

The Role of AI in Fashion: A Review of Design, Sustainability and Retail Applications

Nyasha Grace Gatawa and Charles Mbohwa

Sustainability Engineering and Future Technologies Centre

University of South Africa

Johannesburg, South Africa

gatawng@unisa.ac.za, mbohwc@unisa.ac.za

Abstract

Artificial intelligence is pioneering a new world order and applications. We are living in an age where technology is rapidly changing and where the advent of artificial intelligence has been disruptive to industries globally, ushering in a new era that continues to evolve rapidly. As AI technology advances, industries globally will need to adapt quickly to a rapidly changing environment. The global fashion industry is an important sector in the global economy estimated to be worth a significant 1.7 trillion dollars. The fashion industry shows the uniqueness of countries, regions and communities. Artificial intelligence can be a game changer driving a new and changing dispensation in technology. The impact of artificial intelligence on the fashion industry is quickly unfolding. In Africa the sector has emerged as a dynamic sector that has contributed to the economic, social and cultural landscape of a continent where fashion is rapidly gaining traction as a key sector in the creative economy. What role is AI playing in the fashion industry? Is the industry ready to tap into the opportunities presented by AI? This paper examines the emerging role of artificial intelligence in the fashion industry to address these and other questions

Keywords

Fashion industry, Artificial Intelligence, Artificial Intelligence Applications, Technology, Innovation.

1. Introduction

Artificial Intelligence (AI) can be defined as ‘the field of computer science that focuses on creating systems capable of performing tasks that typically require human intelligence’ and include tasks such as learning, reasoning, problem solving, perception and understanding language (Manchiraju, 2025). AI technology continues to evolve and especially since the early 2020s. AI has taken off, becoming a technology with widespread impact.

The beginnings of AI can be traced to a Dartmouth University conference in 1956 where the term artificial intelligence was proposed and since its early roots it has become increasingly significant in recent years (Zhang & Lu, 2021) The advent of artificial intelligence is one of the most significant technological developments in recent years (Babu et al. 2024). The ubiquity of AI usage makes it vital for the future and it is increasingly used everywhere and in the last two decades technological changes have advanced notably with AI being one of the most notable (Jiang et al. 2022). It is expected that AI will continue to grow rapidly charting new territory. AI has been a significant game changer across industries and AI continues to evolve with contributions from many disciplines (Golec et al. 2025). The significance of artificial intelligence continues to unfold. AI continues to redefine the trajectory of industries globally ushering in a fresh dimension across industries.

Digital technology has been revolutionary to the fashion industry (Lee & Suh, 2024). Technology is increasingly driving growth in the fashion industry in an industry that is a pivotal sector and where there is increased focus on the creative economy. The global fashion industry is one of the most dynamic and key sectors of the world economy.

Valued at over a trillion dollars the industry is a fast-paced behemoth industry with significance globally (McKinsey, 2023). Post the COVID-19 pandemic the industry has rebounded and remains a formidable sector.

The increasingly globalised nature of the fashion industry has been a central feature of the industry in recent years (Ciarniene & Vienazindiene, 2014, Muhwati & Salisbury, 2017). Fashion is increasingly operating through global networks including global supply chains and global retail and distribution. The advent of fast fashion has been one of the key developments in the fashion industry in recent years. Fast fashion is fashion that is cheap and widely available and is extremely trend-driven (Bick et al. 2018). Fast fashion has completely changed the dynamics of the fashion industry. As the industry becomes fast fashion focused the sustainability of the industry has come under scrutiny.

Technology is shaping the fashion industry. Digitisation and ecommerce are playing a key role in the industry. Online shopping has become a significant sector of the fashion industry and the COVID-19 pandemic accelerated this digital trend in the fashion industry, which continues to expand and develop. There is increasingly a focus on the customer and the customer experience and responsiveness to customers is key in a world where customer experience is an important factor of customer satisfaction.

