

Research Article

Fashion Sector and Artificial Intelligence Applications

Özlem KAYA

Responsible Author, Uşak University
dr.ozlemky@gmail.com, ORCID: 0000-0002-8572-6577

Serpil AYTAC

Fenerbahçe University
serpil.aytac@fbu.edu.tr, ORCID: 0000-0001-6659-4639

Abstract

Artificial intelligence is one of the technologies that has been used in different stages of the fashion sector for a long time. Recently, with the emergence of new artificial intelligence tools such as ChatGPT and Midjourney, the fashion sector has begun to become one of the centers of these applications. The industry's picture of using artificial intelligence applications has strengthened the idea that artificial intelligence, which is on the agenda of fashion, may be the technology that will shape the future of fashion.

Artificial intelligence technologies can be used in different areas in the fashion sector. Artificial intelligence technologies, which provide benefits in the processes and methods of fashion design, are used more intensively in areas such as the design process, demand forecasting, selection and communication. Artificial intelligence applications, which have been one of the most frequently discussed topics of recent times with the advantages they offer to the sector, have managed to become one of the most important topics of today. In this context, in this article, artificial intelligence applications used in the sector are included, and sample model analyzes are made with ChatGPT. In this context, the study aimed to reveal the situation of artificial intelligence applications in the fashion sector and emphasized its advantages by presenting some examples.

Keywords: Fashion design, technology, artificial intelligence, ChatGPT

JEL Classification Codes: L67, O14, L22

Moda Sektörü ve Yapay Zekâ Uygulamaları

Öz

Yapay zekâ, uzun süredir moda sektörünün farklı aşamalarında kullanılan teknolojilerden biridir. Son dönemlerde özellikle ChatGPT ve Midjourney gibi yeni yapay zekâ araçlarının ortaya çıkmasıyla moda sektörü, bu uygulamaların merkezlerinden biri haline gelmeye başlamıştır. Sektörün yapay zekâ uygulamalarını kullanma noktasındaki tablosu modanın gündeminde olan yapay zekanın belki de modanın bile geleceğini çizecek teknoloji olabileceği konusundaki fikirleri güçlendirmiştir.

Yapay zekâ teknolojileri moda sektöründe farklı alanlarda kullanılabilir. Moda tasarımında süreç ve yöntemlerinde fayda sağlayan yapay zekâ teknolojileri, tasarım süreci, talep tahmini, seçim ve iletişim gibi alanlarda daha yoğun olarak kullanılmaktadır. Sektöre sunduğu avantajlar ile son dönemlerin en sık tartışılan konularından biri olan yapay zekâ uygulamaları günümüzün en önemli konularından biri olmayı başarmıştır. Bu bağlamda bu makalede özellikle sektörde kullanılan yapay zekâ uygulamalarına yer verilmiş ve ChatGPT ile örnek model analizleri yapılmıştır. Bu kapsamda çalışma ile yapay zekâ uygulamalarının moda sektöründeki durumunun ortaya konması amaçlanmış ve bazı örnekler sunularak sektöre sunduğu avantajlar üzerinde durulmuştur.

Anahtar kelimeler: Moda tasarım, teknoloji, yapay zeka, ChatGPT

JEL Sınıflandırma Kodları: L67, O14, L22

Geliş Tarihi (Received): 24.07.2024 – Kabul Edilme Tarihi (Accepted): 03.12.2024

Atıfta bulunmak için / Cite this paper:

Kaya, Ö. ve Aytaç, S. (2024). Fashion sector and artificial intelligence applications. *Çankırı Karatekin Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 14(4), 1100-1122. doi: 10.18074/ckuiibfd.1520744

1. Introduction

The changing world and advancing technology in the 20th century naturally affected the tools and equipment of the age and what it brought with it, in terms of having tools and equipment in their sectors. One of these sectors is the fashion sector. The fashion sector, with its strong structure, both artistically and sectorally, and open to change at any time, has developed and transformed from past to present and has become one of the topics that people talk about and focus on the most.

In order to understand the future and find more space in the future, it is important to see that technology is a constant in the fashion industry. In this context, studies and jobs created with the help of technological equipment and applications are extremely noteworthy for the sector. In addition, new approaches that emerge from the combination of traditionally done work with computers, technology, and artificial intelligence applications will lead to radical changes in both technical, aesthetic, and business ways.

Technology and artificial intelligence have a significant impact on every aspect of fashion, from design to production and consumption. Artificial intelligence has been used to analyze fashion trends and consumer needs for over a decade (Csanák, 2020: 117). In this context, as stated by Giri et al. (2019), the tremendous impact of artificial intelligence, in particular, on the transformation of the fashion and apparel industry in the past decades has been noticed.

According to the European Commission High Level Group on Artificial Intelligence (2019): “Artificial intelligence (AI) refers to systems that exhibit intelligent behavior by analyzing their environment and taking action with a certain degree of autonomy to achieve specific goals.

AI-based systems can be entirely software-based and operate in the virtual world (e.g., voice assistants, image analysis software, search engines, speech and facial recognition systems), or AI hardware devices (e.g., advanced robots, autonomous cars, drones, or the internet of things) can be used.

AI can be defined as systems that imitate human intelligence in its most basic sense, make inferences, and learn from the information they collect, and in this way constantly improve themselves. Different applications working on the principle of these systems have created a huge market today. AI-based algorithms, which can produce images, prepare presentations, design, shoot videos, write code, translate, and present news programs just by giving words have increased the value of the AI market to 136.55 billion dollars in 2022. This market is estimated to grow by approximately 40 percent between 2023 and 2030. This rate is actually not surprising. Because AI ChatGPT reached 100 million users in just two months after its launch, making it the fastest-growing application in such a

short time in the history of the internet. 13 million people visit chat.openai.com every day to ask questions of ChatGPT, an AI -based chat robot developed by OpenAI. When we evaluate the issue from the perspective of the fashion sector.

It is possible to see that AI is used in almost every link of the sector's value chain, from production to the end consumer. Particularly, the application of AI has been adopted in the fashion sector at various stages, such as garment design, pattern making, sales production forecasting, supply chain management, etc. (Gou et al., 2011; Nayak and Padhye, 2018; Laszkiewicz and Kalinska-Kula, 2023).

In this context, the aim of the study is to consider the association of AI applications and the fashion industry within the framework of today's conditions. It will be discussed how AI can be applied and which technological programs can be integrated into the system to enrich the way of doing business in the fashion sector.

