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Digital Transformation 4.0: Integration of Artificial Intelligence & Metaverse in Marketing

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ABSTRACT

The main objective of digitalizing the fashion industry was to attain sustainability through the use of numerous digital tools while streamlining operations, production, and business of tangible products for the real world. But the recent creation of the metaverse, a parallel virtual reality universe, has given rise to new possibilities for digital clothing. The integration of artificial intelligence and the metaverse, as well as the analysis of vast volumes of data to uncover important information, are all included in the notion of digitalization. In the fashion industry, artificial intelligence is increasingly being used to forecast trends by analysing consumer behaviour, preferences, and emotions. Over the years, the concept of the metaverse and artificial intelligence has been the subject of academic studies in a variety of fields ranging from literature to art, music to education. AI and the metaverse are two of the most prominent technologies of the twenty-first century. Each can improve people's lives in a variety of ways, as well as many industries and working processes. AI and the metaverse can be used in a variety of industries, including operations, fashion, management, marketing, and education. The purpose of this paper is to investigate the impact of integrating artificial intelligence and the metaverse in the fashion industry, specifically in the marketing sector. The method used in this paper is a descriptive literature review delivered by reviewing as many journals as possible from 2014 to 2023. The results of this research provide both researchers and technology developers with brief information about the research area. Furthermore, recommendations for future research on technology integration have been made.

Keywords: **Artificial Intelligence, Metaverse, Fashion Industry, Digitalization, Marketing**

INTRODUCTION

The fashion business has gradually changed to a more social media and mobile-friendly environment, which has created opportunities for AI to shape this market's future. Designer brands are attempting to enhance the client experience with the aid of artificial intelligence technology [1].

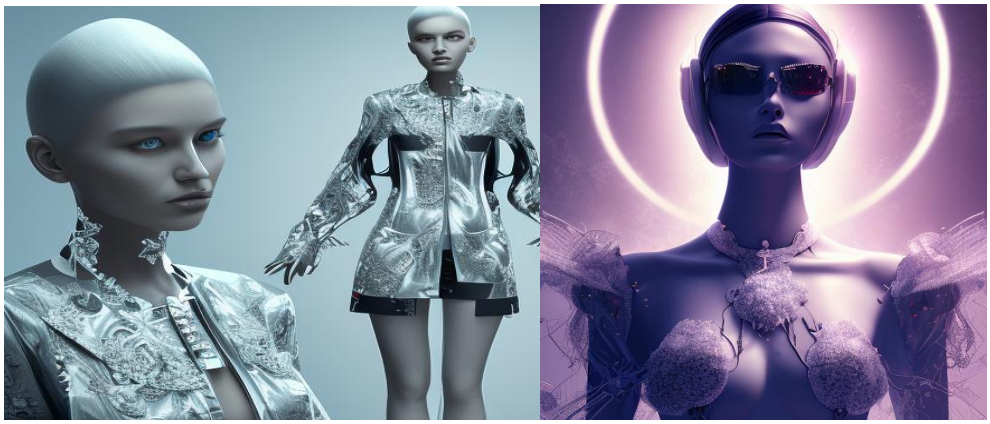
They frequently employ AI technologies to enhance customer service or develop cutting-edge products. For instance, AI may be used to automate repetitive processes, find patterns and trends in massive volumes of data, and make better product suggestions [2]. AI can also be utilised to develop automated customer service representatives who offer personalised responses and enhance the overall client experience [3].

The phrase was originally mentioned in 1992 when science fiction author Neal Stephenson combined the terms "meta" and "universe" in his book Snowcrash. The metaverse was depicted in the book as a virtual environment where people might interact with one another after donning a set of goggles.