Bringing a wave of innovation and technological enhancements, AI has revolutionised the fashion industry. Fashion brands are increasingly expanding their digital presence and AI has immense potential to drive change in the industry in an age characterised by rapid shifts in consumer behaviour and a focus on sustainability. AI provides the fashion industry with opportunities to provide enhanced customer experience and unique data insights. This paper examines recent trends in the adoption of artificial intelligence in the fashion industry, and the potential AI has to change the industry and influence its trajectory. An understanding of how AI is reshaping the fashion landscape can help stakeholders better anticipate the opportunities and disruptions in the fashion industry.

1.1 Objectives

Artificial Intelligence is shaping industries worldwide. The advent of AI has been transformative across a range of industries. As AI continues to evolve it is important to understand how it is shaping the fashion industry and to unpack the opportunities and challenges in the incorporation of AI in the industry. This review paper seeks to contribute to the growing body of research focused on AI in the fashion industry and to accomplish the following objectives:

1. To provide an exploratory and introductory outline of the role that AI is increasingly playing in the fashion industry.
2. To outline the challenges in the use of AI in the fashion industry
3. To provide tentative recommendations on how best AI can be harnessed for greater success in the fashion industry.

2. Methodology

The study adopts an exploratory qualitative scoping review methodology to explore, synthesise and map literature on the use of Artificial Intelligence within the fashion industry. A scoping review approach was considered appropriate as the emergence of artificial intelligence is recent and evolving rapidly and there is rapid growth in related research. The aim of the research was not to provide an exhaustive review or a systematic review but to provide a largely broad review of key themes, trends and examples of applications of AI in the fashion industry. The purpose of the exploratory review was to provide a concise and informative mapping of recent trends in the use of artificial intelligence in the fashion industry,

Leading academic databases including Google Scholar, Scopus and Science Direct were used to identify relevant literature. These databases were selected to provide a broad overview of peer reviewed research across relevant key disciplines. The search was conducted using combinations of specific keywords and these keywords were used to search for and identify articles to be included in the review.

Keywords used include

“Artificial Intelligence”

“Fashion”

“Technology in the fashion industry”

“Artificial Intelligence in the fashion industry”

Inclusion and Exclusion Criteria

The following inclusion criteria were applied to ensure relevance and consistency

- Recent peer reviewed journal articles and conference papers
- Publications written in English
- Largely focused on studies published within the last decade
- Articles focused on the application of AI in the fashion industry

The exclusion criteria included:

- Focused mainly on articles directly related to the fashion industry
- Articles not written in English
- Included limited non academic sources such as opinion pieces and blog posts

Screening and Selection Process

Following the initial database search article titles and abstracts were screened for relevance. Relevant recent articles focused directly on artificial intelligence in the fashion industry were selected. While this study does not comprise a comprehensive review it endeavours to provide an overview or snapshot of the emerging role of AI in the fashion industry. The intention in this review was to capture key themes and representative examples rather than provide an in-depth and exhaustive review. AI and fashion is an emerging interdisciplinary field with a literature base that is rapidly growing. There is a growing body of research on artificial intelligence as it increasingly plays a key role across industries but while research on AI is increasing there is still scope for systematic and comprehensive review of literature (Banerjee et al. 2021).

3. Overview of a Selection of Included Studies

Table 1 summarises key characteristics and contributions of a selection of recent studies reviewed in this paper providing an overview of how artificial intelligence has been applied within the industry.

Table 1. An overview of selected studies in this review

Author (s)	Year	AI Application Area	Methodology	Key Contribution
Shi et al.	2021	Trend Forecasting	AI based quantitative modelling	AI based models significantly improve trend forecasting accuracy and are more accurate than manual forecasting
Banerjee et al	2021	Design Process	Systematic Review of Literature and development of a conceptual framework	AI has the ability to aid the design process enabling greater creativity and trend forecasting.
Bienkowska	2025	Sustainability	Systematic Literature Review conducted according to PRISMA standards	AI can play a role in fashion sustainability and promotes the fashion industry’s sustainability
Goti et al	2023	Ecommerce		