Additionally, the use of ChatGPT as an AI tool in fashion design processes was also discussed in the study. At the same time, in this article, the subjects or areas in which AI applications are used in the sector are discussed, and sample model analyzes are made with ChatGPT. In this context, the study also aimed to reveal the application areas of AI in the fashion sector and emphasized the advantages it offers to the sector by presenting some examples.

2. Artificial Intelligence

In addition to the great inventions and discoveries with the impact of the industrial breakthrough, developments in protecting the comfort and health of humanity cannot be ignored. Researchers have tried to design a constantly automated human model that works with minimal error in order to achieve maximum efficiency at every stage of production. Within the digital technology system, this process has accelerated with applications such as blockchain, the internet of Things, big data, and AI.

As a result of the studies carried out using AI since 1950, visible steps have now begun to be taken. AI has sub-branches such as problem solving, natural languages, robotics, fuzzy logic, expert systems, and artificial neural networks, and each sub-branch

Recently, as developments such as AI and machine learning have become widespread in many sectors and fields, changes and transformations have been experienced in areas such as communication, production, design, marketing, and advertising. As a result of these developments, different applications attract attention in many sectors (Laszkiewicz and Kalinska-Kula, 2023).

AI techniques were formed as a result of concepts and algorithms that emerged in

the 1950s with the development of computers and have become widely used today. AI, which has become a part of our daily life after being used in industrial areas, is used in many subfields such as classification, regression, image processing, audio processing, autonomous driving, and text mining (Güven, 2020: 26). Productive AI technologies such as Hotpot and DALL-E are also widely used in many areas and can create text, visuals, and other content (OpenAI, 2021).

At the same time, it is seen that AI tools are widely used in many fields, especially today. Figure 1 shows the usage areas of AI. The most notable of these tools is ChatGPT, which has had a very high usage area since the first time it was used.

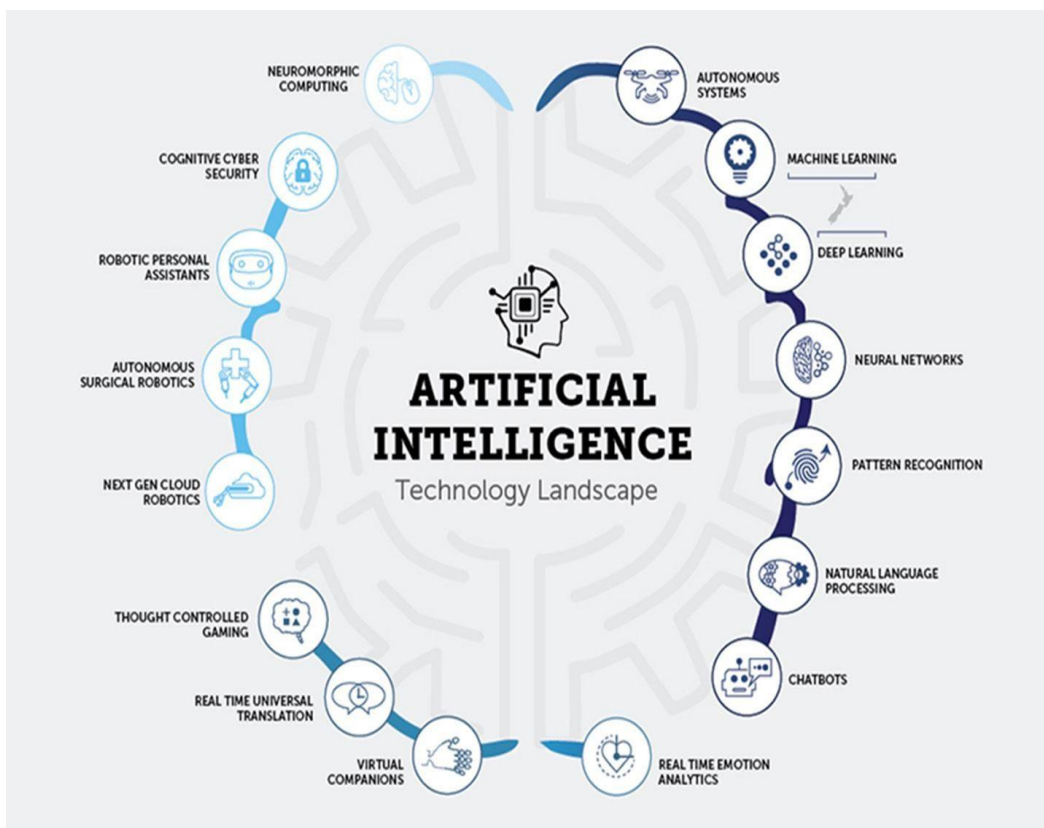


Figure 1. Artificial Intelligence (Ahmed, 2023)

3. Artificial Intelligence Applications in the Fashion Sector

With the increase in studies on AI technologies, there are concerns and thoughts that computers or robots may replace humans in the field of fashion design, as in many business branches. Is it possible for machines to replace designers in the future? To reach the answer to this question, technology companies benefit from cognitive information technologies and carry out studies on machines that design clothes according to the expectations of consumers.

In order to explore how effectively AI technologies, designed to mimic human intelligence, can perform in design, where originality holds significant importance, Google, a global technology leader, and Zalando, a prominent name in the industry, collaborated to develop Project Muze. In the study, which started with the claim of "developing design in line with the tastes and preferences of the user," the tastes and styles of six hundred trendsetters were defined in the data pool to be analyzed by cognitive information systems. In addition, different moods and different style features have been processed into the data pool, and a comprehensive infrastructure has been created.

The intense use of data, increasing computing power, and the availability of advanced algorithms and fundamental analysis have led to a tremendous increase in the use of AI. The fashion sector has also followed this trend and has included AI applications in every field of the sector. According to McKinsey (2018: 58), 75% of retailers invested in AI in 2018 and 2019, and AI in the fashion sector began to be used "to reinvent design, sales, and marketing, as well as provide significant speed."

Fashion is one of the most valuable sector in the world. The estimated value is approximately over \$3 trillion (Sennaar, 2019). But this sector has remained fairly traditional for decades. Despite this, as digital transformation progresses, it has also imposed profound transformations on the fashion sector. The abundance of data, especially obtained through the use of digital technologies, has allowed many AI applications to become widespread in this sector.

The most common applications are in the field of customer service, bringing the ability to capture the trend of customer personalization by improving the customer experience online and in stores.

The increasing scale and granularity of personalization in online fashion with chatbots or AI smart assistants would be impossible to manage without AI applications.

ASOS, an online fashion company, increased purchases by 300% using a chatbot, while Levi's also uses them to help customers find the best jeans (Catchoom, 2018; OECD, 2019: 2; Misischia, Poetze, Strauss, 2022).

