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STAKEHOLDERS' READINESS FOR ADOPTING BLOCKCHAIN IN THE FASHION INDUSTRY

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Abstract. *This paper examines the current state of readiness among stakeholders in the fashion industry regarding the adoption of blockchain technology. The main aim of the research paper is to assess the industry's preparedness and identify potential barriers and opportunities associated with implementing blockchain solutions. Recognizing the need for additional investigation in this domain, the paper presents a model that addresses pertinent questions related to blockchain technology. The research focuses on exploring the advantages that blockchain technology can bring to the fashion industry's supply chain. Furthermore, the research paper emphasizes the significance of evaluating stakeholders' readiness levels for embracing blockchain technology. By utilizing the proposed model, the findings of the research paper are examined and analyzed. The paper presents a novel business model specifically designed for implementing blockchain in the fashion industry. The proposed model aims to facilitate the adoption of blockchain technology in the industry's supply chain. To evaluate the readiness of fashion industry stakeholders to adopt blockchain, the research paper employs the TOE model. The collected data from stakeholders will be subjected to analysis using the PLS-SEM with the assistance of the SmartPLS software tool. By utilizing the TOE model and employing rigorous analytical techniques, this research paper intends to provide insights into the readiness of stakeholders in the fashion industry for blockchain adoption. Ultimately, this research aims to contribute to understanding blockchain technology in the fashion industry and pave the way for its successful implementation in the supply chain.*

Key words: *Fashion industry, Blockchain, Fashion supply chain, Stakeholders*

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1. INTRODUCTION

Digitalization has had a significant impact on the fashion and textile industry, transforming their complex supply chains and enabling more efficient management of raw materials. Therefore, this complexity of the industry requires the system to be transparent, distributed, and able to protect intellectual property. On the other hand, with today's technology development and modern approach to business, there is an increasing desire to create a stable system that will greatly facilitate the monitoring and control of this complex set of information.

The fashion industry surrounds us every day in this modern world and plays a significant role in everyone's life. Likewise, the development of the technological production system, both in many industries and in fashion, has caused significant changes in terms of industrial automation. Constant investment in automation ensures not only survival in the market but also the competitiveness of the products themselves. Product development, sales and marketing, manufacturing, and shipping are the four main steps in the apparel supply chain. Within each of the mentioned areas, digital technologies have the full potential to further develop [1].

In the fashion industry, blockchain should be able to enhance security and trust by incorporating an additional layer of protection, leveraging key features like decentralization, immutability, consensus protocols, and others [2]. One of the biggest challenges this industry faces are counterfeit products flooding the market. These counterfeit products harm the image and value of the brand. Blockchain can protect and secure digital identities and establish authenticity in the fashion industry. Centralized control is eliminated as reliable, secure, and immutable transactions are enabled [3].

On the other hand, a big problem is the management of the supply chain, which consists of a series of key business processes from the supply of raw materials to the delivery of the specific product to the end user. The fashion industry supply chains are complex, involving numerous intermediaries in a comprehensive network. Long delivery times, a high degree of uncertainty about consumer demand, as well as the necessity to respond quickly to requests make the supply chain much more complicated. Because of all the above, the flow of information in the chain must be smooth, accurate, and in real-time. Customers strive for transparency and visibility throughout the entire supply chain, which the current traditional chain does not fully enable, although most brands today use it [2, 4]. Blockchain, on the other hand, makes all this possible, and that makes it significant and essential in the supply chain itself.

In this paper, we will explore the impact of blockchain technology as one of the modern technologies and how it can change the fashion industry, showcasing its operations beyond the point of sale.

The main aim of this paper is to test stakeholders' readiness for adopting blockchain in the fashion industry. The paper proposes an innovative business model for applying blockchain in the fashion industry. To examine the readiness of the stakeholders in the fashion industry to adopt blockchain technology in the supply chain, we will use the TOE model. Collected results will be analyzed using the PLS SEM method, and the SmartPLS software tool.

2. Blockchain Technologies in the Fashion Industry

Blockchain is a type of technology that enables the automation of business transactions themselves by not storing the data in standard databases, but their mental storage is done in a system consisting of the master data of administrators and large management teams [2]. This makes the blockchain a distributed database with a peer-to-peer architecture. "Distributor" means that the data is stored in a higher place, and "peer-to-peer" means that there is no central authority that holds a master copy of the data. In this way, the problem of synchronizing the actions of the participants in these transactions is removed after everyone enters a different value into the database itself.

The fashion industry has evolved over the past 20 years when boundaries first began to expand globally. Influenced by dynamics, mass production, and multi-layered modified supply chains, retailers are forced to apply a model of low cost and high flexibility in design, quality, delivery, and speed to market. There is high competition and the concept of "fast fashion", which leads to pressure on the fashion market to constantly renew products. All this ultimately results in a shorter product life cycle and negative consequences for the environment through the accumulation of textile waste.

One of the biggest problems facing this technology from the fashion industry is the counterfeit products that flood the market these days. Counterfeit products are consumer goods that are not genuine but are designed and branded to look identical to authentic products. Therefore, consumers are fooled and believe that such products are authentic. Such products harm the image and value of the brand itself. Blockchain can protect and create secure digital identities and thereby establish authenticity in the fashion industry [2]. Merging the fashion industry with blockchain can enable manufacturers to provide better service to their customers.

With blockchain technology, a unique identity is provided to designers, which is why many brands are already starting to implement this technology in their business models. This paper will present the possibilities of applying blockchain technology in the fashion industry, as well as the design of blockchain systems and smart contracts that will be used between different stakeholders in the value chain.

2.1. Blockchain Technologies

Today, in the world of digital technologies and with the development of the digital economy, the way of doing business and exchanging digital information is increasingly changing. Business is expanding, and information and data are increasing and intensively exchanged, which leads to the need to ensure and secure the transfer of transactions through the network. This consistency of data and transparency of information exchange can be achieved by applying blockchain technology.

The English word Blockchain means chain of blocks which represents a cryptographically protected chain of transaction blocks. Each transaction represents one block, and the blocks are connected in a chain [5]. Block binding itself is cryptographic and each block is linked to the next one, so changing the content of one entail changing the content of all the blocks that precede it [5].

Each member of the network has an identical copy of the blockchain, and all members are aware of the content, and they verify together the blocks in the chain. Each block also contains information about the previous block that is hashed using an algorithm, which prevents hacking and unauthorized access to information. At the request of a new transaction,

it is necessary to adopt a new block into the chain, but only after the transaction it contains has been verified by other participants. If there are inconsistencies between this block and the previous blocks, verification is missing, and this results in the rejection of the block's inclusion in the blockchain [5]. On the other hand, if the block is successfully verified, it is added to the chain linked to previous blocks, and cryptographically secured. Therefore, the transaction is approved and finally executed. Once recorded, a transaction can never be deleted or modified.

Based on this, we conclude that unanimous verification and decision-making is necessary for each transaction. It represents a consensus algorithm based on this principle of verification and validation. We will learn more about the consensus algorithm in the section with blockchain elements.

Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis has become one of the key tools used by various businesses for strategic management. Using a SWOT analysis, it is possible to determine where blockchain technology is the strongest, i.e. what are her virtues, where is she weakest and what are her weaknesses. It is possible to determine what potential this technology has, i.e. where there is free space for growth and development, but also where it is weakest. In this way, you get to know the environment in which you do business better [6]. SWOT analysis for blockchain technology is shown in Figure 1.

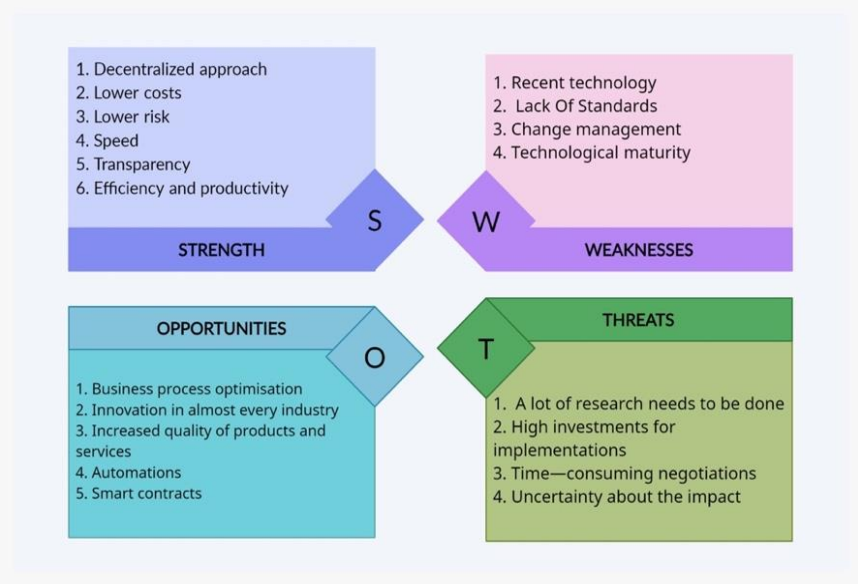

Fig. 1 SWOT analysis for blockchain technology adapted from [7]

The data obtained with the help of this analysis can be used further for some strategically important decisions, as well as for determining priority actions in the future. The goal of a SWOT analysis is to initiate proactive thinking and planning, rather than reactive decision-making [7].