The metaverse could have numerous implications in terms of social, economics and politics – and practical and technical applications [4]. For instance, the metaverse could enable more efficient globalised collaboration between users through virtual meetings, virtual conferences, and virtual education, cutting operational and infrastructure costs. Moreover, an interconnected metaverse could enable businesses to expand their scope and reach, as well as provide access to new markets and new sources of revenue [5]. Furthermore, it could provide a whole new level of electronic safety and security for online communications, data, and transactions [6]. Additionally, it could provide a strategic platform for governments to create policy for digital assets, establish cybersecurity standards, and manage the larger impacts of rapid digital transformation [7]. Finally, the metaverse could use technological breakthroughs such as blockchain and machine learning for intelligent automation and to facilitate trust and security.

In terms of technical applications and practical applications, the metaverse could have numerous implications. For example, it could enable a multi-user shared environment with avatar-driven interaction [8]. Web-based digital assets could be seamlessly accessed and distributed in this virtual environment, creating a truly immersive virtual experience. Additionally, it could use blockchain and other distributed ledger technologies to ensure transparency, trust and privacy. AI-powered bots and assistants could also be employed to further enhance the user experience [9]. Overall, the potential for the metaverse is incredibly exciting and could revolutionise the way people communicate and collaborate on a global level.

The metaverse could also enable enhanced entertainment experiences such as virtual reality games, wherein players could fully immerse themselves in a virtual world [10]. Additionally, augmented reality applications could be used to bridge the gap between the physical and virtual worlds, which could lead to a more interactive user experience. Furthermore, the metaverse could create new markets for the sale of digital goods, services, and even ownership of digital assets such as real-estate, shares, and intellectual property. Finally, the metaverse could facilitate a partnership between the physical and virtual worlds for the development of new technology such as robots and connected devices, allowing for intelligent automation and real-time analytics [11].



It is believed that the metaverse will enable more efficient globalised collaboration between users through virtual meetings, conferences, and educational opportunities, virtual shopping experiences, crowd sourced labor, and access to new markets and sources of revenue [12]. The metaverse could also provide a new level of security for online communications, data, and transactions, as well as enable a platform for governments to create policy for digital assets and cyber security standards [13]. Technologies such as blockchain and machine learning to facilitate security and trust could be used in the metaverse [14]. Additionally, the metaverse could enable enhanced entertainment experiences through virtual reality, augmented reality, and the sale of digital goods and services [15]. AI & Metaverse have a wide range of offerings that can help the fashion industry capitalize on the opportunities created by the rise of social media and mobile-friendly environments [16]. From automated product tagging and categorization to personalized customer experience and real-time analytics, there are many solutions that fashion brands can use to improve their overall business [17]. AI & Metaverse propose fashion brands to automate product recommendation, customer segmentation, and inventory management. AI & Metaverse also facilitate better customer engagement strategies and targeted advertising campaigns [18]. Additionally, we can help fashion companies optimize their website and mobile applications by using natural language processing, facial recognition, and computer vision [19]. All of these AI-driven solutions help fashion companies build stronger customer relationships and increase their competitive advantage.

AI & Metaverse can help businesses more effectively implement their digital marketing strategies by providing data-driven insights and analysis that can help businesses better understand customer needs and preferences [20]. AI & Metaverse predictive marketing analytics can help companies design and optimize their marketing campaigns and identify the most profitable customer segments [21]. Additionally, AI-powered customer segmentation and targeting algorithms can help companies allocate budget and resources more efficiently. Finally, AI & Metaverse automation capabilities let businesses automate marketing activities like personalization, customer segmentation, rewards, and promotions for improved customer experience [22].

AI & Metaverse can provide comprehensive insights into how digital markets work by leveraging its comprehensive artificial intelligence platform. AI-driven market research and analysis can help businesses better understand consumer preferences, market trends, and competition in the digital space [23]. AI & Metaverse predictive analytics can help businesses gain a deeper understanding of consumer behaviors and build accurate consumer profiles. Finally, AI & Metaverse can help businesses use natural language processing and machine learning to identify consumer sentiment and improve customer engagement [24].

Studies in the literature on digital marketing that incorporated metaverse & artificial intelligence were looked into [25]. Authentic reports sought to illustrate numerous behavioural shifts in marketing-related subjects using robotics and artificial intelligence. A conceptual and theoretical study on the application and effects of AI and robotics in marketing science was intended to be conducted in light of industry breakthroughs and the need for academic research on the future of marketing science and customer relations [26]. The potential of artificial intelligence in marketing and suggested creative uses for this sector. We have examined national and international research on marketing management decision assistance [27].