Dior also uses a chatbot to interact with customers via Messenger on Facebook (the platform is called Dior Insider). This service makes the shopping experience much easier by offering the ability to use slideshows and links to the website.

Natural language understanding, a subset of natural language processing techniques, helps understand human language. In particular, it makes it possible to apply sentiment analysis, that is, to understand how the customer interacting through the chatbot feels about a particular topic or product (Luce 2019: 33).

The advantages offered by AI applications and tools, which have a wide range of usage in the fashion industry, are extremely important and are shown in Figure 2. In this context, (RQ1) “In which areas is artificial intelligence used in the fashion industry?” and (RQ2) “How is artificial intelligence used in design in the fashion industry?” research questions are sought to be addressed.

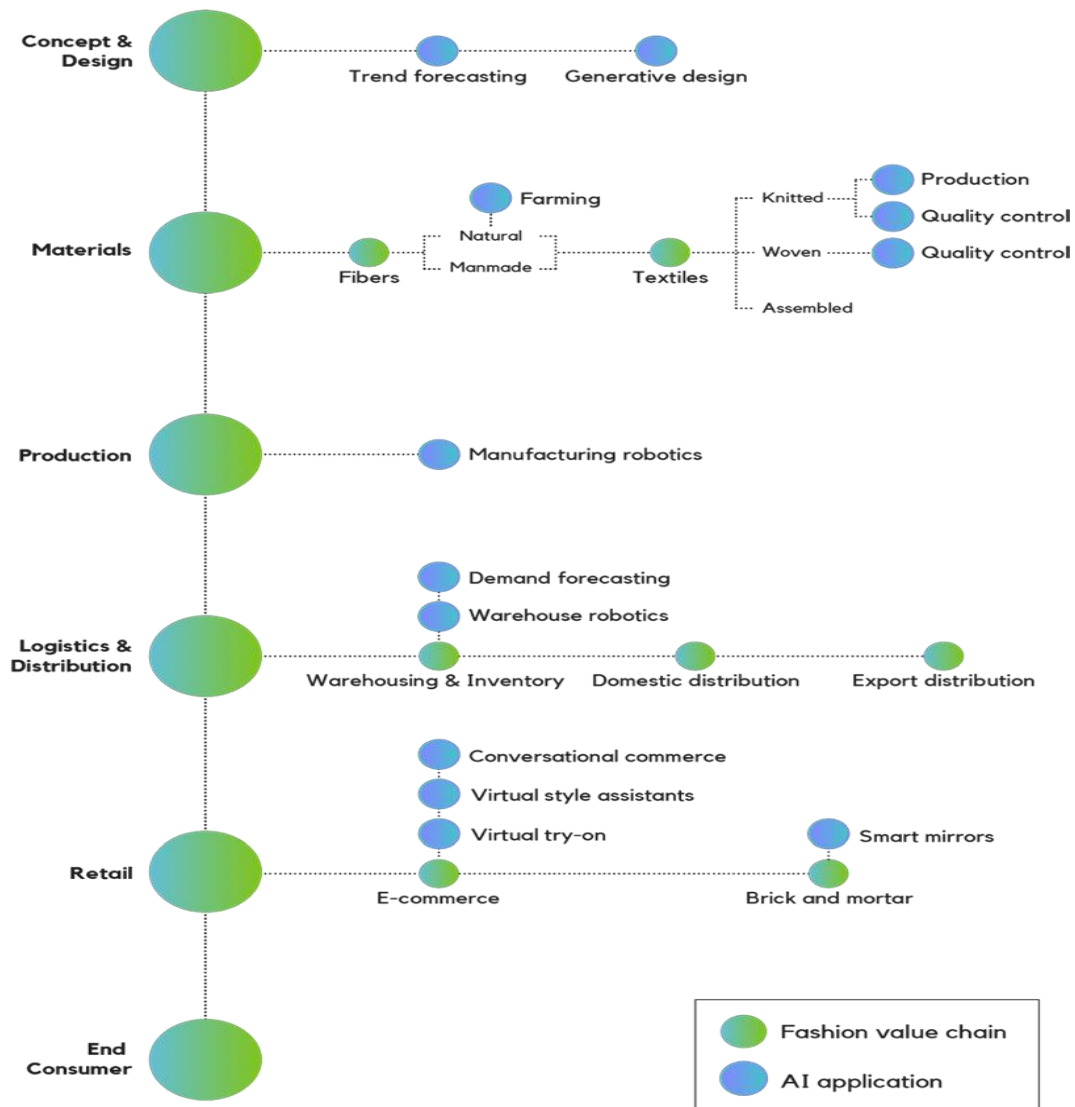


Figure 2. The Fashion Value Chain and The Current AI Applications to Each Phase (Evangelista, 2019-2020: 28)

4. Method

Qualitative research methods were used in this study, which tried to reveal the extent of AI applications in the fashion sector. Descriptive content analysis and document analysis were used as methods in the study. The ChatGPT generative artificial intelligence application was selected as a sample in the study. Document analysis was used as the data collection method in the study. In this context, the study revealed the current state of artificial intelligence applications in the sector and in which areas they are used, and sample model analyzes were conducted with ChatGPT, one of the artificial intelligence tools. In this way, it has been seen in which areas artificial intelligence can be used, especially in the fashion sector. With this analysis, which provides great convenience to fashion designers, it has been revealed that processes and jobs can be done more easily with such artificial intelligence robots, and some suggestions have been offered.

5. Findings and Discussions

5.1. ChatGPT

It is an AI model that stands for “Chat Generative Pre-training Transformer.” This model was created using natural language processing (NLP) techniques. Thanks to this technique, ChatGPT can answer questions on similar subjects by reading texts written on a certain subject. Additionally, because the model can understand written text, it can answer users' questions naturally. ChatGPT is based on deep learning (DL) technology, which is a sub-branch of AI. This technology is a method that increases performance in machine learning by imitating learning. ChatGPT learns by analyzing millions of data sets using DL technology. In this way, the model improves itself to provide more accurate and consistent answers.

ChatGPT is a generative AI chatbot that understands written language and responds in a conversational manner. (OpenAI, 2022; OpenAI, 2021). Productive AIs work on user-inserted commands, called prompts, to generate the desired output (Siegel, 2023; Ahmed, 2023).

Advanced generative AI technologies such as ChatGPT are considered abstract technologies that process and use language (OpenAI, 2022). Using the Generative Pre- training Transformer model, ChatGPT and other similar generative AI technologies can analyze the complex patterns and structures of human language and can be trained to primarily understand and produce human language.