2.2. Blockchain Elements

Blockchain technology has reached a tipping point and has become popular in all industries. Every company is looking for ways to take advantage of its decentralized nature and features that process transactions securely and privately. Since blockchain is widespread, it is necessary to follow its development.

These are the blockchain elements:

- Consensus algorithms
- Blockchain platforms

Consensus algorithms - It is an automatically synchronized process that logs all transactions and takes care of them at the network level. Any update is done only after the transaction has been unanimously verified [8].

There are several types of consensus algorithms that all have a common goal:

- Proof of Work: represents mining of users who solve cryptographic problems, and in return receive a certain amount of cryptocurrency. They verify each transaction and form a new block of transactions based on the previous one. A large amount of energy is consumed annually, which is a disadvantage, but on the other hand, anyone can mine cryptocurrency.
- Proof of Stake: in this case, some users process the transactions while others validate them. For a user to become a blockchain validator, it is necessary to pledge a certain amount of cryptocurrency. The reward for this work is not cryptocurrency, but compensation from the transaction cost of the blockchain network.
- Delegate Proof of Stake: in this type of protocol, there is a clear division of users into delegates and witnesses. Witnesses secure the blockchain network, and delegates compete with each other to get as many user votes as possible. Voted delegates influence the operation of the entire network and its maintenance.
- Proof of Importance: the idea of this protocol is to prove the importance of nodes in the system so that they can create blocks. Users who are actively involved in transactions, as opposed to those who trade or mine cryptocurrencies, are more important.
- Proof of Capacity: this is the type of algorithm that allows miners in the network to use their available hard disk space and does not require expensive equipment.
- Due to all the above, blockchain enables the authenticity of digital data, as well as trust and transparent exchange of information in wide IT networks.

Blockchain platforms - Today, with the ever-increasing development of blockchain, interest in blockchain platforms to streamline supply chains and improve traceability is growing. Also, on the other hand, the goal is to overcome challenges in terms of energy consumption and speed.

The goal of blockchain platforms is to enable the development of blockchain-based applications. Ethereum, Hyperledger, Algorand, R3, Ripple, and EOS are some of the names that have built blockchain frameworks by allowing users to host and develop applications on the blockchain.

Some of the basic features that need to be considered when choosing a blockchain platform are shown in Figure 2.

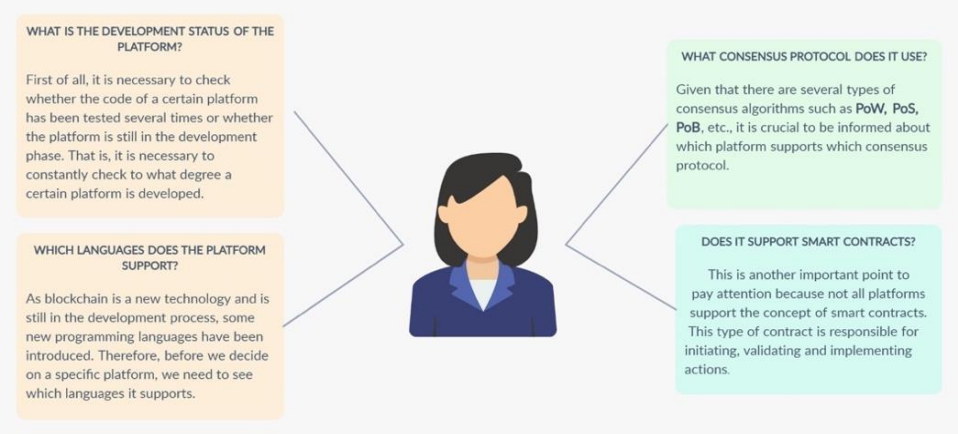

Fig. 2 Essential features of Blockchain platforms

Today, people have many platforms at their disposal, considering that they discovered the ability of blockchain by building blockchain applications. Currently, the five most used blockchain platforms stand out.

Ethereum is one of the oldest and most respected blockchain platforms. It provides a decentralized blockchain with support for smart contracts. It supports business applications but also has its cryptocurrency called ether. It contains tools for writing smart contracts on a virtual machine. Also, it has an active team of developers that has more than 250 members and is constantly working on improving the current business.

The platform is transitioning from proof of work to proof of stake, a more economically viable algorithm with lower energy consumption.

IBM Blockchain is one of the most suitable and successful platforms for less risk-averse business customers. It represents a private and decentralized blockchain network and is designed to be flexible, functional, and adaptable Significant investments were made to develop a user-friendly interface, simplifying tasks, enabling easy testing, and fostering smart contract creation. Currently, the platform is making notable strides in financial services, banking, and supply chain.

Hyperledger Fabric platform forms a set of tools to help create blockchain applications or build solutions using a modular architecture. The modularity of the architecture allows network designers to include their desired components, such as different consensus algorithms, which differentiates this platform from other blockchain solutions. It implies the use of a distributed ledger of data in companies. It works well in closed blockchain implementations and provides good security and speed. Today's platform developments provide additional support to any organization that chooses to join the channel. Namely, it is not necessary to previously copy the entire data history, which enables a faster startup process with less required storage space. Today, the platform's organizing team and the entire community are working on adding new features related to consensus algorithms, and privacy options, and improving current business and operational solutions.

Hyperledger Sawtooth is another open-source blockchain platform designed to create, deploy, and execute distributed blocks of data without central authority. It uses a new Proof of Elapsed Time consensus algorithm that allows this platform to be integrated with

hardware security solutions, known as "trusted execution environments", which represent protected areas of computer memory. Also, mechanisms are currently being adopted that will improve transaction processing as well as expand the capabilities of smart contracts.

R3 Corda is an open-source platform built in 2015 and is a state-of-the-art blockchain platform that allows institutions to transact directly through smart contracts. It allows data access only to authorized participants and not to the entire network. Therefore, it improves privacy and offers fine-grained control over access to digital data. It was originally designed for the financial sector, but today it is also applied in healthcare, supply chain, and many other areas.

Algorand was founded in 2017 by Silvio Micali and is an open-source public blockchain that uses proof of stake to achieve consensus. Silvio founded Algorand as a fully decentralized, secure, and scalable blockchain that provides a common platform for building products and services for a borderless economy [9]. Algorand owns the Algos currency, and all users have the right to participate in selecting and writing a given block in the blockchain. At most one block is certified and entered the chain so we can use its finality property to confirm a transaction in just a few seconds. When it comes to an account in Algorand, it consists of a corresponding private key and a unique public address. Each account has certain associated data on the chain and some a person can sign and send to the blockchain transaction from his account if he uses the private key. As for smart contracts in Algorand, we can split them into two categories, stateful and stateless. Both categories of smart contracts are written in the Transaction Execution Approval Language (TEAL). These two categories of contracts are often linked together, this is usually done when some persistent data (stateful), either local or global, which is paired with some type of spending transaction (stateless) needs to be stored [10].

Another great advantage of Algorand is that it implements the Pure Proof-of-Stake mechanism, which is more environmentally sustainable and requires minimal electricity in which block validators do not choose based on the number of tokens they have invested, but that choice is random through a Verifiable Random Function (VRF). VRF acts like a kind of lottery as if every participant who has [11].

Blockchain moves at a rapid pace of innovation, and new platforms are constantly being developed with additional features and new releases. Therefore, today there are many blockchain platforms around the world, and companies are obliged to understand them well and decide on the one that is most suitable for them and provides them with the most value.

2.3. Blockchain in Supply Chain in the Fashion Industry

As blockchain has become more and more advanced, many fashion brands are starting to introduce this technology into their business and use all its benefits. There are several domains within the fashion industry where the application of blockchain technology not only facilitates the process itself but also makes it more efficient and better for both stakeholders and consumers.

When we mention the fashion industry, we have to take into account that it is an industry that brings in more than 450 billion dollars in global sales, which makes it one of the most important industries with the highest income worldwide [12]. In addition to bringing in the highest revenues, it is also one of the most environmentally damaging industries and is constantly under pressure to move to a more circular economic model.