Our investigation illustrates how artificial intelligence can be leveraged to extract the most from data to improve customer service and lower operational costs and work load for marketing executives[28]. Moreover, this research focuses on analysing how AI can be harnessed to construct and execute creative tactics in marketing research and customer relations management (CRM) [29].

We also reviewed current technological progress and advancement in AI and metaverse, and proposed a practical approach for marketing strategy to make use of the advanced advances in technology and the potential of artificial intelligence to more effectively engage with customers, enhance decision making, and raise effectiveness within the marketing operation [30].

The research method employed in this study centers around a systematic literature review. In order to generate a comprehensive list of studies, the keywords “digital marketing”, “metaverse”, “artificial intelligence”, “decision support system”, “customer relationships” and “insights” were used in a comprehensive search of relevant titles, abstracts and keywords from various databases and journals [31].

In terms of the time period of the studies examined, the results revealed that the majority of articles were published within the last 8-10 years; the earliest study being published in 2014 and the most recent in 2023 [32]. The research areas covered in these studies included marketing, customer relationships, robotics, AI, data mining and decision support systems, among others. The majority of the studies were published in various national & international reputed journals [33].

RESEARCH CONTEXTUALISATION

There are few questions, which we tried to resolve through this research:

Q1. Howartificial intelligence (AI) techniquescan resolve operational issues in organisations at different level in fashion industry?

Q2. How artificial intelligence (AI) techniques are useful in data-driven decision making in fashion industry?

Q3. How artificial intelligence (AI) is useful to fashion ecommerce retailers in providing varied experience to the consumer?

AI can be used for improving inventory-management decisions by predicting demand, forecasting trends in rates of customer purchases, and optimizing the selection of goods that are available in the store. AI can also be used to reduce lead time by automating order fulfillment and tracking orders in parts [34]. Finally, AI can improve logistics optimization by providing personalized customer service, providing real-time tracking and discounts, automating payment methods, and improving customer loyalty programs. ? AI can also be used in the fashion industry to create personalized collections based on customer behaviors and preferences. AI can also be used to automate sample making, enabling businesses to reduce labor costs and improve production speed. Additionally, AI-powered virtual fitting rooms can give customers the ability to view and try on items online in a 3D space [35] .

The study also discusses the implications for the future of the apparel industry if organizations fail to embrace AI and automation [36]. Adopting AI technology can help apparel businesses stay competitive in the increasingly digitized world. However, businesses need to be prepared for the changes that will accompany the increased use of AI. This means adopting comprehensive reforms in terms of industry structure and labor organization[37]. Companies must also plan for the development of new skills to make the most out of AI technology and collaborate to create new value from AI. By doing so, the fashion industry will be able to continue to deliver excellent customer experience while improving efficiency and cost-effectiveness. Some specific AI techniques used to accomplish these goals include predictive analytics, machine learning, natural language processing, anomaly detection, computer vision, and chat bots [38]. All of these techniques can help businesses to make better decisions, optimize logistics and production, and provide better customer service [39].

It can be used to analyze historical customer data, create rules, and leverage machine learning to make accurate recommendations. Other data like customer feedback or purchase history can also be used to further customize the recommendation to each customer's preferences. By doing this, businesses can provide customers with a more personalized shopping experience and increase customer satisfaction [40].

Data-driven analytical solutions can be used to sustain competitive advantages within the apparel supply chain by using data and knowledge available to create strategies for improving processes [41]. Data-driven insights can be used to understand customer needs, identify potential opportunities, and optimize inventory management [42]. AI analytics can also be used to identify potential issues with the supply chain, help manage changes in customer demand, and provide a better understanding of customer preferences, so that businesses can create tailored solutions that can increase customer satisfaction, profits, and efficiency [43]. Additionally, advances in technologies like computer vision and natural language processing can help businesses gain insight into product trends, visual data, customer conversations, and competitor activity to further improve decision making and operations [44].