As a generative AI technology in the field of NLP, ChatGPT represents a significant development as a pioneering initiative in the field. ChatGPT, a generative AI technology, has the ability to produce human-like text and understand natural language input like a human (Bozkurt, 2023).

Built on OpenAI's generation of GPT language models and working according to machine learning principles strengthened by both supervised and reinforcement learning techniques, ChatGPT, unlike known search engines, uses the datasets on which it is trained rather than crawling the web to compile information about current events (Rudolph et al., 2023: 4). As a result, OpenAI's ChatGPT model allows users to ask questions and have those questions answered by an AI trained through augmented machine learning. The answers emerge depending on the input the algorithm receives from users as well as the context given to it.

For example, the use of ChatGPT-style model has become common in sectors such as customer service (ChatGPT can provide 24/7 automated customer service). Can provide immediate answers to frequently asked questions, direct queries without the need for human intervention.), healthcare (can quickly provide simple medical information or instructions, answer patient inquiries according to specific protocols.), finance, education (language models can help students provide explanations, frequently asked questions, or information about learning resources), and fashion.

In addition to the mentioned areas, the contributions of ChatGPT to the sectors are extremely important. Its use, especially in the field of fashion, has become the most popular topic of recent times and has initiated a rapid transformation in the sector. AI applications and the use of ChatGPT are used in many business functions, from human resources to marketing, design, finance, and production. With AI applications, it is seen that there is an increase in effectiveness and efficiency in businesses operating in the fashion sector. In this sense, it has been clearly seen that AI provides businesses with a significant speed and cost advantage.

5.2. (RQ1) “In which Areas is artificial intelligence used in the fashion industry?”

5.2.1. Demand Forecast

The survival of companies today depends on their ability to predict the future. Changing customer needs and trends do not make forecasting easier. To maintain their profitability, companies need to predict customer needs and create and implement short-, medium-, and long-term plans as a result of these predictions. Because the basis of planning is prediction. Being able to accurately predict the quantity and model of product to be produced for the next sales season and producing accordingly is a serious investment. If this estimate is made incorrectly, it may result in reduced sales and loss of reputation and revenue. For this reason, demand forecasting is one of the most important inputs in achieving companies' short-term goals. Moreover, since many variables affecting demand differ by sector and are shaped outside the supplier, it may not be possible to intervene. Considering the diversity of the markets served by companies and the difference in customer behavior, many demand forecasting methods have been developed.

Failure to make accurate future projections is directly related to failure to analyze period data correctly. Effective use of data leads to accurate projection and accurate results. In some cases, since previous period data are insufficient, the error rates of the predictions may be high, or predictions cannot be made. In demand forecasting studies, determining the factors affecting the forecast is another factor that makes forecasting difficult. While the data must be complete for the use of classical methods, today it is possible to fill in missing data and ensure data integrity using AI systems. Considering the size of the data, it is more reasonable for AI systems to process data and create patterns than classical methods. In addition, while classical methods inherently require statistical verification (hypothesis), this is not true for AI techniques.

Basically, demand forecasting methods are classified into two areas: qualitative and quantitative methods. While qualitative data uses personal judgments and expert opinions, quantitative data uses mathematical and statistical data. The accuracy and reliability of the prediction made is another evaluation issue. With AI technology developing in parallel with technological developments, the accuracy and reliability of predictions have increased considerably (Güven, 2020: 2).

5.2.2. Trend Forecast

Predicting trends accurately is more important than ever today. Developing salable products and being preferable in the fiercely competitive fashion sector is indispensable for brands to survive. In line with this importance, brands and research companies use cognitive information technologies to develop consistent trend predictions. However, cognitive computing technologies make the trend forecasting system more accessible. Revealing the predictions developed by AI in seconds is work that takes months and requires high costs. For this reason, annual subscription fees of trend analysis companies such as WGSN go up to 50,000 dollars, putting purchasing manufacturers in a difficult situation (Lauglin, 2017). Particularly small and medium-sized businesses that cannot pay the subscription fee follow the fashion shows of big brands and carry out delayed production. The mentioned situation creates time pressure; the design phase is kept short. This paves the way for copies or products with low added value to be released to the market.

Data science is a discipline that uses specialized programming, AI, machine learning, and analytics to address business objectives (IBM, n.d.). Developed by WGSN, the TrendCurve+ tool is an AI-based tool that combines data from various sources to derive the silhouettes, prints, colors, and design details consumers will likely demand in fashion in the future (WGSN, 2023). Thanks to this tool, very important data can be accessed. In the field of fashion, AI is especially used to detect patterns and color spectrums that determine future trends (Mengyun and Van Dyk, 2016).

AI programs for trend predictions and fashion style recommendations have taken their place in the fashion sector in this sense. For example, founded in 2011, Stitch Fix periodically delivers boxes in which it offers style suggestions to users, using an AI algorithm. The company, which reached a turnover of 1.7 billion dollars in 2020, has 3.5 million active users. Using AI as a style consultant, Amazon also scored the clothes people wore and offered style suggestions with a device called Echo Look, which it released in 2017. However, in 2020, Amazon stopped the Echo Look program and stated that it had collected data for Alexa on its own devices for three years and would use this data for the section called Style by Alexa in Amazon shopping. Brands such as Louis Vuitton, Dior, and New Balance also cooperate with a trend forecasting company called Heuritech, which uses AI algorithms for trend predictions. In this context, AI is not just software that collects information, makes designs, or answers questions; this algorithm, which is also used in devices, has also taken its place in smart stores and phones. For example, in 2018, Gap released a DressingRoom application, allowing users to try on clothes virtually. Nike also helped users choose the shoes that best suit them with its AI-supported application called Nike Fit. Brands such as Uniqlo, Zara, Rebecca Minkoff, and American Eagle have also started to use systems that make physical recommendations to consumers with AI-based smart stores and fitting rooms.

Luca Morena, CEO of Next Atlas, a data analysis and trend prediction company, said, "AI will primarily replace social media content producers. When you give people more technology, that is, when they taste it, their attitudes on every subject will change. They will pursue more work based on themselves." By saying, "Brands will not have to run after social media content producers to analyze consumers' trends and sell their own designs. Social media content producers will be replaced by AI," he actually signaled how important AI will become for the industry in the future.