Author (s)	Year	AI Application Area	Methodology	Key Contribution
			Narrative Literature Review	AI is playing a role in ecommerce operations
Zhang & Liu	2024	Fashion Design & Ecommerce Applications	Action Research Approach	AI can streamline the fashion design process and plays a role in ecommerce applications

4. Fashion and Artificial Intelligence

There is growing recognition that AI is the next frontier across all industries. From manufacturing to service-oriented industries and beyond AI is shaping a new dynamic that is increasingly transforming industries across the board. In the fashion industry AI is emerging in different ways and bringing a more customer centric approach. AI in the fashion industry is becoming more prevalent (Lee & Kim, 2024). Artificial Intelligence is reshaping every stage of the fashion value chain from design and production to retail, marketing and customer experience.

4.1 The Intersection of Fashion, Digital Transformation and AI

The 4th Industrial Revolution is fundamentally changing society in all aspects (Jin & Shin, 2021). Digital transformation globally has impacted a range of industries and AI has led the way in the way it has impacted industries. Digital technologies have had an impact on various aspects of the fashion industry including supply chains as well as fostering sustainability (Casciani et al, 2024). Technology and AI have had a significant impact on aspects of fashion. There is a growing fascination with the use of artificial intelligence in the fashion industry (Bienkowska, 2025). Babu et al. (2024) note the role that artificial intelligence can play in the fashion industry. The authors note the wide-ranging applications of AI in the textile and apparel (T&A) value chain from product discovery to robotic manufacturing (Babu et al. 2024).

The fast pace of the fashion industry and especially the advent of fast fashion has been in tandem with developments in technology such as AI (Csanak, 2020). Fast fashion refers to fashion that is cheap and widely available and this type of fashion has had a profound impact on the fashion industry (Bick et al. 2018; UNEP, 2025). The fast fashion model is very trend driven and is focused on the rapid replacement of clothes. Fast fashion has indelibly changed the landscape of the global fashion industry resulting in mass consumption and consumerism fueled by low prices and an enhanced and often obsessive trend focus (Ozdamar – Ertekin & Atik, 2020).

4.2 AI and the Fashion Design process

AI is transforming the design process. Design is a critical component of the fashion industry and is a crucial and foundational step in garment construction. It is a differentiator in a competitive market. AI has potential to aid designers in the design process enabling fashion designers to make timely, accurate product decisions, allowing them to focus on creativity (Banerjee et al. 2021). AI use in garment design using garment development technology has significant promise. Choi et al. (2023) created an AI- based garment development system and tested it on real fashion designers and it showed the practical significance of the system and its potential for practical applications.

AI complements human designers : it provides data insights and can forecast trends and can automate design elements. and the application of AI in fashion design has continued to evolve with many promising opportunities (Guo et al. 2023). AI also has significant cost cutting advantages (Guo et al. 2023).Kouslis et al (2025) identified several AI uses in the fashion industry noting that AI can transform the fashion industry. The use of AI in the design process is one of its key uses. AI can not only aid in garment design but can generate new designs. Personalised production in the fashion industry has also been aided by AI (Jin & Shin, 2021). The ability of AI to personalise experiences to the customer is one of its key advantages (Kouslis et al. 2025).

4.3 AI and Fashion Sustainability

Sustainability is a contested term but generally refers to three aspects of sustainability, environmental, economic and social sustainability. While it has three aspects, more focus has been placed on the environmental and social aspects of sustainability. Sustainability has become a key concern and business imperative in the fashion industry due to a growing awareness of the environmental and social impacts of the sector. Environmental issues have become a key global concern across all industries including the fashion industry (UNEP, 2025). The rise of fast fashion has worsened the sustainability challenges of the fashion industry. The fashion industry has a negative relationship with the environment as its production and distribution as well as waste management practices have significant negative impacts on environmental sustainability (Shen et al., 2014, Moorhouse, 2020).