From the very beginning and the design phase to the production and service phase, the ideas of the circular economy are pushing the fashion industry to give more importance to concepts such as sustainability, recycling, and modernization. These very concepts are part of the transition of the fashion industry to the circular economy, and the main focus is on aligning values throughout the supply chain, especially consumer values. This circular economy differs from the traditional linear model in that the traditional model focuses on how to use resources efficiently, while the circular economy focuses on how to use them eco-efficiently. In the circular model, the focus is on recycling discarded items to create items with greater value. Regeneration and use of waste can affect the increasing competitiveness of the company and reputation, lower costs and minimize the burden on the environment.

When we talk about the introduction of blockchain technology, it is necessary to understand well which are the segments in which it can be applied and what it can provide us concerning traditional ways of doing business. It is very important to consider in detail all aspects of the application, compare costs, and see what the results and effects of use are the most effective. In the next chapter, it will describe the application areas of blockchain in the fashion industry [2].

These are areas of application of blockchain in the fashion industry [2]:

- **Tracking of materials and finished products.** Inventory management based on blockchain provides a clear system for maintaining and updating inventory in real-time. With the help of a connected blockchain, it is possible to easily track all available inventory items. On the other hand, blockchain provides better inventory forecasting and therefore we can more easily manage them and meet the dynamically changing demands of users.
- **Security.** Smart contracts regulate the right of access to only legitimate entities of the system. Each entity has a specific role based on which it has access to the system. Also, on the other hand, the anonymity of blockchain technology allows users to communicate with each other without fear that their data will be misused.
- **Supply chain.** As traditional supply chains have failed to meet customer demand for reasonable prices and high quality, it is recommended a new approach based on a sustainable supply chain. Real-time tracking of goods and services, coupled with advanced analytics and blockchain technology, enables more informed decisions for supply and demand balance [2].
- **Distributed management.** Blockchain provides the possibility of distributed organization of data. This data is all linked together through the blockchain. Blockchain technology allows for a decentralized network of goods and services, eliminating the reliance on a single server [2]. With distributed data, there is greater security because there is no centralized control. This mechanism provides great efficiency and scalability, especially with increasing customer needs.
- **Product authenticity.** When we look at the fashion industry today, what sets brands apart is the creativity, uniqueness, and quality of the designs and products themselves. It is precisely for this reason that counterfeiting of fashion pieces is often encountered and brands face a serious authentication problem. Therefore, blockchain technology offers the possibility of embedding chips that ensure the legitimacy of goods and services. It is also possible to track the product throughout the entire life cycle from raw materials to the final product.
- **Inventory management.** Based on blockchain-based tags, products, and services can be tracked from the beginning to the end of production. There is also the possibility of providing information to clients about the history of clothing, the origin of raw materials,

the life cycle of the product, what procedures are involved in making the product, and the like. This instills additional trust and security in users, which gives them a great advantage over competitors.

3. Designing Business Model for Application of Blockchain in the Fashion Industry

Supply chain management in the fashion industry consists of a series of key processes such as procurement of raw materials, both in-house and from external merchants, production, quality control, and delivery to the end user. The supply chain is very complex and consists of many interrelated processes and participants, which must be well coordinated and harmonized for the result to be satisfactory.

Today we are faced with increasingly long delivery times, short seasons, and great consumer uncertainty. Therefore, to meet the needs of customers, supply chains must respond quickly to changes, and to achieve this, the flow of information must be smooth, accurate, and in real-time [2].

Figure 3 shows all the processes that are involved and their mutual connection and dependence in the supply chain in which the blockchain is implemented. To model a blockchain-based system, it is necessary to understand and analyze all the operations it involves. Only after a good analysis can data management and traceability be ensured at different levels of the supply chain.

Most of the partners in the cycle itself take raw materials in certain forms as input data and after the operation, the product is passed on to the next partner in the chain. This process is repeated until the final product is delivered to the seller. As a result, in each phase and process of such a system model, a large amount of information is generated, which must be adequately managed. Each participant must take care of flow control and protection of confidential information. Therefore, all information is recorded and stored in a blockchain-based distributed ledger, so that it can be easily shared between all partners [14, 15]. With this technology, all participants in the supply chain would be safe and would always have insight into all the production processes of a single product from the fashion industry.

In the phase of procurement of raw materials, blockchain integration enables tracking the source and origin of raw materials and providing all the necessary materials for further production. The quality and authenticity of raw materials, as well as compliance with environmental protection laws, can be ensured using this technology.

The next phase, the design phase, refers to defining the very appearance and model of the product and represents one of the key processes of every fashion brand. As we face an increasingly common problem of counterfeiting, manufacturing, and selling non-original products, blockchain technology is developing a mechanism that allows fashion brands to remain protected from copyright infringement and intellectual property theft. Blockchain-based tags can be used to uniquely identify designs in an unforgeable digital format [2].

The next step is the mass production of the product according to the predetermined design and type of material that is recorded and forwarded in the supply chain. At this stage, blockchain technology can be used to monitor the production steps and transparently control them.

After successfully realizing production, product distribution to all planned locations follows. Here it is possible to track items during the transport cycle until they reach the desired destination.

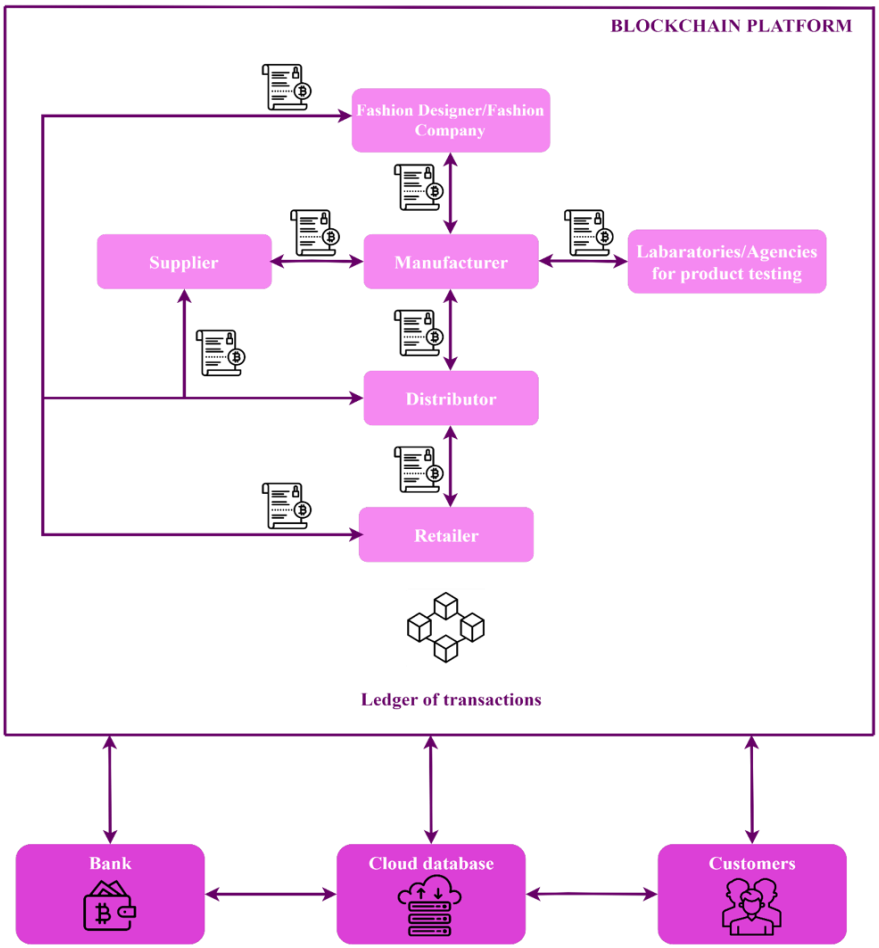

Fig. 3 Blockchain application model in the supply chain

During the entire supply chain, it is possible to use blockchain tags, bar codes, and GPS devices that are intended for constant monitoring and registration of all raw materials, products, and shipments. The entire life cycle of all products will be recorded and publicly available to all participants in the chain, to track all interactions, transactions, and exchanges.

Another activity that is available in this system is compliance with all regulatory, industry, and consumer standards in a transparent and reviewed manner. In this way, business operations are ensured they are credible, ethically correct, and by the policy and culture of the company itself. Also, all regulatory inspections have transparent insight into the life cycle of all raw materials and products. An additional advantage of using blockchain

technology in the system is the possibility of auditing by monitoring all interactions in each supply chain process. Problem areas and possible problems can be easily determined and thus proactively react and prevent their occurrence.

Shopping as the next stage is made possible by a transparent and secure payment method using blockchain technology. All transactions are fully valid, transparent, and not subject to any fraud and abuse. This significantly increases security and trust among consumers, which is one of the key advantages compared to the competition.

