APPLICATION OF 3D VIRTUAL TECHNOLOGY FOR THE DEVELOPMENT OF DIGITAL SHOWCASES FOR FASHION PRODUCTS IN THE DIGITAL AGE

By

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Abstract

The advent of Industry 4.0 necessitates comprehensive operational efficiency through digital optimization, prompting a holistic transformation in the fashion industry from design conceptualization to consumer services. Three-dimensional (3D) Virtual Fashion technology has emerged as a disruptive innovation, fundamentally altering product development and consumer presentation paradigms. Conventional two-dimensional (2D) visualization in e-commerce often lacks precision, leading to significant product return rates due to expectation discrepancies. This study aims to investigate the application of Virtual 3D technology as a solution for developing interactive and realistic digital showcases. Employing an empirical approach to 3D development in contemporary fashion coupled with a literature review, this research explores the integration of features such as 360-degree viewing, virtual try-on, and material texture visualization. The findings indicate that implementing 3D digital showcases enhances consumer engagement while significantly reducing operational costs related to physical sampling and product returns. Ultimately, the adaptation of Virtual 3D technology streamlines production phases, accelerates design validation, and establishes valuable digital assets, ensuring competitiveness and sustainability in the digital economy.

Keywords: 3D Fashion, Digital Showcase, Contemporary Fashion.

INTRODUCTION

The conventional fashion design process involves creating sketches using conventional drawing tools such as pencils with dry or wet colouring techniques. With the advancement of technology, the design process can now be done digitally using various graphic design software and applications, including Corel Draw, Adobe Photoshop, Adobe Illustrator, and Ibis Paint. The result of this design process is still a two-dimensional design. Automation through the use of CAD/CAM technology integrated into the digital pattern-making process has long been used in the garment industry. The use of this technology can only be done by large industries because it requires very high investment in both software and hardware.

The digital era has brought about a transformation in the global fashion industry. The shift in consumer behaviour from conventional shopping to e-commerce platforms requires businesses to continue to innovate in how they present their products. In the past, the success of a fashion brand was highly dependent on the physical location of the store, but now, digital appeal is the main determinant in winning market competition. This transformation is not limited to a shift in transaction media, but also encompasses how the aesthetics and value of a product are communicated through digital screens.

Although online stores offer ease of access, there are major challenges that are difficult to solve with traditional visual media such as two-dimensional (2D) photos or videos. Consumers often find it difficult to visualise material details, how the fabric falls on the body (drapery), and accurate size precision. These limitations in perception often lead to hesitation in purchasing and disappointment when the item arrives because it does not meet expectations. This results in high return rates, which are an operational burden for fashion companies.

3D Fashion Technology is one of the software and applications whose demand is increasing and is being utilised for business

communication in the fashion industry. Through 3D technology, a fashion product can be displayed as if it were a physical product. 3D fashion technology is becoming an increasingly popular solution that will disrupt the process of creating physical prototypes and displaying them in digital showcases. Virtual 3D technology has emerged as a revolutionary solution in the development of digital showcases. Through precise three-dimensional modelling, fashion products are no longer static, but have become interactive digital assets. This technology enables the integration of cutting-edge features such as Augmented Reality (AR) and Virtual Try-On, where consumers can see stitching details and virtually try on clothes on avatars that resemble their actual body shapes. The application of this technology bridges the gap between the tactile physical shopping experience and the efficiency of digital shopping.

METHODE

The method used in writing this article is a descriptive qualitative method with a library research approach. This method was chosen to provide a comprehensive overview of the phenomenon of 3D technology application in the fashion industry through data collection from various credible scientific and technical sources.

According to (Kusuma et al., 2025), conventional methods have several limitations, including efficiency. If there are changes to the design after the sample is completed, it requires the physical sample to be remade, which takes a long time and hinders a quick response to changes in market trends. This process also requires high production costs due to the repeated use of materials and labour. Secondly, from a sustainability perspective, conventional methods tend to produce large amounts of textile waste in the form of fabric scraps, unused samples, and product mock-ups that are ultimately discarded.

This is contrary to the principles of sustainable fashion, which demand minimal waste and the optimisation of resource use.

According to Narwastu & Purnomo, 2023 in (Ahsan et al., 2025), Indonesia's cultural and textile wealth is a source of inspiration that can be processed into high-value fashion products, increasing their appeal in domestic and international markets. Despite their great potential, fashion MSMEs face several problems related to human resources. Their research found that 56% of fashion MSMEs still use black and white sketches with pencils and pens, 24% use coloured pencils, and only 4% use digital tools, which shows that most MSME players still lack the use of digital design techniques.

According to (Azzahrah & Nursari, 2023), public interest in modest fashion has increased due to creativity and innovation in the fashion industry. The design of modern modest fashion with a zero-waste concept can be one way to optimise fabric usage by digitally arranging patterns so that they are more measurable and planned, and the fabric cutting process does not produce a lot of waste.

Although the presence of various e-commerce platforms such as Zalora and Indonetwork has digitised the marketing and presentation of fashion products, the production aspect is still largely manual. In fact, amid fierce industry competition, the adoption of digital technology in the production process is a strategic opportunity to improve the progress and competitiveness of this sector, according to (Kasus et al., 2020).

Based on the phenomena described above, it can be concluded that the Indonesian fashion industry is currently at a point where marketing digitalisation is not yet in line with production digitalisation. Although e-commerce platforms have grown rapidly, the production process is still dominated by conventional (manual) methods, which carry risks such as slow response to market trends and a negative impact on the environment due to textile waste.