AI solutions can provide a wealth of opportunities for businesses in terms of data management. AI-driven data management solutions can be used to track inventory, analyze customer behavior, and predict future customer demand. By leveraging AI for data management, businesses can reduce costs, increase efficiency, and identify potential problem areas before they become an issue [45]. Additionally, AI can be used to automate tasks, reduce manual errors, and free up resources for more complex tasks. AI can also be used to develop predictive models, identify patterns, and derive insights from large datasets to enable businesses to make more informed decisions. All of these opportunities can be used as starting points for businesses looking to leverage AI for data management [46].

AI and machine learning can enable brands and retailers to generate more robust customer data and insights. Furthermore, it can enable better customer segmentation and personalized pricing. AI-driven recommender systems can provide more accurate and tailored product recommendations, driving conversion rates and customer loyalty [47]. AI can also be used to improve product design and development, shortening the time to market and decreasing the risk of assortments. AI can also be used to improve logistics by providing real-time tracking and timely customer service, as well as to recommend and validate inventory allocations. Finally, businesses can use AI to

detect and analyze customer sentiment through social media and reviews, adapting to the customer perspective and reducing dissatisfaction [48].

In particular, there is an increase in the demand for sustainable apparel products as consumers become more aware of their environmental impact when purchasing products. AI can help brands and retailers to fulfil this demand by creating more accurate and efficient optimization models for inventory management and production that minimize the cost and environmental impact associated with production and distribution [49]. This would enable brands to respond quickly to seasonal trends and changes in customer behaviour, minimizing their environmental impact and creating a competitive advantage. Additionally, AI can be used to analyze customer sentiment data gathered from online reviews and social media, helping brands to understand and react to shifting customer expectations and demand, as well as to improve customer satisfaction. Finally, AI can be also be used to detect counterfeiting or to set up effective authentication systems to combat counterfeits, thereby preserving brand identity and protecting customer loyalty [50]. The Statista estimates that across the globe households spent €18910 on textiles and clothing in 2019. As the demand for apparel grows, there is a growing need for businesses in the industry to develop more efficient and cost-effective operations in order to compete [51]. Predictive analytics, machine learning, and computer vision are examples of AI solutions that can assist businesses in the apparel industry in identifying trends and making decisions that can lead to cost savings, increased efficiency, and better customer experiences [52].

CONCLUSION

The study then goes over the strengths of AI technology in improving business operations within the apparel industry. Specifically, the researcher looks at ways AI can help in optimizing inventory-management decisions, forecasting demand, reducing lead-time, and improving logistics optimization. The study then goes over the various uses of AI in the fashion industry such as personalization of products, application of robotics in sample making, and virtual fitting room.

Finally, the industry's implications for the AI-powered apparel industry are discussed. The study highlights the need for comprehensive reforms in terms of industry structure and labour organization to enable organizations to reap greater advantages from AI. By drawing upon existing evidence and trends, this study emphasizes the steps businesses in the apparel industry should consider in order to optimize their operations and keep costs under control.

The study identified the following three AI-enabled applications as practical and scalable for use at different level:

1) AI-enabled product design: Applying AI to pattern making and material selection in product design can enable businesses to understand customer preferences quickly, create more fashionable items, and reduce lead time.

2) AI-enabled customer segmentation: Applying AI to customer segmentation can help businesses better understand customer needs and tailor marketing and product connections to the various customer segments.

3) AI-enabled real-time pricing optimization: Applying AI to real-time pricing optimization can help businesses respond to market trends more quickly and react to customer behaviour rapidly.

The results of this study suggest that the use of AI, when properly applied, can yield substantial benefits to garment manufacturers, especially in terms of boosting customer satisfaction and product innovation. By leveraging AI-enabled product design, customer segmentation, and pricing optimization, garment manufacturers can overcome the current challenges they face in the market. Future studies should focus on assessing the financial performance gains associated with AI adoption.

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