The last possibility of blockchain technology in the resale phase is the monitoring of the products themselves even after the initial purchase by all participants of the supply chain. In this way, additional data can be collected and the life cycle of the product can be better understood.

The supply chain, as we mentioned, consists of many interconnected participants and starts from the supplier, then passes through various partners to finally be delivered to the end user. The blockchain technology applied in this case serves to track all transactions, regulate interactions, and collect key traceability information [15]. Any cooperation between partners during production must be by the legal framework and achieved in such a way that both interested parties agree. In the system model described above and designed with the help of blockchain technology, these rules and obligations are defined through smart contracts.

Smart contracts set the rules that govern all business transactions and are available to all participants in a transparent manner [16]. Every completed transaction must first be verified by the set rules before being recorded in the blockchain. Each address corresponds to a specific account with a specific balance, and transactions contain information about the transfer of funds between different accounts. A transaction is confirmed and recorded only when the sender has a value in the account equal to or greater than that required for transfer in the transaction. Therefore, this type of transfer of funds is not susceptible to fraud and abuse, which additionally instills security for both production participants and end users [16].

On the other hand, smart contracts also establish other obligations of all participants, from the required number of raw materials, types of models, delivery dates, and all other key information that is necessary for the production to be carried out adequately. The algorithm checks whether the partner has the appropriate number of raw materials so that the further flow of production is smooth. The goal is to make production accurate, safe, and error-free [17]. In this way, each partner is included and instructed in the activities of the previous participant, and upon completion of his contribution and performance of one stage in the production, the process is further forwarded to the next partner, who continues with the started work. In this way, the supply chain is completely transparent, controlled by all participants, and designed to advance business and avoid delays and other problems that the fashion industry faces.

3.1. Blockchain – based Business model for fashion industry

In the upcoming chapter, the "Blockchain-based Business Model for the Fashion Industry" will be elucidated, along with a detailed description of all its elements (Table 1).

Table 1 Blockchain – based business model for fashion industry

Business idea: Offering fashion and quality at the best price in a sustainable way and creating a Blockchain-based business model for the fashion industry.
Products and services: Clothing, footwear and accessories

Partners	**Key activities**	**Suggested value**	**Relationship with users**	**Market segments**
- Fashion designer - Supplier - Manufacturer - Agencies for product quality testing - Distributor -Media partners (public figures, influencers...) - Retailer - Bank - Customers	- Raw material sourcing - Manufacturing & Production - Research & Development - Quality Control & Quality Assurance - Marketing & Advertising - Customer support - Sales & Distribution - SCM - Financial Control - Product Value Chain - Product Innovation - Development and maintenance of the website -Partnership development	- Transparency - Tracking all transactions - Regulate interactions - Monitoring of the products - Monitoring all interactions in each supply chain process - Minimal risk - Protection of confidential information	Communication through social networks(Instagram, Facebook and TikTok) - The possibility of replacing the product - Discounts and promotions - Brand loyalty - Timely delivery- for the business segment - Quick & friendly service for the customer segment - Referral discounts, loyalty discounts	- Part of the female and male population that follows fashion trends and prefers online shopping - Technophobe - Brands that invest in new inventions
Cost structure	**Key resources**		**Channels**	**Revenue Streams**
Website development, marketing costs, employee salaries, equipment maintenance costs, brand advertising costs, material costs, designer costs, legal formalities, fabric costs	- Funds (govt schemes, investors) - Skilled labor, machinery, and raw materials - Professional staff - Know-how - offices, warehouses, and machines - Software & Analytics		- Distribution through the supply chain - Social media advertisement through- Instagram, Facebook, WhatsApp - Business website- for more information & direct purchasing of products - Product availability on various websites	- Product sales - Affiliate Clicks - Sponsorships - Cooperation with other brands - Ads

The focus is primarily on the development of the website and online store for the fashion brand. Partners include suppliers for pre-contracted goods, a courier service for delivery, media partners for marketing promotions, and payment companies for secure transactions.

Key activities involve website and store development for customer benefits and implementing an internet marketing strategy. All the mentioned activities are carried out with the help of key resources (partners, development team, physical resources). All of this is carried out to achieve the proposed value in the form of an open market that facilitates communication between the buyer and the seller. Necessary for optimal user relations, loyalty program, and secure product purchases.. The channels through which business is conducted would be the website of the brand itself, social networks, and also the websites of other companies with which there is cooperation. The target market would be women who follow and love fashion but also prefer online shopping. Online sales of products would generate the highest income.

Taking all the above into account, the sources of costs are large. This primarily includes the costs of investment, employees, marketing, and online advertising. The costs of equipment, materials, and designers are basic and unavoidable. In addition, more and more investments are being made in the maintenance and development of the website through which one is present on the Internet.

The main and obvious source of income is the production and sale of fashion brand products. However, in recent times an increasing source of income has been certain collaborations with brands of similar culture and politics.

4. Testing Stakeholders' Readiness for Adopting Blockchain in the Fashion Industry

Today, in the fashion industry, the need to ensure traceability through production in all fields is growing more and more. It is necessary to ensure visibility and meet consumer demands in terms of transparency and quality assurance. It is difficult for customers to access information about the product, the origin of the material, and the authenticity of the product itself. On the other hand, all stakeholders in the supply chain have a challenge in sharing key information with the environment due to the risk of manipulation and exploitation of confidential data. Due to all of the above, blockchain technology is proposed to enable compliance in the supply chain and network architecture at the organization level. The proposed system can be built so that trust will be based on a technology that has a distributed database for storing and authenticating all transactions in the supply chain. Also, on the other hand, all authorized partners have the opportunity to monitor their supply network and create a sustainable and transparent supply chain.

4.1. Research Question

The main hypothesis of the test is to determine the readiness of all interested parties for the application of blockchain technology in the fashion industry. Therefore, the goal is to conduct research by surveying all participants and to plan future directions of research and the introduction of blockchain in the fashion industry based on the conclusions obtained.

The technology-organization-environment (TOE) model is a statistical technique used to measure the impact of a specific intervention, program, or treatment on an outcome of interest. While TOE is commonly associated with education and assessing teacher effectiveness, it can be applied to various fields and contexts. The basic premise of TOE is to compare observed outcomes with expected or predicted outcomes, taking into account

various factors that may influence the outcome. By doing so, it aims to isolate the value or contribution of a particular factor or intervention in influencing the outcome.
TOE involves analyzing data over time, typically at an individual or group level, to determine the change in outcomes that can be attributed to a specific intervention. This could involve comparing pre- and post-intervention scores, comparing treatment and control groups, or analyzing the relationship between variables of interest.

In this paper, the TOE model will be used to examine the readiness of stakeholders in the fashion industry. This model contains certain categories that include very important roles in making the main decision in accepting new technologies and opportunities [18, 19]. The adoption of this technology will enable various benefits in concrete business and cooperation between all interested parties.

The data that will be analyzed later was collected by surveying various participants in the supply chain in the fashion industry. In this way, we will have a realistic representation of the current state and readiness of the participants to improve and adopt new technology. Participants of various demographic characteristics will be surveyed, to include more factors in considering the eventual adoption of blockchain technology.

This technology would make it possible for all transactions between interested parties to be transparent, which leads to greater security and trust. Also, a unique identity is provided to designers, without the possibility of counterfeiting products, as well as the design of blockchain systems and smart contracts that will be used between different stakeholders in the value chain.

The survey is carried out using the TOE model to examine the attitudes and readiness of stakeholders for the introduction of blockchain technology. This model consists of certain categories that represent important factors for technology adoption [18, 19]. Also, it represents one of the important theories considering the different perspectives that can be considered and which are also the main obstacles in the adoption of new technology.

The model is widely used and explains different technological, industrial, and cultural contexts. In a large number of researches, it has been shown that technology, organization, and environment are key factors and influence in such a way that, based on them, every company identifies the need to adopt new technology [18, 19]. Each of them, depending on the type of study, consists of individual categories that are relevant to the given research and have an impact on decision-making.

In the context of this research, technology consists of relative advantage, complexity, compatibility, and capability. Relative advantage refers to all the capabilities and advantages of technology over any other traditional way of doing business. The question of what it is that gives added value compared to the current business is considered here. Complexity refers to the very complexity of adopting new technology and the adaptability of the company itself to the given technology. Compatibility can be defined as the degree to which an innovation fits with the potential of an existing business. The term trialability refers to the ability to try out an idea, process, or system before making a final decision to implement it or not.

As another but no less important factor stands out in the organization with its categories: top management support, organizational readiness maturity, and performance. The support of the top management has an important role because it refers to the allocation of resources, integration, and reengineering of processes, therefore it has a lot of influence on the members of the organization and the implementation of changes and decisions. Organizational readiness refers to the readiness to introduce innovation and depends to a

large extent on capital, number of employees, annual income, etc. On the other hand, the maturity and performance of the organization are closely related to the previous category and refer to the skills, experiences, and ability of the company to take risks.