5.2.3. Creating a Collection

There are many examples of designers using cognitive technologies in the collection creation process. One of these is the Falguni & Shane Peacock brand, which adopted the vision of reflecting the future of Bollywood fashion and collaborated with IBM in its 2017 collection. Founded in India and operating in the luxury clothing industry, Falguni & Shane Peacock offers consumers a unique style by combining modern and traditional. The company strives to create a brand personality that is open to innovations with the motto "Progress or perish" and has proven this attitude with its cooperation with IBM. Falguni Peacock, one of the founders of the brand, who received support from IBM's cognitive information technology Watson during the collection preparation process, explained the reasons for choosing AI technology as follows: "To understand trends and get inspired, it is necessary to follow hundreds of blogs and examine thousands of

fashion show images. You can carry out this process yourself as a designer or hire people to do it. However, examining so many images takes a long time, and it is not possible to maintain the focus level while working on the images. "AI technology comes into play at this stage, presenting the data that human beings would have obtained as a result of months of work to designers within seconds." (IBM, 2017: 1). Falguni & Shane Peacock collected the data expected to be obtained as a result of working with Watson under three categories. These;

Color prediction for the collection: Determining seasonal color trends and trend colors by analyzing the images examined in line with the determined limits with image recognition technology.

Visual Scanning: As a result of visual examination, collecting design samples that are compatible with the silhouette, pattern and style line of the brand.

Pattern Inspiration: Examining thousands of patterns with AI technology and developing unique textile pattern designs with AI technology.

5.2.4. Production Processes

In the fashion sector, in addition to the systems in which automation technologies with AI features detect errors that occur during the production process, studies are also carried out on cognitive technologies that affect the production volume, the selection of materials to be used, and production strategies. Investopedia, a company that researches production, finance, marketing, and education, is working on controlling the supply chain with blockchain. There are initiatives to add a QR code to every garment produced, which provides information about the product and labels and instructions for use. In this way, he/she argues that a more transparent supply chain will be created and that they will be able to improve production processes for other manufacturers by making it possible for everyone to access the answers to many questions (CBI, 2019; Toorajipour et al., 2021).

In the fashion sector, industrial robots are used for sewing and supply chain management. One such company focusing on sewing robots is Soft Wear Automation, a robotics company based in Atlanta. According to its CEO, the use of sewing robots has significant advantages in reducing costs, restoring production, reducing waste and therefore environmental impact, and increasing production flexibility (Luce, 2019). At the same time, robots are used in the industry to improve warehouse picking and packaging procedures and customer service. Zara, for example, uses robots to speed up the store pickup process (Musariri, 2018; Lu, 2021).

Enterprises engaged in textile production also carry out many digital operations and optimizations in both production and supply chains thanks to AI-based programs. Another of these examples is the Hugo Boss (Izmir, Turkey) factory.

One of the most important teams in Hugo Boss's factory, which has adapted its production center to industry 4.0, is AI systems. These systems enable the company to speed up its production by reducing costs and to make improvements by quickly collecting production data. Hugo Boss is just one example of this. Many manufacturers are now making significant investments in AI. Because AI also contributes to sustainability by preventing unnecessary production and shortening sample processes, thanks to the predictions and suggestions it makes. In addition, AI, which is also used in the supply chain, allows companies to ship products accurately and quickly, control stock, and make more accurate planning thanks to data on these issues. In this context, AI, which has started to penetrate the dynamics of fashion, is really very effective for the industry. Since AI acts on data, it already provides great benefits to the fashion industry at many points and facilitates many processes. This issue returns profit to fashion brands.

Today, many fashion businesses have realized the contribution of AI to their business goals and have prioritized the benefits provided by this technology throughout the business. In this context, AI technology can be used to reduce costs, reduce risks, accelerate the market entry process, and provide many other benefits (TIM, 2023: 79-80).

5.2.5. Product Sale or Recommendation

Merchandising personalization is also carried out by retailers through AI-supported recommendation engines. Personalized product recommendations are offered based on customer data, and recommendations are often made using expressions such as "You may also like" or "Customers also bought..." Recommendation engines help users filter out vast amounts of information they don't need. Companies like Amazon are even promoting a personal virtual AI stylist, offering services like Style Check, which makes personalized clothing recommendations based on existing outfits by combining many AI technologies such as natural language processing and understanding, computer vision, neural networks, and machine learning.

Personal AI stylist: Having a personal stylist represents the pinnacle of personalization. AI is making this possible by creating a personal virtual AI stylist. Many people are familiar with virtual assistants that use automatic speech recognition, such as Amazon's Alexa, Apple's Siri, Google's Google Home, and Google Assistant. However, the virtual style assistant is a step forward because it emphasizes the use of images, the possibility of taking photos, image recognition and visual search features, as well as recommendation engines and access to fashion products (Pupillo, 2019: 31).

Improving customer experience in the store; digital technologies also improve the customer experience in stores. Fashion luxury brands use smart mirror technologies with their physical stores. The smart mirror is a two-way mirror with

an electronic display on the back. They are computers supported by a full technology stack, from depth-sensing hardware to software equipped with advanced computer vision algorithms (Luce, 2019: 39). Mirrors allow users to not only see how they look in clothing with different colors but also to change the type of clothing and make side-by-side comparisons between different outfits.

The fashion marketing part of the subject is one of the most visible and fastest-growing points. Fashion brands now use AI algorithms to promote their products. For example, Levi's collaborated with a company called LaLaLand.ai and introduced its new collection through AI-designed models. Revolve also announced the famous Revolve Festival and promoted its collection with billboard visuals designed by AI. Another company called Deep Agency has also established the "AI Model Agency." This futuristic model agency allows people who pay \$29 per month to take photos with digital models designed by AI in the style they want. AI has also entered fashion weeks, the most magnificent fashion marketing event. The world's first AI Fashion Week was held digitally on 20-21 April 2023.

Kering (French Luxury Group) has launched an initiative where they apply the latest technologies to fashion by establishing a digital platform called KNXT. On the platform in question, products of Kering's brands, such as Gucci, Alexander McQueen, Balenciaga, and NFTs, can be purchased with cryptocurrencies. At the same time, the AI chat robot called "Madeline" on the platform, supported by ChatGPT, makes style suggestions to users and offers products that they can buy with cryptocurrencies such as ETH and BTC.

5.2.6. Fashion Design

Artificial intelligence is also used in the fashion industry in the field of design. To reveal more detailed results on this subject, RQ2 was sought to be addressed.

5.3. (RQ2) "How is artificial intelligence used in design in the fashion industry?"

One of the areas of interest to the fashion sector is the use of AI in fashion design. On November 6, 2018, leading Italian e-commerce company Yoox presented 8 by Yoox, the first fashion collection designed using AI (Mazza, 2018; Marchetti, 2019). Yoox's products, which emerged as a result of the information given to its own AI program and analyzes made from social media, have shown us how AI can use data in fashion design processes. Later, different brands also used AI for design. Finally, Gstar Raw has released the world's first AI-supported denim collection using Midjourney, an AI program that produces images from words. The twelve-piece products, made entirely of denim, are designs with a very futuristic appearance.