AI can help address and contribute to managing fashion sustainability (Bienkowska, 2025). The fashion industry has been castigated for its negative impacts not only on the environment but also been flagged for its social sustainability shortcomings. The tragic Rana Plaza collapse in 2013 in Bangladesh killed over 1000 garment workers highlighting the social sustainable challenges of the industry and the precarious nature of the working conditions of garment workers (Ozdamar-Ertekin, 2017). One of the key environmental challenges that the fashion industry is facing is waste management. With the advent of fast fashion, the waste challenges of the fashion industry have multiplied (Ozdamar-Ertekin & Atik, 2020). The fast fashion industry generates large amounts of waste, presenting significant disposal challenges (Khandual & Pradhan, 2019). AI could help address the waste challenges of the industry by streamlining operations and innovative tools that result in greater precision in resource management. AI can reduce excess production, improve recycling and support sustainability initiatives.

The impact of AI in fashion sustainability is a key focus for research. Jaitly and Desai (2021) highlight the potential of AI in the fashion industry when leveraged properly and how it can help in efficient resource management and result in innovative materials and processes as well as personalized experience and lead to greater sustainability. AI can play a role in the fashion industry achieving its sustainability goals and technology has a range of tools to help the fashion industry achieve sustainability (Ramos et al. 2023). AI has helped promote sustainability by reducing environmental impacts (Singh, 2024).

4.4 AI and E-commerce

Ecommerce has transformed the world in a variety of ways particularly in the post COVID-19 pandemic era. As e-commerce continues to grow as a vital sector the opportunities for new technologies and methodologies connected to the ecommerce fashion business are extremely promising (Srivastava, 2021, Soni, 2020). AI is increasingly playing a role in ecommerce operations and ecommerce fashion businesses are thriving (Goti et al. 2023). AI greatly influences ecommerce by improving customer experience. For instance, AI chatbots are playing an increasing role in the fashion industry improving customer experience and customer satisfaction (Kang et al. 2024). The world has moved online so the growth of the ecommerce industry is set to continue and opportunities for AI to be incorporated will multiply.

4.5 AI and Content Generation

AI generated content in the fashion industry has led to captivating content generating interest among designers and businesses (Guo et al. 2023). AI has several benefits in content generation including its speed and efficiency as well as its creativity and idea generation. Image generation is one of the key tools of AI. The potential of AI image generation systems in the fashion industry is increasingly apparent.

AI image generation systems are emerging as key tools for fashion businesses and provide an innovative and efficient means of digitalising the design process and they also enhance communication with consumers. AI Image generation systems have a number of advantages including accelerating the design process, stimulating creativity, saving resources, saving costs and shortening the product development cycle (Zhang & Liu, 2024).

Zhang & Liu (2024) assessed the AI image generator system Midjourney. It was revealed that Midjourney has promise in its ability to enhance the fashion design process especially ideation. While Mid Journey has potential it was shown that its major weaknesses are its restriction to assisting in early design stages and that it requires designers to be quite involved in the process.

4.6 AI and Customer Experience

AI has transformed customer experience significantly, bringing smart tools that enable more attuned interaction between brands and consumers. Consumers are increasingly relying on AI recommendations for their shopping needs. In the online space AI has greatly enhanced the shopping experience. AI has enhanced customer experiences through virtual try ons, personalised recommendations and co-creative designs (Singh, 2024). AI has helped brands understand consumer preferences and market trends, allowing them to make informed decisions. In the future AI will continue to be significant with more customers relying on AI in their shopping experience.

4.7 AI and Trend Forecasting

Shi et al (2021) explored the application of artificial intelligence in fashion trend forecasting highlighting the critical importance of trend forecasting in the fashion industry. Their research revealed that AI can significantly enhance fashion trend analysis and forecasting. The authors also noted that AI models can more efficiently predict fashion trends compared to traditional methods. Furthermore, AI can also help fashion professionals save time and reduce costs. A new era in trend forecasting has arrived with the advent of AI and is set to become even more entrenched as AI evolved and new and novel opportunities for trend forecasting emerge.

5. A comparison of traditional vs AI driven fashion approaches

AI has transformed the fashion industry, ushering in fresh approaches to every facet of the industry, bringing notable improvements to the processes and systems of the industry as shown in Table 2.