The last group of factors refers to environmental factors. Competitiveness is one of the categories that defines these factors and refers to relationships with existing competition and can greatly stimulate and encourage organizations to adopt new technologies to provide better services and gain a competitive advantage. As for the state of the market itself as an additional factor, it refers to the readiness of consumers and their adaptability to adopt innovations and technologies. All other market influences from supply and demand also largely determine the outcome of the final decision. Within the framework of the environment, legal support, which refers to the support of state authorities to encourage the adoption of innovations and technologies, has a great impact. In this way, legal regulations have a great influence and can encourage or discourage companies from undertaking certain changes.

All the above-mentioned and described factors are shown in the Figure 4 and represent an important step in analysis and research, which will later play a crucial role in making decisions related to the adoption of blockchain technology in the fashion industry.

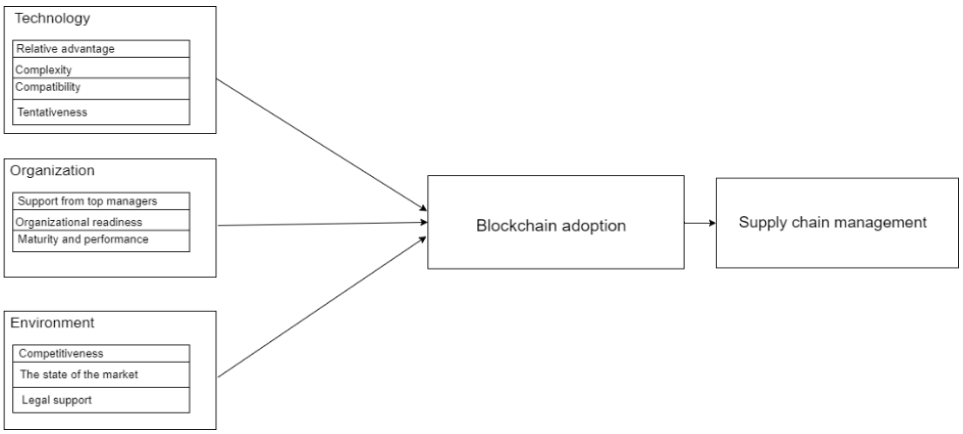

Fig. 4 A proposed framework for the adoption of blockchain technology

To examine the willingness and interest of stakeholders within this research, a survey was conducted through which all data was collected. The survey was formed according to the constructs of the TOE model, which was adapted to the topic under consideration. All questions in the survey itself are classified according to the categories mentioned above: technology, organization, and environment. The questions are aligned to include all the set factors and in this way the research is spread across multiple segments and a true representation of the readiness of stakeholders for the application of blockchain technology in the fashion industry is presented. The survey consists of 39 questions, of which 4 are demographic questions, which are not classified according to the set criteria. All questions are closed and the respondent has the opportunity to express his opinion based on a scale from 1 to 5. In the table below, all questions are classified by stakeholder research model.

Table 2 Categorization of questions by research model for stakeholders – Technology factor

	Technology
Relative advantage	On a scale of 1 to 5, rate the extent to which the following statements match your opinion when it comes to the use of blockchain technology in the fashion industry. (1: I do not agree, 5: I completely agree) [I believe that the implementation of blockchain technology would result in increased consumer trust and satisfaction.]
	On a scale of 1-5, How much safer do you think this type of business transaction would be compared to the traditional way of doing business? (1: not safer, 5: very safer)
Complexity	On a scale of 1-5, rate how complex would be the introduction of smart contracts for you and your associates. (1: it would be complex, 5: it would not be complex)
	On a scale of 1-5, rate How much easier would it be if you could transparently share your reports and data with your colleagues online. (1: it would not be easier for me, 5: it would be very easier for me)
	Rate on a scale of 1 - 5 how much you agree with the following statement: "Using this technology would be simple and practical for me." (1: I disagree, 5: I strongly agree)
Compatibility	Rate on a scale of 1-5 how much you agree with the following statement: "I would rather choose colleagues who use blockchain technology than those who don't"? (1: I disagree, 5: I completely agree)
	On a scale of 1-5, rate How much more practical would it be for you if all your associates had constant insight and the ability to monitor raw materials and products from the beginning to the end of production? (1 : it would not be more convenient for me, 5 : it would be more convenient for me)
	On a scale of 1 - 5, rate to what extent do you agree that for brand protection it is better to prosecute those who make and sell fakes compared to prevention through investing in technology that ensures the authenticity of the product's origin? (1: I disagree, 5: I completely agree)
Trialability	On a scale of 1-5, rate how inclined you are to try new technologies. (1: I am not inclined, 5: I am completely inclined)
	On a scale of 1-5, rate whether you need to use a trial version of a technology before full adoption. (1: It's not important to me, 5: It's very important to me)
	On a scale of 1-5, answer whether you doubt the safety of using new technologies. (1 : I do not doubt at all, 5 : I highly doubt it)

Table 3 Categorization of questions by research model for stakeholders – Organization factor

Organization	
Top management support	On a scale of 1-5, rate whether it would be useful for you to track information about your product throughout the entire production chain? (1: not useful, 5: very useful)
	To what extent from 1 - 5 would you like the availability of information about the product (such as the quality of the material, the amount of stock, whether the packaging equipment is sterilized, whether the product has a certificate, under which temperature and humidity the product was transported or stored, and many others) influenced the selection of collaborators? (1: it would not affect, 5: it would affect a lot)
	Rate on a scale of 1 - 5 How often have you come to a situation where you cannot agree with your co-workers due to a lack of information? (1 : not so often, 5 : very often)
	On a scale of 1-5, rate how important is it to you that your consumers have insight into all information about the product. (1: It's not important to me, 5: It's very important to me)
Organizational readiness	On a scale of 1-5, would you engage in this type of business, if your co-workers demanded it? (1: I wouldn't do it at all, 5: I would do it)
	On a scale of 1-5, rate how much you are ready for an additional cost due to the implementation of smart contracts, if the price of the product remains the same? (1: I'm not ready, 5: I'm ready)
	On a scale of 1 - 5, rate how much you are ready for an additional cost due to the implementation of smart contracts, if the price of the product is higher? (1: I'm not ready, 5: I'm ready)
	On a scale of 1-5, rate how ready you are to transparently share information with your colleagues? (1: I'm not ready, 5: I'm ready)
	On a scale of 1 - 5, rate to what extent are you ready to invest money for the introduction of blockchain in your business of collecting reliable data related to the production, storage, distribution, and sale of your products? (1: I'm not ready, 5: I'm ready)
Maturity and performance	On a scale of 1 - 5, rate to what extent you are ready to invest money in technology that would enable you to confirm the quality of your products and reduce counterfeiting? (1: I'm not ready, 5: I'm ready)
	On a scale of 1-5, rate how willing you are to invest additional time and money in training employees to use blockchain technology? (1: I'm not ready, 5: I'm ready)
	On a scale of 1 - 5, rate whether the technology for ensuring the authenticity of product origin would be harmful to your business? (1: It would not be harmful, 5: It would be harmful)

Table 4 Categorization of questions by research model for stakeholders – Environmental factor

The environment	
Competitiveness	To what extent from 1 - 5 do you think that the availability of information about the product (such as the origin of the product, what is the quality of the product, the amount of stock, whether the packaging equipment is sterilized, whether the product has a certificate, under what temperature and humidity was the product transported or stored, and many others) influenced them to choose yours rather than a competitor's product? (1: it would not affect, 5: it would affect a lot)
	Rate on a scale of 1-5 to what extent do you agree that you would achieve a competitive advantage by applying blockchain technology, given that manufacturers in our market do not use this method? (1: I do not agree, 5: I completely agree)
Market Situation	Rate on a scale of 1-5 to what extent do you think that customers would be willing to spend more money because they would be sure of the quality and originality of the product? (1: I do not agree, 5: strongly agree)
	Rate on a scale of 1-5 to what extent do you think that information about the product they buy is important to customers? (1: not important, 5: very important)
Legal Support	On a scale of 1-5, rate whether it is possible to introduce smart contracts in the fashion industry in Serbia? (1: not possible, 5: very possible)
	Rate on a scale of 1 – 5 do you think blockchain technology is applicable shortly? (1: not applicable, 5: very applicable)
Blockchain Adoption	On a scale of 1 - 5, rate what your attitude will be when blockchain technology is implemented in the fashion industry. (1: I disagree, 5: I strongly agree) [I intend to use this technology when it is implemented.]
	On a scale of 1-5, rate what your attitude will be when blockchain technology is implemented in the fashion industry. (1: I disagree, 5: I completely agree) [I intend to recommend users and contributors to use blockchain technology.]
Supply Chain Management	On a scale of 1 to 5, rate the extent to which the following statements match your opinion when it comes to the use of blockchain technology in the fashion industry. (1: I disagree, 5: I strongly agree) [I believe that the implementation of blockchain technology would increase the security and accuracy of the obtained product information.]
	Rate on a scale of 1-5 rate the extent to which the following statements match your opinion when it comes to the use of blockchain technology in the fashion industry. (1: I disagree, 5: I strongly agree) I believe that the implementation of blockchain technology would result in significant time savings, both on the part of the consumer and on the part of other interested parties.
	On a scale of 1-5, rate how the application of blockchain technology would affect your business? (1: I disagree, 5: I strongly agree) [This technology would make my process of tracking products through the supply chain easier.]
	On a scale of 1-5, rate how the application of blockchain technology would affect your business? (1: I disagree, 5: I strongly agree) [This technology would increase the efficiency of my business and that of my associates.]