In 2017, Amazon announced the possibility of training a generative competitive network with a family of generative models to design clothing. These models could create clothing images and help designers as a starting point. Amazon's core AI fashion designer can learn a particular fashion style from images and create new products in similar styles from scratch (Ramirez, 2018).

IBM has collaborated with Tommy Hilfiger and the Fashion Institute of Technology's Infor Design and Tech Lab on a project called Reimagine Retail to demonstrate “how AI can assist design teams by enhancing efficiency, reducing overall lead times, and broadening their exploration through analysis.” Moreover, this initiative allows designers to identify trending colors, essential patterns, and methods to integrate style effectively (Segura, 2018).

At the same time, special effort is being devoted to the creation of electronic textiles, known as smart fabrics, that contain digital components to offer users a variety of benefits, from customized fit to weatherization, drug release, temperature regulation, heart rate monitoring, and more (Bagaar, 2018; Intelistyle, 2018; Wong, 2019).

5.3.1. Model Analysis Example with ChatGPT

As an overarching category that includes various tools, techniques, and application areas, AI is contributing to major changes in the fashion sector. As one of the tools used, ChatGPT, a productive AI chat robot, attracts attention with the advantages it offers to the sector. ChatGPT offers alternatives for the sector in many areas of suggestions.



Figure 3. Model Example (Bottan, 2023)

ChatGPT, whom we asked to evaluate the model given in Figure 3, can convey a lot of information selection to the ergonomic condition of the model. ChatGPT's evaluation is summarized below: "The design in the image you provided offers a modern and avant-garde style. Especially the color choice, details of the outfit, and interesting accessories are remarkable. Here are my evaluations and suggestions about this design:

Color Palette: Shades of blue dominate the design. This color palette can be suitable for both summer and winter seasons. However, including such pieces in the collection and pieces that can be combined with some neutral colors (gray, white, black) can add diversity and appeal to a wider audience.

Details and Accessories: The details used in the clothes (for example, waist-tied accessories) are quite stylish. However, there may be some concerns about the functionality of such accessories. These details may be optional for customers looking for practicality and comfort.

Fabric Selection: It is difficult to understand exactly what the fabric is from the visual. However, it is important to use flexible and comfortable fabrics in such clothes with an avant-garde design. Especially in the mid-price segment, comfort is an important purchasing factor for many customers.

Clothing Length and Cut: The length of the skirt of the design on the right may be ideal for many customers. However, to customers from different age groups.

Pricing: If we think the price will be average as you stated, it may be a reasonable price range for such original designs. However, the production quality of the garment, the quality of the fabric, and the overall image of the brand also play a role in pricing.

As a result, the presented design is quite original and eye-catching. However, some improvements can be made by taking into account factors such as target audience expectations, comfort, and functionality. "Especially in the middle price segment, offering quality and comfort at an affordable price can increase the



popularity of the design."

Source: <https://www.portfolyohazirlikakademisi.com/helin-esen-universita-luav-di-venezia-fashion-design/>

Figure 4. Model Example

Notably, when we asked ChatGPT to analyze the model in Figure 4, it suggested improvements at some points. ChatGPT made the following evaluation for this model.

"The overall aesthetic of this design feels modern and stylish. However, the feature that caught my attention while evaluating and could potentially require improvement is this:

Drape Detail of the Skirt: The drape detail on the skirt seems to add extra volume to the waist and hip part of the model. This may create an undesirable appearance for some users and make the figure appear wider. If the drape detail of the skirt is simpler and less bulky, the skirt can have a more elegant and balanced appearance overall.

"You can increase the overall balance and aesthetics of this design by making the drape detail of the skirt less obvious or simplifying the overall form of the skirt a little more." In line with these suggestions made by ChatGPT, designers can re-evaluate the models in the collection and make various improvements.



Source: <https://www.portfolyohazirlidikademisi.com/helin-esen-universita-luav-di-venezia-fashion-design/>

Figure 5. Model Example

When asked to ChatGPT to analyze the model in Figure 5, we see that it focuses on points that can be potentially improved. ChatGPT made the following evaluation for this model.

“As we evaluate this design, I would like to point out the following features that could potentially require improvement:

Loose Cut: The overall loose fit of jackets and trousers may appeal to some customer segments, but this may be perceived as a negative feature for those who prefer a tighter or body-fitting cut.

Back Design of the Jacket: The square stitch detail on the back of the jacket may cause confusion for some users. The functionality or aesthetic contribution of this detail is not clearly understood.

Waist Part of the Trousers: Details on the waist part of the trousers (for example, excess pockets and belt detail) may not be very functional and may seem confusing to some users.

Color Combination: Although the yellow top contrasts well with the gray jacket and trousers, it may seem too bright to some users. A more neutral color choice may be more appealing to a wider audience.

Front of the Jacket: The cut of the front of the jacket may seem too open to some users. An alternative with a more closed or different collar may appeal to a wider audience.

Shoe Selection: The shoes of the model in the image may not be fully compatible with the overall design. A simpler shoe model can make the overall look more balanced.

Of course, these comments are subjective and may vary depending on the target audience of the design, the overall aesthetics of the brand, and the overall theme of the collection.

"I can say that the design overall has a modern and stylish aesthetic, but playing on some details can further strengthen the overall perception." Considering the evaluations made by ChatGPT on these examples, it can be seen that it provides great convenience for the fashion sector, especially in all processes from design to production, and various arrangements or changes can be made in the light of these

suggestions. These suggestions may provide the opportunity to start the season with more accurate and/or appropriate collections for the sector.

6. Conclusion and Recommendations

AI technology has developed rapidly in the 21st century and has begun to participate in many aspects of our lives. This technology, whose first concrete steps date back to the 17th century, has today taken on a structure that can learn autonomously from the data set, and process, and present the data. AI has been recognized as the center of digital technological transformation in various industries and different multidisciplinary fields. It is the collection of multiple technologies that enable machines to learn from experience, adapt to new inputs and perform human-like tasks. AI is the basic component that plays an active role in the development of many technological infrastructures that we use every day, even if we are not aware of it. Rapid developments in technology have made AI and digital technology a strategic and critical factor in this process.

Trying to keep up with rapidly changing consumer needs, the fashion sector has rapidly adopted post-modern, Industry 4.0, AI, and, more recently, 5.0 ready-to-wear production technologies, as well as today's newest digital achievements.