Table 2. Traditional vs AI driven fashion approaches

Process Area	Traditional Approach	AI Driven Approach	Key Improvement
Trend Analysis	Manual Analysis	Automated Approach using AI	More accurate trend analysis which is more efficient and faster
Customer Experience	Generic segmentation	Personalised recommendations often tailored to individual customers	Greater customer satisfaction
Demand Forecasting	Manual demand forecasting	Accurate and timely demand forecasting	Improved operational processes and efficient systems

6. Case Study: H&M

Hennes & Mauritz (H&M), a leading Swedish fashion retailer has recognised the potential of AI (H&M Group, 2025). Technology can be transformative to the fashion industry and H&M is increasingly looking to technology to build a more competitive brand globally, Fashion companies are increasingly incorporating artificial intelligence into their operations. In novel and breakthrough approaches fashion companies are looking to AI to transform their approach in every area of their business. They are exploring the use of generative AI to find new ways to showcase their creativity and to find new ways to connect with customers (H&M Group, 2025). H&M has a multifaceted AI approach that touches different aspects of their business including operations and supply chain, customer experience, marketing and creative content and trend insight and design (Forbes, 2018).

Using AI algorithms to analyse large quantities of data, H&M obtains key insights that drive demand forecasting. Online and instore systems driven by AI provide product recommendations AI use in trend analysis and trend forecasting is also one of the ways that H&M has incorporated AI into their operations. One of the other ways that H&M is planning to incorporate AI is to use digital twins of models instead of real models (BBC, 2025). These digital models will be used in social media and marketing although they emphasised that these models would not replace their human-centric focus. H& M has also developed a responsible AI framework which has key principles that aim to foster the ethical use of AI.

7. Challenges

AI in the fashion industry is an emerging trend that has transformed industries worldwide but it has some challenges. Some of the challenges include the following.

7.1 Issues in design creativity

Design creativity is a bedrock of the fashion industry. In many ways the success of the fashion industry is influenced by creativity and showcasing it in novel designs. AI usage in fashion design is emerging but has also been criticised. While AI has been increasingly hailed in the fashion industry it has also been questioned regarding the quality of the design and its cultural aspects. The human aspect is fashion design and AI could compromise the innate creativity of humans (Csanak, 2020).

7.2 Ethical Issues in AI usage in the Fashion Industry

A key issue that has also arisen in response to AI is the ethics of AI. According to Manchiraju (2025) AI raises several ethical issues in the use of AI including privacy concerns and the need for accountability and greater transparency. . Additionally, other concerns relate to the risks of bias and discrimination in AI algorithms

The ethical challenges posed by AI have been widely cited and there is need to develop responsible and ethical frameworks for AI practices (Babu & Vasumathi, 2023). UNESCO (2025) identifies some of the challenges associated with AI as the potential of AI to embed biases, impact the climate adversely and also threaten human rights.

8. Results and Discussion

This exploratory review has highlighted the potential of AI in the fashion industry. The significance of AI in the fashion industry is in the multifaceted ways it can be used in the industry. At every stage of the fashion value chain AI is bringing a new approach and is increasingly integrated. The unfolding nature of the impact of AI on the fashion industry is clear. For instance, in the design process AI has become a key creative tool complementing the work of human designers

AI has become a crucial element of ecommerce, driving evident change in a world where ecommerce has become a fast-growing sector in the global economy. Trend forecasting in the fashion industry using AI tools has allowed retailers to operate more efficiently. AI is not only bringing a new dynamic to the fashion industry but it is transforming the fashion industry.

As an evolving application AI still has areas where it has shortcomings. The ethics surrounding AI remain a key concern and it is necessary to find ways to counteract these challenges. The future of AI in fashion is very promising and new applications of AI in the industry will continue to emerge.