Considering the model used for this research and all its variables, we will formulate hypotheses corresponding to the constructed constructs.

H1: The relative advantage of the technology affects the willingness of stakeholders to apply blockchain technology in the fashion industry.

H2: The complexity of the technology affects the willingness of stakeholders to apply blockchain technology in the fashion industry.

H3: Technology compatibility affects stakeholders' willingness to implement blockchain technology in the fashion industry.

H4: Technology trialability affects stakeholders' willingness to implement blockchain technology in the fashion industry.

H5: Top management support affects stakeholders' willingness to implement blockchain technology in the fashion industry.

H6: Organizational readiness affects stakeholders' willingness to implement blockchain technology in the fashion industry.

H7: Maturity and organizational performance influence stakeholders' willingness to apply blockchain technology in the fashion industry.

H8: Competitiveness affects stakeholders' willingness to apply blockchain technology in the fashion industry.

H9: The state of the market affects the willingness of stakeholders to apply blockchain technology in the fashion industry.

H10: Legal support affects the willingness of stakeholders to apply blockchain technology in the fashion industry.

H11: Blockchain adoption affects stakeholders' willingness to apply blockchain technology in the fashion industry.

H12: Supply chain management affects stakeholders' willingness to implement blockchain technology in the fashion industry.

4.2. Analysis of Results

In the next chapter, we will deal with analyzing the survey and conducting research to obtain adequate results related to the readiness of all interested parties for the application of blockchain technology in the fashion industry. It is necessary to observe the behavior and attitudes of stakeholders about the set constructs according to the research model and to observe all cause-and-effect relationships. In this connection, the PLS-SEM method was used, which takes into account all the constructed constructs and the questions from the survey classified according to them, and SmartPLS was used as a software tool.

When we look at our target group, the biggest focus is precisely on employees, young people, and middle-aged people, who have a significant share in business related to the fashion industry. The survey was conducted on different groups of people, of different ages and interests, to see what the preference for the application of new technologies, familiarity with the applications and importance, and in general, what is the prevailing attitude in business in the fashion industry. 55 respondents participated in the survey and the following part, all demographic data related to them were analyzed.

As for age, the largest percentage of respondents is between 25 and 35 years old, followed by 20 to 25 and only 18.2% older than 35. So we conclude that the research was mainly conducted on the younger population. In the following graph, this is also illustrated and presented in the form of a histogram.

When it comes to gender, the largest percentage of survey participants is the female population, 72.7%, which is perhaps expected, considering the field of research. The gender ratio is graphically presented in the following graph.

To collect data on the current status of the survey participants themselves, a question was asked in which the participants decide whether they are pupils, students, employed, unemployed, or retired. The survey showed that the highest percentage is employees, 89.1%, followed by students, 7.3%. Now we are already getting the bigger picture, that these are employed, young people, as can be seen in the following graph.

The last demographic question is related to the level of education of the respondents themselves. In the following graph, we can see that the highest percentage is higher education/faculty, followed by postgraduate studies.

To gradually introduce the respondents to the subject of the research, the demographic questions were followed by the following questions, with which we gain an idea of the interests and values valued by our participants.

The first question related to the extent to which they consider that their data is safe and protected within the framework of business with associates. The results showed that out of a total of 55 respondents, three of them voted that they were not completely sure, six with a score of 2,14 with a score of 3,19 with a score of 4, and 13 with a score of 5. So we conclude that the largest percentage of them, namely 34,5% opted for rating 4, or that they are quite sure about the security of their data, which can be seen from the attached.

It was then analyzed to what extent it is important to them that data throughout the production chain is never lost, changed, or misused. From the attached, we can see that the largest percentage of them, even 83.6%, answered with the highest rating on the scale, which leads to the conclusion that the security of the data they have is extremely important to the respondents.

The last question from this group, which we analyze using the graph, refers to the extent to which respondents are familiar with blockchain technology and its application in the fashion industry. The results show colorful answers, but the largest percentage answered with a score of 3, which is the expected answer considering the current application of blockchain technology in the fashion industry. On the other hand, 9 of them answered that they were fully aware, which represents a positive shift compared to the previous business and indicates that we are gradually striving for modern technologies.

The following survey questions were used in the software tool and analyzed using the PLS-SEM method.

From the attached, we conclude that each latent variable corresponds to one construct from the TOE model, and each variable is also associated with a group of questions from the conducted survey. In this way, we can monitor which questions are related to which group of factors and thus how the answers to them define the attitude of stakeholders toward blockchain technology in this area. So we can see the variables belonging to technological factors: relative advantage (RA), complexity (CPLX), compatibility (COMP), and trialability (TR). Among the factors related to the organization, we distinguish the variables: top management support (TMS), organizational readiness (OR), and maturity and performance (MPI). On the other hand, the group of environmental factors includes competitiveness (CP), market conditions (MC), and legal support (LS). The last two constructs relate to blockchain adoption (BA) and supply chain management (SCM). All these variables have a great influence on the stakeholders in our research subject and act in making the final decision related to the adoption of blockchain technology.

In the conducted survey, 55 participants from the field of the fashion industry were examined, in different positions and from different perspectives, and the following analysis was collected. If we focus only on the demographic aspect of the respondents, we present the given data in the following table.

Table 5 Demographic distribution of respondents

	Variable	Values	Frequency	%
General demographic data	*Years*	<20	0	0%
		20-25	16	29.1%
		25-35	29	52.7%
		>35	10	18.2%
	Gender	Male	15	27.3%
		Felame	40	72.7%
	Status	Disciple	0	0%
		Student	4	7.3%
		Employed	49	89.1%
		Unemployed	0	0%
		Pensioner	2	3.6%
	Level of Education	Primary	0	0
		High school	4	7.3%
		University/Faculty	42	76.4%
		Postgraduate	9	16.4%
Attitudes by degree of data security	*To what extent do you think your data is safe and protected within the scope of business with all your associates?*	5	13	23.6%
		4	19	34.5%
		3	14	25.5%
		2	6	10.9%
		1	3	5.5%
	Is it important to you that your data is never lost, changed, or misused throughout the production chain?	5	46	83.6%
		4	6	10.9%
		3	3	5.5%
		2	0	0%
		1	0	0%
Blockchain technology	*Have you heard about blockchain technology and do you know its application and importance in the fashion industry?*	5	9	16.4%
		4	15	27.3%
		3	16	29.1%
		2	2	3.6%
		1	13	23.6%

To perform a detailed analysis of the survey results, two algorithms were performed within the SmartPLS software: PLS algorithm and bootstrapping.

After applying the PLS algorithm, in the final reports, we can see detailed data related to all questions, their mutual correlation, and their relationship to the set constructs. Analyzing the report, we can see that some of the questions are not by the constructs do not measure it adequately, and are colored red.

For further research to be as detailed and precise as possible, we exclude those questions from the model and further analysis. In this case, it is question COMP4 from the group of questions related to compatibility, CPLX2 from complexity, MPI3 related to maturity and performance, TMS1 and TMS4 related to top management support, and TR2 and TR3 from technology trialability. After removing these questions, the PLS algorithm is applied again with the following results (Figure 5).

The presented model now only contains questions that are relevant to the constructed constructs, and based on it, we continue the further analysis of the research results. In the reports, we can find data related to R-squared what its value is, and what its predictive accuracy is. The coefficient of determination (R2) is a measure of the relationship between the dependent and independent variables. In this research, it is used to predict the accuracy of the model and is 0.668. This value should tend to unity as much as possible so that the predictive accuracy is 100%. The value of the coefficient in this case is acceptable considering that it describes the behavior of stakeholders in the fashion industry.

