals a major technological breakthrough in the continent's textile and apparel industry. The study investigates the opportunities and challenges posed by AI and provides insights into how AI may influence African print designs in the future. AI has the potential to deliver unprecedented advances that can optimise designers' workflows and, in turn, maximise creativity and promote sustainability. Given the deep cultural and ethnic roots of African print designs, there is concern that AI will dilute these values and alter the symbolic and aesthetic meanings embedded in them. As AI-based technologies become integral to the design process, culturally sensitive algorithms and collaboration between technology experts and local designers are essential. Moreover, accessibility continues to be a major problem for many designers, especially those who operate in small and medium enterprises (SMEs) as they might lack the infrastructure, financial resources, or training needed to use AI tools effectively. The research elaborates how AI is central to promoting sustainability within the African print industry. Economic machine learning can enhance the environmental performance of African fabric production by increasing fabric-use efficiency, reducing overproduction, and improving supply-chain visibility. Nevertheless, creating AI systems focused on sustainability and ethical procurement will require increased investment in research and development.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article since this is a review paper.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work, the author(s) used ChatGPT, Grammarly and QuillBot in order to support language refinement, clarity improvement and structural enhancement. After using these tools/services, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the publication.

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REFERENCES

Acquaye, R., Amankwah, A. M., & Seidu, R. K. (2024). The "Authenticity Discourse" in Contemporary Application of West African Textiles. *TEXTILE*, 22(1), 218–232. https://doi.org/10.1080/14759756.2023.2178050

Adeloye, A. A., Oladesu, J. O., Oyinloye, M. A., Sobowale, T., & Uzzi, F. (2023). Conservation of African Craft through Art Entrepreneurship: Case Study of Kente Craft. *Gazi University Journal of Science Part B: Art Humanities Design and Planning*, 11(4), 675-688.

Adeyokunnu, O., Abayomi-alli, A., Alabi, O.A., Arogundade, O.T., Daniel, D.W., & Omoyiola, B.O. (2024). Classification and Augmentation of African Fabrics Using Convolutional Neural Network and Generative Adversarial Network Models. *2024 IEEE 5th International Conference on Electro-Computing Technologies for Humanity (NIGERCON)*, 1-5. https://doi.org/10.1109/NIGERCON62786.2024.10927147

Ahmad, S., Miskon, S., Alabdan, R., & Tlili, I. (2020). Towards Sustainable Textile and Apparel Industry: Exploring the Role of Business Intelligence Systems in the Era of Industry 4.0. *Sustainability*, 12(7), 2632. https://doi.org/10.3390/su12072632

Aldoseri, A., Al-Khalifa, K. N., & Hamouda, A. M. (2024). AI-Powered Innovation in Digital Transformation: Key Pillars and Industry Impact. *Sustainability*, 16(5), 1790. https://doi.org/10.3390/su16051790

Amankwah-Amoah, J. (2015). Explaining declining industries in developing countries: The case of textiles and apparel in Ghana. *Competition & Change*, *19*(1), 19-35.

Anuyah, O., Wan, R., Adejoro, C. O., Yeh, T., Metoyer, R. A., & Badillo-Urquiola, K. A. (2023). Cultural Considerations in AI Systems for the Global South: A Systematic Review. In *Proceedings of the 4th African Human Computer Interaction Conference* (pp. 125-134). https://doi.org/10.1145/3628096.3629046

Badaru, A. A. (2024). A Systematic Review of Knowledge Management in Nigeria: Introducing The "Prisma" Protocol. *Fuoye Journal of Management Science*, 1(1).

Boamah, F., Tawiah, B., & Howard, E. K. (2024). Biomimetic Design Concepts in African Textile Prints: Embracing Nature's Influence on Fashion and Textiles. *Fashion and Textiles Review*, 5, 22-39. https://doi.org/10.35738/ftr.v5.2024.08

Chakraborty, S., & Biswas, M. C. (2020). Impact of COVID-19 on the textile, apparel and fashion manufacturing industry supply chain: case study on a ready-made garment manufacturing industry. *Journal of Supply Chain Management, Logistics and Procurement*, 3(2).

Chaudhary, S., Kumar, P., & Johri, P. (2020). Maximizing performance of apparel manufacturing industry through CAD adoption. *International Journal of Engineering Business Management*, *12*, https://doi.org/10.1177/1847979020975528

Danso, W. B., & Hanson, E. (2023). Artificial Intelligence disruption and its impacts on future employment in Africa - A case of the banking and financial sector in Ghana. *I-manager's Journal on Software Engineering*, 18(1). https://doi.org/10.26634/jse.18.1.20082

Deng, M., Liu, Y., & Chen, L. (2023). AI-driven innovation in ethnic clothing design: an intersection of machine learning and cultural heritage. *Electronic Research Archive*, 31(9).