Despite the established nature of the fashion sector, AI has fundamentally transformed the industry, from the way fashion companies produce their products to the way they market and sell them. AI technologies have transformed the fashion sector in every element of its value chain, such as design, production, logistics, marketing, and sales.

In the powerful digital age, consumption is increasing day by day, recently involving AI. Although the increasing application of AI in fashion brings with it new questions in terms of the quality and cultural aspects of design, it continues to be applied and used in many areas. AI technologies are actively used in many areas such as sales and marketing activities, customer management, logistics, supply chain management, and payment transactions. Thanks to these technologies, manufacturers in particular can manage their products and services better, increase customer satisfaction, and compete more effectively.

AI technologies help manufacturers make more accurate and efficient decisions by utilizing large data sets. These technologies allow companies to make more informed decisions by analyzing sales trends, customer behavior, product performance, and many other factors.

Additionally, AI technologies are also preferred in logistics and supply chain management. These technologies are used to make optimized plans in logistics processes such as transportation and storage of materials and products. This situation especially allows exporters to deliver their products to customers faster

and at lower costs. These technologies also help exporters better manage their products and services, increase their efficiency, and become more competitive. In the 2000s, when the concept of efficiency became more important day by day, it was extremely possible for companies to export smarter and more efficiently by using AI technologies.

In this study, in addition to revealing the uses of AI in the fashion sector, the importance and usage areas of tools such as ChatGPT for the sector are also mentioned. In this context, ChatGPT's contributions to the fashion sector and its usage areas have been tried to be summarized below. In addition, when evaluated specifically in terms of research questions, answers were sought to the questions of in which areas is artificial intelligence used in the fashion industry (RQ1) and how is it used, especially in the field of design in the industry (RQ2). The points summarized below were reached in terms of these questions.

- *Trend Forecast*: ChatGPT can be used for fashion and trend forecasting. For example, by interacting with users, it can understand their fashion preferences or tastes and use this information to make predictions about future trends. Designers can take these trend predictions into account in the design and color selection of their collections.

- *Design Suggestions*: ChatGPT can serve as a consultant in fashion design. Designers can receive suggestions on various styles, color combinations, cuts, or patterns through ChatGPT. This allows them to explore fresh and unique design concepts.

- *Fabric Selection*: ChatGPT can assist in fabric selection. ChatGPT can be interacted with to understand the fabric properties the user needs for a particular design. ChatGPT can offer users recommendations on suitable fabric types, thicknesses, or textures.

- *Sustainability Analysis*: ChatGPT can be used for sustainability analyzes in the fashion industry. For example, it can evaluate sustainability criteria in material selection, offer suggestions to increase energy or resource efficiency in production processes, or provide information on recycling strategies.

- *Understanding User Needs*: ChatGPT can be used to understand user needs and preferences regarding textile products by interacting with users. This can help designers better understand the expectations of people who will use their products and provide ergonomic solutions.

- *Material Selection*: ChatGPT can also assist with ergonomic material selection. Depending on the user's needs and the intended use of the product, ChatGPT can make recommendations on material properties. This can help designers choose materials that are ergonomic, comfortable, durable, and environmentally friendly.

- *Communication and Customer Experience*: ChatGPT can be used in customer service and communication in the fashion sector. They can answer customers' questions about products, offer product suggestions, or perform operations such as order tracking. Thus, customer satisfaction can be increased.

- *Data Analysis and Trend Forecast*: ChatGPT can contribute to trend forecasts by analyzing data in the fashion sector. By working with AI algorithms through big data analytics and user feedback, it can make predictions about future trends and help designers design products in line with trends.

Finally, as stated by Öztemel (2020), fashion companies should not be indifferent to technological developments, especially AI, and should strive to intelligentize all operations throughout the system.

AI will undoubtedly be with us for many years, and more fashion brands will continue to use this technology in every field. The contributions of AI-supported systems to sustainability will perhaps, at some point, make it necessary to use AI algorithms in fashion brands. Therefore, if it is necessary to take a step towards AI, it is necessary to start as soon as possible.

References

- Ahmed, N. A. (2023). What is Artificial Intelligence? (AI), Access: <https://www.aitimejournal.com/what-is-artificial-intelligence-ai/29625/>
- Bagaar, (2018). Digital leading the way to a more sustainable textile & fashion industry, Access: <https://www.bagaar.be/insights/digital-leading-the-way-to-a-more-sustainable-textile-fashion-industry> Access:13.11.2023
- Bozkurt, A. (2023). ChatGPT, Üretken Yapay Zeka ve Algoritmik Paradigma Değişikliği, *Alanyazın*, 4(1), pp: 63-72.
- Catchoom, (2018). Top 10 Coolest AI Trends in Fashion E-Commerce. Sept. 18, 2018 [https://Catchoom.Com/Blog/Top-10-Cooler-Ai-Trends-In-Fashion-Ecommerce Merchandising-Cx/](https://Catchoom.Com/Blog/Top-10-Cooler-Ai-Trends-In-Fashion-Ecommerce-Merchandising-Cx/) Access:13.11.2023
- Csanák, E. (2020). AI for fashion, 13th International Scientific-Professional Symposium Textile Science and Economy, Zagreb, p: 117.
- CBI. (Computer Based Instruction) (2019). Technology Trends in The Apparel Industry. Access: <https://www.cbi.eu/node/2863/pdf/>
- European Commission - AI High Level Expert Group (2019). A Definition of AI: Main Capabilities and Scientific Disciplines, 18 December <https://ec.europa.eu/digital-single-market/en/news/definition-artificial-intelligence-main-capabilities-and-scientific-disciplines> Access:

14.11.2023

- Evangelista, P. N. (2019-2020). Artificial Intelligence in Fashion: How Consumers and The Fashion System Are Being Impacted By AI-Powered Technologies, Politecnico di Milano, School of Design Master's Degree in Design for the Fashion System.
- Giri, C., Jain, S., Zeng, X., Bruniaux, P. (2019). A Detailed Review of Artificial Intelligence Applied in The Fashion and Apparel Industry. IEEE Access: <https://doi.org/10.1109/ACCESS.2019.2928979>
- Guo, Z. X., Wong, W. K., Leung, S. Y.S. and Li, M. (2011). Applications of Artificial Intelligence in The Apparel Industry: A Review, *Text. Res. J.*, Vol. 81, no. 18, pp: 1871-1892.
- Güven, İ. (2020). Perakende Hazır Giyim Endüstrisinde Yapay Zeka Yöntemleri İle Talep Tahmini, Karabük Üniversitesin Lisansüstü Eğitim Enstitüsü Endüstri Mühendisliği Anabilim Dalında Yüksek Lisans Tezi. Karabük.
- IBM. (2019). What is Quantum Computing? IBM, <https://www.research.ibm.com/ibm-q/learn/what-is-quantum-computing/> Access:13.11.2023
- IBM (International Business Machines), (2016). The Cognitive Advantage Insights from Early Adopters on Driving Business Value. Access: <https://www.slideshare.net/DiegoDiaz49/the-cognitive-advantage-insights-from-early-adopters-on-driving-business-value-ibm>
- Laszkiewicz, A. and Kalinska-Kula, M. (2023). Virtual Influencers as An Emerging Marketing Theory: A Systematic Literature Review. *International Journal of Consumer Studies*, 47(6), 2479-2494. doi:10.1111/ijcs.12956
- Lauglin, S. (2017). The Future of Trend Prediction Will Come from Tech Innovators, Not Fashion Designers. Access: <https://qz.com/1061405/the-future-of-trend-prediction-will-come-from-tech-innovators-not-fashion-designers/>
- Lu, Y. (2021). Application of Artificial Intelligence in Clothing Production. *Advances in Social Science, Education and Humanities Research*, volume 638, Proceedings of the 2021 International Conference on Public Art and Human Development (ICPAHD 2021).
- Luce, L. (2019). Artificial Intelligence for Fashion. New York: A press - Springer Nature.

- Marchetti, F. (2019). How A.I. is Shaping Fashion. CNBC, March 6
- Mazza, V. (2018). Artificial Intelligence and Fashion: Between Innovation and Creativity. *Lexology*, Nov. 16
<https://www.lexology.com/library/detail.aspx?g=12304e5f-33db-4615-998c-1b27b17e3427> Access:13.11.2023
- McKinsey & Company (2018). The State of Fashion 2019: A Year of Awakening. Access: <https://www.mckinsey.com/industries/retail/our-insights/the-state-of-fashion-2019-a-year-of-awakening> Access: 15.11.2023
- Mengyun, S. and Van Dyk, L. (2016). Using Artificial Intelligence to Analyze Fashion Trend. *Hearts Magazine*. Access: <https://arxiv.org/pdf/2005.00986.pdf>
- Misischia, C. V., Poecze, F., Strauss, C. (2022). Chatbots in Customer Service: Their Relevance and Impact on Service Quality, *Procedia Computer Science*, Vol. 201, pp: 421-428.
- Musariri, D. (2018). How Artificial Intelligence Is Transforming the Fashion Industry. *May, NS Business*, <https://www.ns-businesshub.com/transport/the-adaptation-of-artificial-intelligence-within-the-business-of-fashion/> Access:06.02.2024
- Nayak, R. and Padhye, R. (2018). Artificial Intelligence and Its Application in The Apparel Industry, in *Automation in Garment Manufacturing*. Amsterdam, The Netherlands: Elsevier, pp: 109-138.
- OECD. (2019). *Going Digital: Shaping Policies, Improving Lives*. Paris: OECD Publishing <https://doi.org/10.1787/9789264312012-en> Access:13.11.2023
- OECD. (2019). *Artificial Intelligence in Society*. Paris: OECD Publishing <https://www.oecd.org/publications/artificial-intelligence-in-society-eedfee77-en.htm> Access:13.11.2023
- OpenAI. (2021). *DALL-E: Creating Images from Text*. Access: <https://openai.com/research/dall-e> <https://openai.com/blog/chatgpt/>
- Öztemel, E. (2020). Yapay Zeka ve İnsanlığın Geleceği. *Bilişim Teknolojileri ve İletişim: Birey ve Toplum Güvenliği*, DOI: 10.53478/TUBA.2020.011
- Pupillo, M. (2019). Artificial Intelligence and The Fashion Industry, Department of Economics and Finance Cattedra Chair in Introduction to Business Economics, *LUISS*, Access: http://tesi.luiss.it/25378/1/212661_PUPILLO_MARIANNA.pdf

- Ramirez, R. (2018). Artificial Intelligence and The Apparel Industry. The Innovation Issue, ASI, Sept. 28 <https://www.asicentral.com/news/web-exclusive/september-2018/artificial-intelligence-and-the-apparel-industry/> Access:13.11.2023
- Rudolph, J., Tan, S. and Tan, S. (2023). ChatGPT: Bullshit Spewer or the End of Traditional Assessments in Higher Education? *Journal of Applied Learning & Teaching*, 6(1), pp: 1-22.
- Segura, A. (2018). Artificial Intelligence in Fashion Retail. The Fashion Retailer Blog. April 30, <https://fashionretail.blog/2018/04/30/artificial-intelligence-in-fashion/> Access: 18.11.2023
- Sennaar, K. (2019). AI in Fashion-Present and Future Applications, <https://emerj.com/ai-sector-overviews/ai-in-fashion-applications/> Access:13.11.2023
- Siegel, J. (2023). The Art of Prompt: How to Get the Best Out of Generative AI. Microsoft.com. Access: <https://news.microsoft.com/source/features/ai/the-art-of-the-prompt-how-to-get-the-best-out-of-generative-ai/>
- TİM. (2023). İhracat 2023 raporu, Türkiye İhracatçılar Meclisi İhracat 2023 Raporu, TİM Ekonomik Araştırmalar Şubesi. Access: 12.11.2023 https://www.tim.org.tr/files/downloads/Strateji_Raporlari/TIM_Ihracat_2023_Raporu.pdf
- Toorajipour, R., Sohrabpour, V., Nazarpour, A., Oghazi, P. and Fischl, M. (2021). Artificial intelligence in Supply Chain Management: A Systematic Literature Review, *The Journal of Business Research*, Vol. 122, January, pp: 502-517.
- WGSN. (2023). Accurately Invest for Future Consumer Demand. Access: <https://www.wgsn.com/en/trading/trendcurve>
- WGSN. (2023). Data and Analytics Powering Best-In-Class Trend Forecasting Services. Access: <https://www.wgsn.com/en/wgsn/data>
- Wong W. K., (2019). Artificial intelligence on fashion and textiles. Proceedings of the Artificial Intelligence on Fashion and Textiles (AIFT) Conference 2018 (Editor). Springer
- <https://www.cnbc.com/video/2019/03/06/yoox-net-a-porters-federico-marchetti-on-how-ai-is-shaping-fashion.html> Access: 06.02.2024.

Ethics Statement: The authors declare that ethical rules have been followed in all preparation processes of this study. In case of a contrary situation regarding scientific ethics issues, all responsibility belongs to the authors of the study and Çankırı Karatekin University Journal of Faculty of Economics and Administrative Sciences has no responsibility.