Table 6 Value of coefficient of determination

	R-square	R-square adjusted
Supply chain management	0.668	0.662
Blockchain adoptio	0.751	0.695

It is necessary to perform 2 evaluations of the latent variable measurement model and the structural model. The first model refers to the establishment of a connection between the collected data from the analysis and the variables themselves that are observed in the model. On the other hand, the structural model refers to the observation of mutual connections between the variables used in the model. First, we will look at the measurement model of the latent variables, and therefore the validity assessment of the given model is shown in the following table.

Table 7 Validity ratings of the latent variable measurement model

Variable extracted (AVE)	Indicator	Cronbach's alpha	Average variance	Composite reliability
Legal support	RS1 RS2	0.763	0.893	0.807
Maturity and performance	MPI1 MPI2	0.630	0.841	0.726
Compatibility	COMP1 COMP2 COMP3	0.781	0.874	0.700
Complexity	CPLX1 CPLX3	0.738	0.883	0.791
Competitiveness	CP1 CP2	0.775	0.897	0.814
Organizational readiness	OR1 OR2 OR3 OR4 OR5	0.831	0.881	0.598
Top management support	TMS2 TMS3	0.764	0.894	0.809
Relative advantage	RA1 RA2	0.550	0.815	0.688
Market situation	MU1 MU2	0.599	0.833	0.713
Supply chain management	SCM1 SCM2 SCM3 SCM4	0.883	0.919	0.740
Blockchain Adoption	BA1 BA2	0.884	0.945	0.896

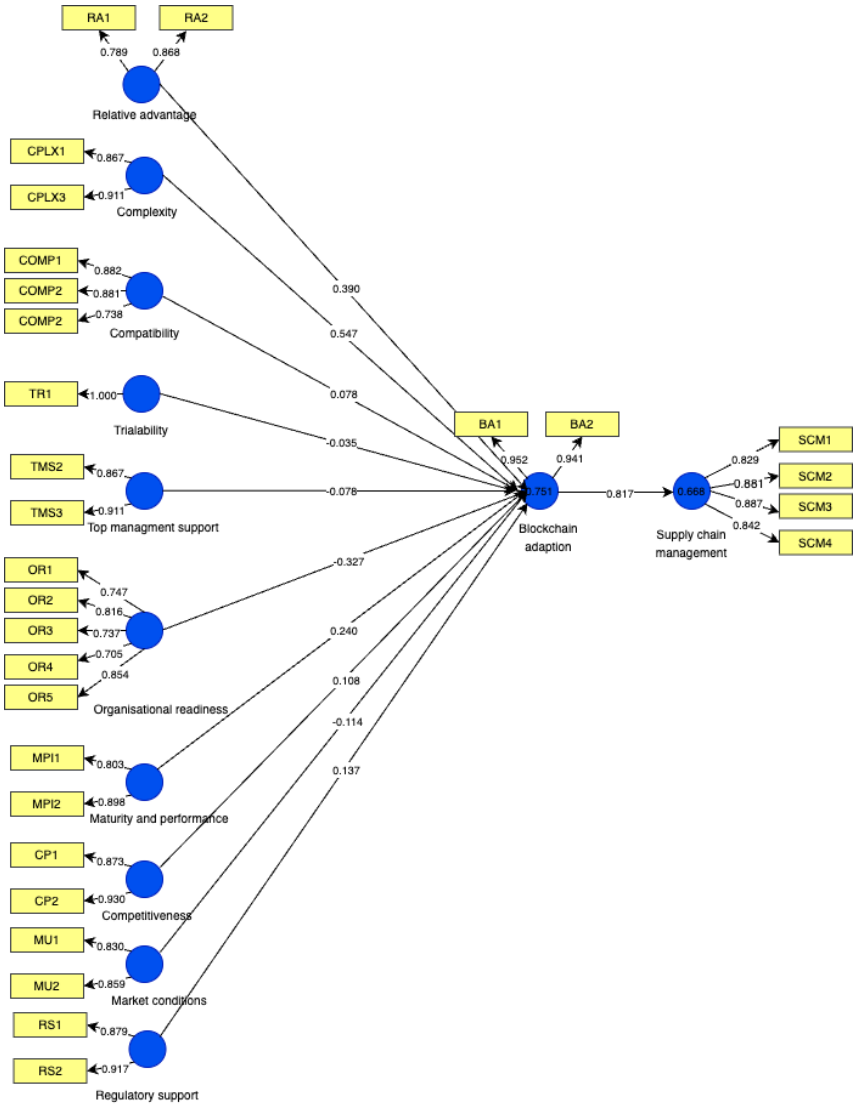

Fig. 5 The result of applying the PLS algorithm to the new model

Cronbach's alpha is a coefficient of reliability or consistency. It measures the consistency of the questionnaire, ie survey items. It refers to how well some items or, in our case, questions are connected as a group, that is, how consistently they measure the very construct to which they are assigned. If the value is higher, it means that the question itself is consistent with the set factor, and all values over 0.7 are considered very successful. Those questions that have a value lower than 0.7 are not consistent, such as questions related to the state of the market, relative advantage or maturity, and performance, must be better formulated and analyzed in subsequent research and further work [20].

Composite reliability is a measure of the internal consistency of survey items and is similar to Cronbach's alpha. This is another way to examine and analyze the consistency of all items. It is recommended that the value be above 0.7 and below 0.95 because it is an indicator that the questions consistently measure the corresponding construct.

To examine the correlation between the indicators for the set variables, the AVE (Average Variance Extracted) parameter is used. To establish a positive correlation, the value of this parameter must be above 0.5. Therefore, we conclude from the table that all indicators meet this condition.

The Cross loadings parameter shows us in the following table how much the indicators and their values differ about the set variables. From the table shown, we can conclude that all indicators have the highest values precisely about the variable they measure, compared to all other variables. This means that the connection of the indicator with that variable is stronger compared to the others [21].

Table 8 Assessment of model validity - Cross loadings of values

	Legal support	Maturity and performance	Compatibility	Complexity	Competitiveness	Organizational readiness	Top management support	Trialability	Relative advantage	Market situation	Supply chain management	Blockchain Adoption
BA1	0.456	0.688	0.591	0.781	0.420	0.544	0.618	0.267	0.725	0.340	0.801	0.962
BA2	0.510	0.564	0.562	0.645	0.473	0.507	0.492	0.288	0.660	0.355	0.744	0.941
CMP1	0.500	0.697	0.882	0.687	0.553	0.684	0.739	0.324	0.416	0.630	0.513	0.505
CMP2	0.519	0.596	0.881	0.638	0.377	0.568	0.690	0.334	0.472	0.496	0.497	0.542
CMP3	0.505	0.460	0.738	0.480	0.477	0.527	0.310	0.100	0.365	0.433	0.315	0.480
CP1	0.375	0.446	0.446	0.364	0.873	0.428	0.365	0.192	0.367	0.624	0.372	0.358
CP2	0.326	0.656	0.550	0.451	0.930	0.627	0.512	0.459	0.565	0.597	0.471	0.477
CPLX1	0.330	0.661	0.620	0.567	0.395	0.747	0.556	0.462	0.549	0.456	0.613	0.605
CPLX3	0.633	0.648	0.664	0.911	0.416	0.662	0.744	0.285	0.541	0.449	0.610	0.732
MPI1	0.404	0.803	0.547	0.631	0.462	0.779	0.510	0.244	0.401	0.418	0.592	0.473
MPI2	0.423	0.898	0.642	0.628	0.553	0.506	0.720	0.366	0.540	0.392	0.591	0.642
MU1	0.432	0.329	0.430	0.383	0.550	0.353	0.476	0.364	0.343	0.830	0.343	0.296
OR1	0.349	0.600	0.615	0.615	0.485	0.747	0.478	0.235	0.377	0.555	0.344	0.413
OR2	0.313	0.564	0.558	0.649	0.490	0.816	0.445	0.228	0.365	0.380	0.429	0.306
OR3	0.442	0.649	0.543	0.505	0.473	0.737	0.437	0.196	0.434	0.465	0.478	0.385
OR4	0.301	0.502	0.405	0.519	0.522	0.706	0.429	0.602	0.344	0.451	0.347	0.363
RA1	0.269	0.524	0.528	0.541	0.356	0.539	0.448	0.113	0.789	0.348	0.523	0.547
RA2	0.206	0.420	0.303	0.483	0.504	0.345	0.322	0.359	0.868	0.290	0.783	0.677
RS1	0.879	0.468	0.554	0.502	0.395	0.531	0.590	0.271	0.303	0.517	0.325	0.414
RS2	0.917	0.408	0.541	0.507	0.302	0.365	0.507	0.158	0.303	0.391	0.329	0.404
SCM1	0.236	0.471	0.259	0.450	0.359	0.324	0.430	0.213	0.645	0.259	0.829	0.609
SCM2	0.404	0.667	0.567	0.674	0.492	0.594	0.639	0.337	0.687	0.419	0.881	0.715
SCM3	0.356	0.643	0.506	0.708	0.410	0.505	0.538	0.335	0.754	0.289	0.887	0.769
SCM4	0.239	0.571	0.400	0.501	0.360	0.306	0.442	0.229	0.683	0.218	0.842	0.705
TMS2	0.519	0.691	0.591	0.668	0.411	0.578	0.897	0.418	0.470	0.439	0.616	0.523
TMS3	0.543	0.632	0.477	0.662	0.480	0.541	0.902	0.427	0.349	0.509	0.463	0.537
MU2	0.412	0.460	0.614	0.471	0.584	0.600	0.456	0.213	0.268	0.859	0.246	0.323
OR5	0.455	0.700	0.606	0.718	0.477	0.854	0.586	0.250	0.470	0.388	0.464	0.554
TR1	0.233	0.366	0.307	0.410	0.380	0.377	0.469	1.000	0.299	0.337	0.328	0.293

