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Investigating the Use of Blockchain Technology in Fashion and Textile Industry

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ABSTRACT

This study investigates the utilization of blockchain in textile and fashion firms and ascertains the motivations behind integrating this technology, along with the anticipated outcomes. The research examined nine textile and fashion companies in a specific region, offering insights into their future implications. Interviews were conducted with representatives from these companies. In light of the information obtained, it has been revealed that eight out of these companies currently do not use blockchain; however, most of them expect the adoption of this technology for future applications, citing its potential to address supply chain challenges and enhance customer satisfaction through transparent traceability.

Keywords: Blockchain technology, Textile, Fashion, Supply chain, Traceability

INTRODUCTION

Software capable of providing superior security for data across all industries has begun to emerge as technology advances. Blockchain technology, in particular, enhances the security of data on the network by employing a unique approach. This involves storing data in blocks, with a chain structure connecting these blocks, thereby bolstering the privacy and security of the system. The foundational elements of blockchain are built in a decentralized manner, independent of external infrastructure. Online transactions are carried out within a decentralized, highly secure network (Gore *et al.*, 2023). Blocks serve as the storage units for data, and when a sufficient number of these blocks are linked together, they form a chain, giving rise to a blockchain. These blocks are utilized to store data in a manner that makes it challenging for unauthorized users to alter or hack the digital ledger. Governments can benefit from the adoption of blockchain and virtual currency. However, it could be challenging to integrate with other databases because every government agency has its own. Future advancements in blockchain technology will enhance the effectiveness of data management. The banking, security, real estate, healthcare, education, and supply chain industries will all continue to employ the benefits of blockchain technology (Patan *et al.*, 2023).

Globally, there is a goal to initiate the utilization of blockchain technology's innovative potential in other major sectors, expanding its scope beyond financial uses. It is claimed that the employed blockchain technology offers five main advantages: improved security, greater transparency, instant tracking, enhanced speed and efficiency, and automation (*Europe's Future in Blockchain Technology - EU Business News*, nd). These advantages are expected to support the utilization of blockchain technology in alternative sectors, one of which is the textile and clothing industry.

The main purpose of this research is to investigate the use of blockchain technology from the perspective of textile and fashion industries by focusing on a specific region in Türkiye. As stated by Takaoglu, *et al.* (2019) blockchain is mainly applied to energy management, smart contracts, real estate and title transactions, foundation and contribution activities. It is also utilized for internet security in addition to these applications in Türkiye (Takaoğlu, Özer and Parlak, 2019). Yet, the amount of knowledge regarding the use and understanding of blockchain in Turkish fashion and textile business is rather limited and needs investigation. Therefore, to examine the current status and to draw an overall picture regarding the textile and fashion industry, interviews were held with Turkish fashion designers, as well as textile and fashion enterprises, in this research. An overview of current applications of blockchain in the textile and fashion industry is also presented, along with some outstanding examples from the industry.

BLOCKCHAIN APPLICATIONS IN THE TEXTILE AND FASHION INDUSTRY

When examining the supply chain of the contemporary textile and fashion sector, several difficulties are discovered. These challenges include the lack of transparency in the supply chain, poor inventory management at different levels, and the potential for unexpected circumstances, such as natural disasters, leading to losses in cash flow, reputation, and raw materials. However, businesses in the textile and fashion industries that choose different levels of integration might be able to record all transactions related to textile and fashion production using blockchain as an immutable database. This includes distribution, logistics, and payment operations. The main aspect expected to make this application useful in the future is that blockchain automates many tasks. If blockchain is used in the textile and fashion industries, it is anticipated to reduce costs, expedite delivery, and, most importantly, mitigate global environmental issues ('Blockchain Can Revolutionize the Textile Industry. Here's How.', nd). Additionally, with blockchain technology, various issues, such as supply chain, product preparation, and fair labor, can be assessed and recorded. In the textile and fashion industries, the most important issue is the lack of transparency, which has long characterized the management of the fashion supply chain, leading to increased costs and inefficiencies in the sector. With the use of blockchain technology to enhance visibility in supply chain operations, fashion enterprises can trace specific production processes from raw materials to the finished product, including warehousing, shipping, and delivery (Chang and Chen, 2020).

Blockchain-supported smart contracts can establish a crypto-legal documentation system that complies with multiple laws to precisely track global operations in the fashion industry and ensure transparency in the sourcing, production, and distribution of fashion products. Immutable records allow documentation and verification of design originality and royalty payments, thus reducing intellectual property crimes. Blockchain technology helps protect consumer personal data in the fashion industry as it uses a unique user digital signature. Blockchain technology offers opportunities to globally accelerate the digital fashion movement characterized by digital collection, digital transactions, and digital tailoring (Fu et al., 2018).

EXAMPLES FROM FASHION BRANDS USING BLOCKCHAIN TECHNOLOGY

For luxury fashion brands seeking digital provenance and authenticity, blockchain technology has the potential to be a powerful tool in the fight against counterfeit luxury products. In March 2019, the "Aura" initiative, a collaborative effort involving LVMH Group, Quorum, Microsoft, and ConsenSys, utilized blockchain technology to facilitate customer verification of the authenticity of fashion products and ensure supply chain transparency. This transparency serves to address growing consumer concerns regarding factory locations, production procedures, environmental implications, and support for human rights (Mesjar et al., 2023). By leveraging blockchain technology in this way, LVMH is improving its ability to combat fraud and protect the interests of its customers (Apicelli, 2023).