RESULT

Samples/prototypes are examples of products that represent a group of products to be manufactured. Samples are a means of communication to obtain orders from buyers. In order for mass production orders in the garment industry to meet the specified quality standards, the sampling department is responsible for producing samples as a reference for production. These clothing samples must also be approved by the buyer.

An intensive communication process and sample refinement are required to obtain buyer approval. The sample production process requires a considerable amount of time, starting from creating patterns according to the design and size, cutting the fabric, sewing, to sending the samples to the buyer via courier or shipping service to obtain production approval. Figure I shows that sample development without 3D software requires a lengthy review cycle, but with 3D software, the review cycle is much faster.

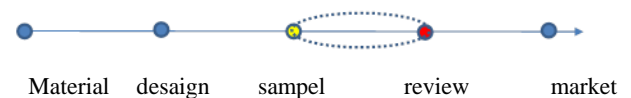Comparison of the sample development process with and without 3D software.

Material   desaign   sampel   review   market

Figure 1. 2D Software

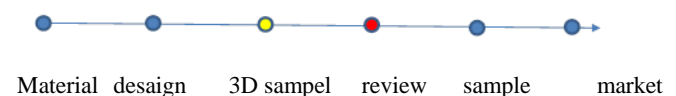Material   desaign   3D sampel   review   sample   market

Figure 2. 3D Software

This 3D fashion technology can be used to create new samples and reconstruct garments made from woven fabrics and other types of fabric. Without having to cut and sew fabric, this 3D fashion technology allows us to display fashion products realistically, even to the point of simulating virtual fashion shows, whether it be fashion show simulations or products that look like the real thing. As seen in the image below, which shows the transformation from 2D design creation visualised into virtual 3D.
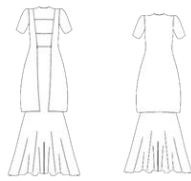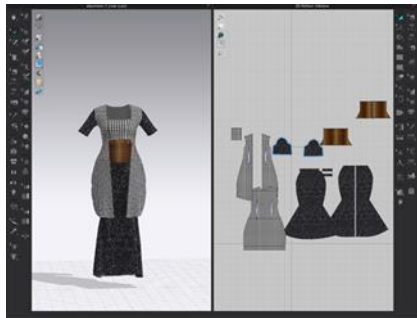
Figure 3. Design 2D /Sketch

Figure 4. 3D Design

The implementation of three-dimensional (3D) modelling technology in the fashion design process enables the creation of product visualisations that are far more representative and realistic than conventional two-dimensional sketches. Through this digital simulation, fabric texture details, drapery, and design proportions on the human body can be presented with a high degree of accuracy that resembles the actual physical product. This visual advantage not only serves as a more aesthetic presentation tool, but also plays a strategic role as a digital prototype that can minimise design errors before entering the physical production stage.

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Figure 5 . 3D design that can be viewed from all angles/360-degree viewing

Once the digital-based design stage is complete, the design can be immediately integrated into a digital showcase as a promotional and marketing tool for consumers at large. The use of digital prototypes enables two-way interaction, whereby designers can accommodate actual consumer feedback or complaints. This flexibility provides a strategic advantage for designers to instantly revise and improve designs before entering the physical manufacturing phase. Thus, the risk of production errors can be significantly minimised, which ultimately increases resource efficiency and customer satisfaction through more accurate product results.

Figure 5. Digital Catalogue

Gambar 6. Etalase Digital

DISCUSSION

According to (Dwi et al., 2025) With the increasing access to the internet and the development of digital technology, consumer shopping behaviour has shifted significantly from conventional

transactions to digital-based transactions. This change is driven by factors such as ease of access to information, availability of various payment methods, and increased trust in digital systems. This phenomenon reflects how technology has become a key supporting tool and catalyst in the evolution of modern consumption patterns.

Research on 3D virtual technology in the fashion industry is not merely a visual aid, but a redefinition of the production-consumption paradigm that offers three main pillars of innovation. The first is dynamic digital assets as a solution to different perceptions, unlike conventional static 2D visualisations. 3D modelling creates interactive digital assets that can precisely replicate the physical properties of fabrics, such as drapery and material texture. This effectively bridges the cognitive gap between consumer expectations and product reality, which strategically reduces the operational burden caused by high return rates in the online market.

The novelty of this research emphasises that 3D technology plays a role in sustainability. By moving the design validation process to a virtual space, the industry can eliminate the need for repeated physical samples, thereby drastically reducing textile waste from upstream production. Furthermore, the integration of 360-degree viewing and Virtual Try-On features creates a new dimension in more immersive digital consumer interaction. This innovation transforms digital storefronts from mere image catalogues into interactive spaces that strengthen customer engagement in the digital economy era.

Thus, this research affirms that the adoption of 3D technology is a crucial step in aligning the imbalance between marketing digitalisation and production digitalisation, which has been a major obstacle to the competitiveness of the contemporary fashion industry.

CONCLUSION

Digital transformation in the fashion industry has shifted from simply digitising transactions to digitising more advanced creative and production processes. Although CAD/CAM technology has been in use for a long time, its limited accessibility to large-scale industries has created a gap for other industry players. However,

the emergence of 3D design technology now presents a disruptive solution that addresses the limitations of conventional methods and 2D visualisation, which have led to high return rates due to consumer perception bias.

The use of 3D technology not only serves as an efficient digital prototyping tool but also acts as an interactive asset in digital storefronts. Through features such as Virtual Try-On and Augmented Reality (AR), this technology successfully bridges the gap between the tactile experience of physical shopping and the efficiency of online shopping. Thus, the adoption of 3D technology is a strategic step for the fashion industry to improve product accuracy, reduce operational costs, and strengthen competitiveness through more realistic and interactive product presentations in the digital era.

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