It is also necessary to examine the correlation of the AVE parameter with the variables, whereby validity is achieved if the value of the indicator is the highest about the variable to which it belongs. This test is achieved by the Fornell-Larcker correlation comparison criterion and the following table shows the given results. The main diagonal and the values on it are observed and we can see that the value of the AVE parameter for all indicators is the highest about the variable to which it belongs, compared to other variables.

Table 9 Assessment of model validity - Fornell-Larcker criterion

	Legal support	Maturity and perfor-	Compatibil- ity	Complex- ity	Competitive- ness	Organiza- tional readi-	Top man- agement	Trialabil- ity	Relative advantage	Market situation	Supply chain man-	Block- chain
Legal support	0.856											
Maturity and performance	0.483	0.452										
Compatibility	0.608	0.701	0.837									
Complexity	0.561	0.734	0.723	0.889								
Competitive- ness	0.383	0.599	0.558	0.456	0.902							
Organizational readiness	0.490	0.765	0.770	0.786	0.622	0.773						
Top manage- ment support	0.590	0.735	0.706	0.740	0.496	0.622	0.899					
Trialability	0.233	0.366	0.307	0.410	0.310	0.377	0.469	1.00				
Relative ad- vantage	0.336	0.561	0.438	0.611	0.525	0.518	0.454	0.299	0.829			
Market situa- tion	0.499	0.470	0.622	0.508	0.672	0.570	0.527	0.337	0.300	0.846		
Supply chain management	0.364	0.669	0.522	0.686	0.473	0.535	0.599	0.328	0.807	0.346	0.860	
Blockchain Adoption	0.509	0.665	0.610	0.757	0.470	0.556	0.590	0.293	0.745	0.367	0.817	0.945

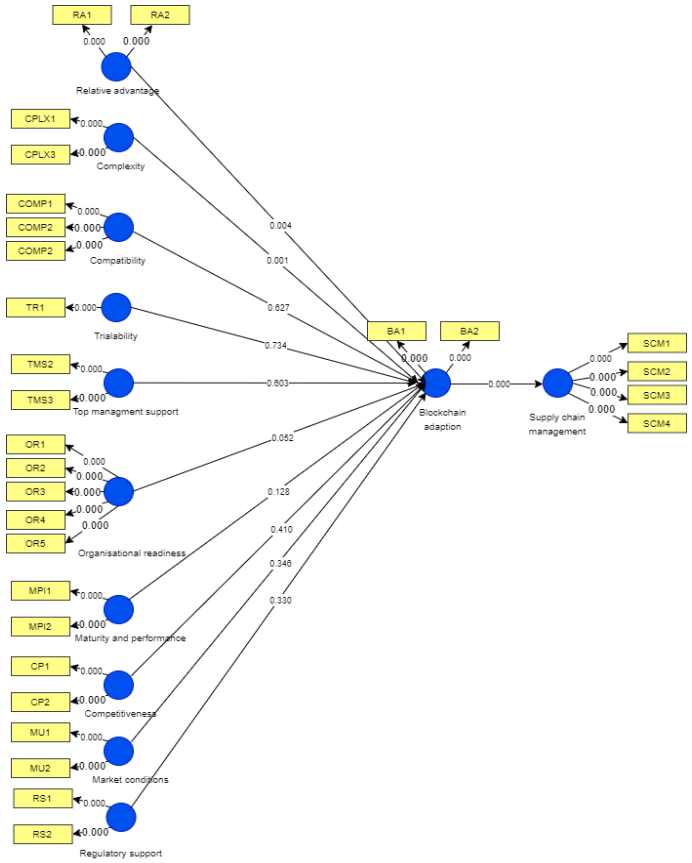

Fig. 6 Bootstrapping results

The next evaluation that must be performed is the evaluation of the structural model, and in this connection, collinearity was evaluated using the VIF (variance inflation factor) factor. This parameter measures the existence of multicollinearity in a set of variables. If the value of this factor is high for a variable, it means that it is highly collinear with other variables [22]. The results show that all values are below 5, which means that there is no collinearity between the variables.

After implementing the PLS algorithm, it is necessary to implement the bootstrapping algorithm, based on which we conclude the significance and relationship between all set variables (Figure 6). The link is determined based on the path coefficient value of the model itself. If the value tends to a positive unit, it means that it is a strong positive relationship, analogously if it tends to a negative unit, then it represents a strong negative relationship. In case it is close to 0 there is no influence.

Hypothesis testing and detailed significance analysis can be performed using the bootstrap algorithm with 5000 samples and 5% significance. The results can be seen in the following figure, from which we conclude that the biggest influence on the adoption of blockchain in the fashion industry has variables related to the complexity and relative advantage of the technology. This means that more and more attention should be paid to these constructs and their improvement because, with the growth of their values, the willingness of interested parties to adopt and apply blockchain technology also grows. Other variables are not statistically significant, therefore this should be taken into account in further research.

Table 10 Hypothesis testing

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
legal support->blockchain adoption	0.137	0.129	0.141	0.937	0.330
maturity and performance->blockchain adoption	0.240	0.250	0.158	1.522	0.128
compatibility->blockchain adoption	0.078	0.069	0.160	0.486	0.627
complexity->blockchain adoption	0.547	0.522	0.170	3.208	0.001
competitiveness->Blockchain adoption	0.108	0.091	0.131	0.824	0.410
organizational readiness->blockchain adoption	-0.327	-0.309	0.168	1.940	0.052
top management support->blockchain adoption	-0.078	-0.080	0.150	0.519	0.603
trial->blockchain adoption	-0.035	-0.031	0.102	0.340	0.734
relative advantage->blockchain adoption	0.390	0.405	0.135	2.886	0.004
market state->blockchain adoption	-0.114	-0.098	0.121	0.934	0.346
blockchain adoption->supply chain management	0.817	0.827	0.044	18.471	0.000

5. Discussion and Conclusion

Blockchain, as a unique technology, has significant potential for development and progress, leading to substantial investments from various industries seeking to refine and enhance its capabilities. It possesses the ability to revolutionize supply chains, enhance business operations, and provide security, transparency, and authenticity, which are rare commodities. To fully harness its potential and increase the value delivered to end users across different domains, it is crucial to raise awareness about its advantages and possibilities.

The rapid rise and advancement of blockchain technology in recent times have generated increased interest, widespread adoption, and development in various fields. Consequently, there is a keen interest in exploring and conducting research on the application of blockchain in the fashion industry. However, the adoption of blockchain in the fashion industry cannot happen overnight, nor can the multitude of opportunities it offers be fully realized immediately. In this study, our focus primarily revolved around specific areas, such as streamlining supply chain management, monitoring and controlling product authenticity, regulating obligations and collaborations through smart contracts, and ultimately fostering consumer trust and security. The objective of this research was to establish a framework and gain insight into the receptiveness and preparedness of stakeholders for embracing this technology and instigating a transformative shift in the current business landscape.

The survey involved 55 participants from diverse positions and interests. The aim was to gather extensive feedback related to their perspectives and attitudes toward the topic at hand. By employing models, and algorithms, and analyzing the obtained results, it can be inferred that, at the time of conducting the research, there was a favorable environment for the development of blockchain technology, coupled with an increasing awareness of its potential and impact. The market demonstrated readiness to adopt new technologies given the current pace of acceleration, resulting in many companies being receptive to innovation and change. However, the process of adopting new technology is often lengthy and slow, and therefore, it is expected that interest will continue to grow and develop further shortly. It is worth noting that the research conducted was not extensive in scale, and the collected data may not be sufficiently authoritative or relevant for conducting detailed analyses. Future research endeavors should expand the survey pool, and until then, the current study has provided an initial understanding and conclusion regarding the readiness of stakeholders in the fashion industry.

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