Moreover, non-fungible tokens (NFTs), a digital combination of art, film, and other virtual materials, are gaining popularity in the sports fashion industry as sportswear fashion brands respond to increasing market demands for innovation and personalization. Nike is encouraging the adoption of blockchain technology by acquiring RTFKT, a blockchain-based sneaker startup studio, and launching "Swoosh," a platform and community ecosystem driven by blockchain technology. With the latest advancements in blockchain technology at its disposal, Nike has embarked on a more ambitious exploration of product innovation for the metaverse (Davies et al., 2024). As depicted in Figure 1 of the collaborative study conducted with RTFKT and Nike, individuals are shown interacting with products on their feet before acquiring them as non-fungible tokens (NFTs) through the Snapchat application. This virtual try-on experience allows consumers to assess the suitability of the product before making a physical purchase.

Moreover, ZARA, one of the most well-known fashion brands in the world as a fast fashion brand, has used radio frequency identification and blockchain technology to improve real-time supply chain transparency and data exchange. ZARA can more precisely assess supply chain participants and reduce the cost of supply chain coordination by using blockchain-based smart contracts to automate the recording of transactions and the flow of data throughout the chain (Pérez *et al.*, 2020).

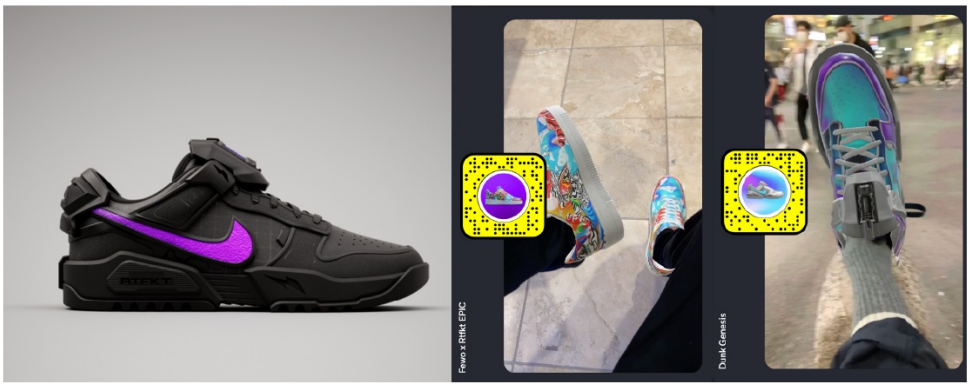

Figure 1: (Left) RTFKT x Nike, NFT sneakers. (Right) RTFKT, blockchain-based Nike sneakers can be tried on through an application (rtfkt.com, nd.), (2024, January 23).

The capability of blockchain to ensure legality, security, and transparency in the supply chain is further enhanced by the direct generation of smart contracts. The advent of Non-Fungible Tokens (NFTs), digital assets acquired by consumers on the blockchain alongside smart contracts, introduces novel dimensions to the fashion industry. The status of being a collector offers potential future sales as licenses and opportunities to enhance brand value. In response to sustainability challenges, facilitated by the emergence of NFTs, the fashion sector is perceiving a transition towards slow fashion, emphasizing more durable and sustainable product offerings. Beyond sustainability concerns, immersive technologies such as blockchain-integrated 3D simulations and visualizations are diversifying their applications beyond the realm of fashion. These technologies streamline the design and production processes by facilitating efficient prototyping and virtual fashion showcases (Rocha, 2023).

INTERVIEWS WITH TEXTILE AND FASHION COMPANIES

Procedures

In this research, interviews were conducted with textile and fashion companies and designers to acquire an understanding of the sector's current approach to blockchain technology. 20 businesses that were considered appropriate were chosen from Izmir/Türkiye. Nine of these were willing to contribute to the research and participated in the interviews. The next phase involved scheduling meetings with the selected companies and determining whether they were using blockchain technology. A set of questions was directed in the interviews based on the company's use of blockchain. The interviews were audio-recorded with the permission of the companies.

The information obtained at the end of the interviews was first transcribed using an application called "transcritor". Later, the interviews, which were transcribed using the qualitative analysis application called "taguette", were evaluated according to appropriate keywords. For data privacy, each company is assigned a specific number for evaluations.

RESULTS OF INTERVIEWS

The primary finding of the study reveals that only Company #5 out of the nine interviewed companies utilize blockchain technology. Specifically, Company #3 employs blockchain solely for identifying the cotton utilized in their operations. However, all companies expressed intentions to understanding the benefits of blockchain and transition to blockchain technology eventually. The interview analysis identified key terms that were most commonly used, including: (1) success factors and customer satisfaction, (2) software and supply chain challenges, and (3) traceability.