Eglash, R., Robert, L., Bennett, A., Robinson, K. P., Lachney, M., & Babbitt, W. (2020). Automation for the artisanal economy: enhancing the economic and environmental sustainability of crafting professions with human–machine collaboration. *AI & Society*. 35, 595–609. https://doi.org/10.1007/s00146-019-00915-w

Ijisakin, E. T. (2021). Printmaking and cultural imagination in contemporary Nigerian art. *Critical Arts*, 35(1), 1-16. https://doi.org/10.1080/02560046.2020.1856900

Kistamah, N. (2024). The applications of artificial intelligence in the textile industry. In *Artificial Intelligence, Engineering Systems and Sustainable Development: Driving the UN SDGs* (pp. 257-269). https://doi.org/10.1108/978-1-83753-540-820241020

Kumar, K. A., Lakshmi, K. V., Chandra, I., Kamalakannan, R., & Kumar, G. P. (2024). Unveiling Textile Defects a Novel Fabric Defect Identification Based on Integrated Image Processing with Logical Learning Scheme. In *2024 International Conference on Innovative Computing, Intelligent Communication and Smart Electrical Systems (ICSES)* Chennai, India, 2024, pp. 1-7, https://doi.org/10.1109/ICSES63760.2024.10910829

Lee, Y. K. K. (2022). Implementation of complex systems in fashion design creation using artificial intelligence. In *International Textile and Apparel Association Annual Conference Proceedings* (Vol. 78, No. 1). Iowa State University Digital Press. https://doi.org/10.31274/itaa.13320

Maia, D. (2023). Reclaiming tradition, fashioning citizenship: Ankara in contemporary Brazilian Afrocentric fashion. *International Journal of Fashion Studies*. https://doi.org/10.1386/infs_00094_1

Mohiuddin Babu, M., Akter, S., Rahman, M., Billah, M. M., & Hack-Polay, D. (2024). The role of artificial intelligence in shaping the future of Agile fashion industry. *Production Planning*. 35(15), 2084–2098. https://doi.org/10.1080/09537287.2022.2060858

Nayak, R., & Padhye, R. (2018). Artificial intelligence and its application in the apparel industry. In: Nayak R and Padhye R (eds) Automation in Garment Manufacturing. Woodhead Publishing, pp.109-138. https://doi.org/10.1016/B978-0-08-101211-6.00005-7

Omanga, D., & Mainye, P. C. (2019). More than just a homecoming: the reception of Black Panther in Kenya. *Safundi*, *20*(1), 18-21. https://doi.org/10.1080/17533171.2019.1551740

Osondu-Oti, A. (2021). China's Market Expansion and Impacts on Nigeria's Textile Industry. *Journal of Contemporary International Relations and Diplomacy*, *2*(1), 193-227. https://doi.org/10.53982/jcird.2021.0201.04-j

Pardie, S., Asinyo, B., Acquaye, R., & Howard, E. (2023). A Comparative Study of Printed Fabric Product Lines and Design Concepts of Texstyle Ghana Limited. *African Journal of Applied Research*, 9(2), 171-190. https://doi.org/10.26437/ajar.v9i2.581

Parschau, C., & Hauge, J. (2020). Is automation stealing manufacturing jobs? Evidence from South Africa's apparel industry. *Geoforum,* 115*,* 120-131. https://doi.org/10.1016/j.geoforum.2020.07.002

Rahman, M. M. (2021). Applications of the digital technologies in textile and fashion manufacturing industry. *Technium: Romanian Journal of Applied Sciences and Technology*, *3*(1), 114-127.

Rathore, B. (2019). From Trendy to Green: Exploring AI's Role in Sustainable Fashion Marketing. *International Journal of New Media Studies*, 6 (2).

Rathore, B. (2023). Future of textile: Sustainable manufacturing & prediction via chatgpt. *EDUZONE: International Peer Reviewed/Refereed Multidisciplinary Journal*, 12 (1). https://www.eduzonejournal.com/index.php/eiprmj/article/view/253

Rizzi, G., & Casciani, D. (2025). Scouting emerging AI applications in fashion heritage and archival practices. *European Journal of Cultural Management and Policy*, 15, 14963. https://doi.org/10.3389/ejcmp.2025.14963

Sawyerr, N. O., Acquaye, R., & Kusi, C. A. (2023). Semiotics of Factory Printed Wax Prints across West Africa. *International Journal of Culture and Art Studies*, 7(2), 64-76.

Seidu, R. K., Howard, E. K., Apau, E., & Eghan, B. (2022). Symbolism and Conservation of Indigenous African Textiles for Museums. In Handbook of Museum Textiles (eds S. Jose, S. Thomas, P. Pandit, R. Pandey and V. Gupta). https://doi.org/10.1002/9781119983903.ch13

Sikka, M., Sarkar, A., & Garg, S. (2024). Artificial intelligence (AI) in textile industry operational modernization. *Research Journal of Textile and Apparel*, 28 (1): 67–83. https://doi.org/10.1108/RJTA-04-2021-0046

Tseng, M., Bui, T., Lim, M., Fujii, M., & Mishra, U. (2022). Assessing data-driven sustainable supply chain management indicators for the textile industry under industrial disruption and ambidexterity. *International Journal of Production Economics*. Vol 245. https://doi.org/10.1016/j.ijpe.2021.108401

Youvan, D. C. (2024). Illuminating Intelligence: Bridging Humanity and Artificial Consciousness.

Yusuf, S. O., Durodola, R. L., Ocran, G., Abubakar, J. E., Echere, A. Z., & Paul-Adeleye, A. H. (2024). Challenges and opportunities in AI and digital transformation for SMEs: A cross-continental perspective. *World Journal of Advanced Research and Reviews*, 23(3), 668-678.

Zhong, H., Wang, L., & Zhang, H. (2021). The application of virtual reality technology in the digital preservation of cultural heritage. *Computer Science and Information Systems*, *18*(2), 535-551. https://doi.org/10.2298/CSIS200208009Z

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