9. Concluding Remarks

AI is unlocking new opportunities for the fashion industry and these opportunities will continue to increase and multiply as AI continues to evolve. McKinsey (2023) provide a comprehensive list of the use of generative AI in the fashion industry highlighting the multifaceted nature of AI. Generative AI can be used in several ways in the fashion industry including in merchandising and product, supply chain and logistics, marketing, digital commerce and consumer experience as well as store operations and in the organisation and support function. Notably the opportunities to enhance customer experience and the design process are clear. Consumers are increasingly open to the use of AI. Greater engagement by consumers in AI is a significant opportunity. A study carried out by Liang et al. (2020) revealed that important and significant factors influencing consumer attitude to AI include perceived usefulness, perceived ease of use and performance risk. AI can transform the fashion industry but the challenges associated with AI need to be addressed. It is important to manage the ethical concerns around the usage of AI in the fashion industry.

Engaging customers on their AI experiences will help create more positive AI experiences. Opportunities abound for the use of AI in the fashion industry. As AI technology continues to evolve it can take on a more significant role in the fashion industry. From trend forecasting to personalised shopping experiences and garment design AI has impacted the fashion industry indelibly. AI has enabled brands to be more sustainable, helping to reduce waste and

environmental impact. AI is becoming increasingly essential for fashion companies to maintain their competitive advantage.

This review of the ways that the fashion industry is adopting AI reveals how AI technology has immense potential to transform the fashion industry and is already transforming the industry. Despite the industry's substantial contribution scholarly work on AI adoption in fashion remains fragmented and focused on developed markets. There is need for more comprehensive research on AI in the fashion industry as the industry is a significant industry in the global economy. Opportunities for AI use in fashion sustainability present a key area that could be a focus for further research as the importance of sustainability and sustainable development increases. Assessing opportunities for AI in fashion sustainability is a critical research gap particularly as sustainability has become more than a buzzword and has become a key business imperative. While this review paper provides insight into the use of AI in the fashion industry it has some limitations. The limitations of this review include the narrowly focused nature of the review and its reliance on existing literature. Future comprehensive studies, especially in Africa and the developing world, can bring new insights in the use of AI in regions outside the developed world. Research that goes beyond existing literature should be prioritised.

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Biographies

Professor Charles Mbohwa is a Distinguished Professor of sustainability engineering and future technologies at the College of Science, Engineering and Technology, at the University of South Africa, Florida Campus. He was, previously the University of Zimbabwe Pro-Vice Chancellor responsible for Strategic Partnerships and Industrialisation. Before that he was a professor and a visiting professor of sustainability engineering in the Faculty of Engineering and the Built Environment at the University of Johannesburg and a Professor Extraordinaire at the Tshwane University of Technology in South Africa. He was a mechanical engineer in the National Railways of Zimbabwe from 1986 to 1991, and lecturer and senior lecturer at the University of Zimbabwe from 1991 to 2007. He was Senior Lecturer, Associate Professor and Full Professor at the University of Johannesburg from 2007 to 2019. He was Chairman and Head of Department of Mechanical Engineering at the University of Zimbabwe from 1994 to 1997. He was Vice-Dean of Postgraduate Studies Research and Innovation in the Faculty of Engineering and the Built Environment at the University of Johannesburg from July 2014 to June 2017 and Acting Executive Dean in the Faculty of Engineering and the Built Environment from November 2017 to July 2018. He was a Special Advisor to the Dean after that until the end of 2018. He has published very widely and holds a BSc Honours in Mechanical Engineering from the University of Zimbabwe in 1986; Master of Science in Operations Management and Manufacturing Systems from University of Nottingham 1992; and a Doctor of Engineering from the Tokyo Metropolitan Institute of Technology 2004.

Nyasha Grace Gatawa is a postdoctoral fellow at the College of Science, Engineering and Technology at the University of South Africa, Florida Campus. She was previously a research fellow at UN-Aligned. She has a PhD in Geography from the University of the Witwatersrand, Johannesburg, a Masters degree in Tourism Studies from the University of the Witwatersrand, a Postgraduate Diploma from the University of Cape Town and a Bachelor of Science Degree from the University of Zimbabwe. She has worked in a range of different roles focusing on research and strategy.