1. Regarding the success factor, eight out of nine companies believe that blockchain will provide information faster and enhance the performance of companies compared to the software alternatives they currently use. They also anticipate that blockchain will create a more secure environment for company payments. Additionally, the transparency of traceability, facilitated by the integration of blockchain with QR codes added to products, is viewed by companies as a success factor that will increase customer satisfaction. Moreover, certain situations, which may not be clearly presented to other parties based on the main certificates held by environmental companies, can be resolved through the transparency provided by blockchain. Consequently, this is expected to bolster the success rates of the companies.
2. Companies identify most of the difficulties they experience as arising from the supply chain. Challenges such as failures to complete work or incomplete entry of certain data in company-specific software compound issues in the supply chain. Furthermore, difficulties arise when the software programs they use are unable to delete incorrectly entered data, leading to concealed errors that exacerbate supply chain problems. Moreover, there are concerns regarding potential challenges in effectively controlling and monitoring various stages of work. This situation arises from the perceived challenge in ensuring complete compatibility between the artificial intelligence utilized in the design process and blockchain technology, as indicated by Company #6.

   Also, Company #1 attributes some of the difficulties to perceived energy consumption associated with blockchain technology. Company #6 encounters challenges in safeguarding design rights stemming from the limited adoption of blockchain technology. Consequently, they rely on conventional methods for protection. Furthermore, the company asserts that this circumstance is solely attributable to the information available to them.

   According to Company #2, failures in areas such as design security or sustainability are anticipated due to incorrect entry of supply chain and quality control data into the systems they use. Regarding software, companies utilize nearly identical systems such as ERP, SAP, PLM, and V3 Nebim software.

In addressing supply chain concerns, Company #2 contends that products with inaccurate dimensions are dispatched without adequate inspection, particularly within the overseas-based supply chain, thereby presenting challenges for companies. Nonetheless, they posit that the integration of blockchain technology can mitigate such issues by enabling preemptive resolution of errors. This assertion is predicated on the notion that comprehensive data, including clothing measurements, will be systematically recorded on the blockchain.

Another significant challenge highlighted by Company #7 is human rights issues in the supply chain, which they believe can be addressed through the implementation of blockchain.

Despite experiencing fewer supply chain issues compared to other companies, Company #6 still transmits information shares through its Enterprise Resource Planning (ERP) system. Nevertheless, they acknowledge encountering challenges within the supply chain attributable to the disparate systems utilized in Europe and Türkiye. Nevertheless, they posit that blockchain technology holds promise in averting such difficulties, potentially offering a solution to the interoperability challenges posed by distinct systems across regions.

Overall, concerns regarding data accuracy within the supply chain and delays in data sharing significantly contribute to notable challenges within the supply chain. As a general opinion, interviewees suggested that these issues could potentially be alleviated through the implementation of blockchain technology.

3. Regarding traceability, only Company #3 plans to leverage blockchain technology specifically for tracing cotton. As a clothing company specializing in products made from organic cotton, Company #3 envisions a future where all relevant product information can be readily accessed through blockchain technology. They emphasize their primary objective of implementing blockchain for the traceability of the cotton they produce. Overall, only three out of nine textile companies assert that ensuring traceability within the supply chain is of paramount importance, emphasizing that advancements in this domain directly impact customer satisfaction. Moreover, these three companies expressed their intention to transition to a digital product passport application for finished products in the future.

   Regarding customer satisfaction, companies generally believe that customer satisfaction will increase when traceability is transparent. They plan to achieve this transparency by presenting all information to consumers through QR codes or digital product passports.

   Overall, only Company #5 holds the belief that blockchain is energy-intensive and unsuitable for implementation within the textile industry. Conversely, the remaining eight companies express intentions to explore blockchain technology in the future, anticipating greater benefits than initially envisioned. However, among these eight companies, only Company #3 has made preparations for the adoption of blockchain. Notably, there is no definitive timeline regarding when the remaining companies intend to transition to blockchain technology.

It is anticipated that this study will contribute to bridging gaps in the literature and illuminating aspects related to textile companies. This study sheds light on companies that operate using traditional methods. Additionally, it underscores the importance for companies that blockchain technology can minimize mistakes and highlight transparency.

CONCLUSION

This study aims to explore the relevance and extent of blockchain integration within companies in Türkiye. Nine companies were subjected to interviews as part of the research process. The companies interviewed in this study are not currently utilizing blockchain. Conversely, eight out of nine companies anticipate that adopting blockchain will lead to increased success in the future. Every company faces challenges in the supply chain, but they express confidence that blockchain's secure and immutable ledger can address these issues. Despite facing similar challenges stemming from the utilization of nearly identical software, the companies hold the collective belief that blockchain technology harbors the potential to alleviate these issues. Furthermore, all companies believe that customer satisfaction will rise when providing traceability to consumers in a transparent manner using blockchain-integrated software, such as QR codes. Additionally, eight out of nine companies are contemplating experimenting with blockchain in the near future.

For future research, reaching out to a larger number of companies is suggested. Additionally, it would be beneficial to include various companies, not only from Türkiye but also internationally, including well-known enterprises, to explore the utilization of blockchain in the textile industry.

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