

# Acceptance of Blockchain Technology in Supply Chains: A Model Proposal

**Haldun Çolak**

Faculty of Economics and Administrative Sciences,  
Anadolu University, Eskişehir, Turkey  
Email: halduncolak@anadolu.edu.tr (*Corresponding Author*)

**Celal Hakan Kağınçoğlu**

Faculty of Economics and Administrative Sciences,  
Anadolu University, Eskişehir, Turkey  
Email: chkaginic@anadolu.edu.tr

## ABSTRACT

The aim of this study is to determine the factors that affect the adoption of blockchain technology by the companies in the industries such as raw material, transportation, healthcare, food, financial and to propose a comprehensive model explaining adoption behavior in the supply chain context. Supply chain, blockchain, information systems, and logistics literature have been extensively examined to create the associated model. Accordingly, the concept of inter-firm acceptance faced by researchers was accepted as a differentiating point and related constructs and the model were designed specifically for blockchain technology. A comprehensive literature review showed that there is a very limited number of studies on the acceptance of blockchain technologies by companies. The model created consists of 4 main determinants and 10 related attributes. In this context, inter-organizational factors such as power and trust of chain stakeholders and readiness for technology as organizational factor were analyzed within the integration of relative advantage, transparency, and cost as main characteristics of the technology. This model provides an important and unique perspective for practitioners and the academic studies to be carried out.

**Keywords:** *inter-firm technology adoption, blockchain, supply chains, model proposal, technology*

## 1. INTRODUCTION

Supply chains are actuated by consumers, and hence, the main goal of supply chains is to change, to meet ever-changing consumer needs, together with ensuring the flow of material from various primary sources (Svensson, 2002). However, these changes in basic operations are not easy to handle by businesses. Because besides satisfying the ever-changing demands and needs of the consumer, businesses have to manage complex and global multi-tiered partnership networks and increasingly keep up with new information technologies within the supply chain (Asare *et al.*, 2016). In addition, globalism, various regulatory policies, changing cultural characteristics, and human behaviour can make risk management and the evaluation of information in this complex chain difficult. Furthermore, inadequate transactions, fraud, and poorly functioning supply chain

processes push chains to new pursuits at the point of verifiable sharing of information.

Another point is that modern supply chains are quite complex in structure and consist of geographically dispersed and different formations competing to serve the consumer (Lambert and Enz, 2017). All this complexity can cause traceability and transparency issues. Current supply systems are also heavily linked to centralized in-house information management systems. In this context, failure at a single point can leave an entire system in a very fragile structure against various errors, hacking, corruption, and external attacks (Abeyratne and Monfared, 2016). Another problem faced by supply chains today is the pressure under the sustainability of the supply chain. Sustainability is defined by Seuring *et al.*, (2008) as 3-layer concept including business, social and environmental balance dimensions. These three dimensions are needed to ensure sustainability in the supply chains. Here, Viriyasitavat and Hoonsopon (2019) define blockchain as “*technology that enables immutability and integrity of data in which a record of transactions made in a system are maintained across several distributed nodes that are linked in a peer-to-peer network*”. With the integration of blockchain, social sustainability with the constant and unchangeable information; economic sustainability by reducing transaction costs and preventing waste; and environmental sustainability by guaranteeing green products, reducing carbon emission, and supporting recycling can be achieved respectively (Saber *et al.*, 2019).

As stated by Queiroz and Wamba (2019), all transactions could be safe and more transparent, traceable, and efficient with the integration of blockchain technologies. This will not only provide cost reduction and increased efficiency in the supply chain but also ensure customers’ trust that will help them to control the whole journey of goods across the supply chain (Queiroz and Wamba, 2019). Hence, the traceability will improve the control of the fraud and fake products across the entire supply chains (Chen, 2018). At the end, the supply chain efficiency will be improved, and this will be a big achievement for the partners in the chain.

Although blockchain applications have shown an increasing momentum day by day, as with all disruptive technologies such as virtual and augmented reality,

cryptocurrency, 3D printers, Internet of Things (IoT), there are various obstacles and constraints such as scalability, integrity of network participants, technical expertise or infrastructure deficiencies, problems with measurability in the adoption and application of these technologies within the supply chain. Because, despite all the developments (digital ledgers, inventory tracking, invoice tracking, loyalty programs, fraud detection) these technologies are still in the first phase of their development and bring some behavioural, organizational, technological, and policy-based problems such as information sharing with third parties and reluctance to invest in new technologies. Therefore, the main purpose of this study is to develop a comprehensive model integrating such concerns mentioned above in a theoretical framework. With the model determined as a result of this theoretical framework, it is aimed to reveal the necessary and preventive factors by reflecting an inter-company perspective at the point of acceptance of blockchain technology along the supply chain. Accordingly, research questions are shaped as follows:

**RQ1:** *What are the main blockchain adoption model attributes considering the supply chain?*

**RQ2:** *What are the benefits arising from the use and adoption of blockchain technologies in supply chains?*

**RQ3:** *What are the major barriers to acceptance of blockchain technologies in supply chains?*

To address and answer the research questions, this research is organized based on the research made by Asare *et al.*, (2016) in which they develop B2B technology adoption model for supply chains. With the integrations of the other variables, the authors in the present study expand Asare *et al.*, (2016)' B2B technology adoption model and adapt it for the blockchain technology adoption for supply chains. In this context, the current study is one of the first studies to propose a model which reflects the inter-organizational perspective (rather than individuals' behaviour) on the acceptance of blockchain technologies in supply chains. The only study we found in this regard is performed by Queiroz and Wamba (2019). However, this study which is based on Unified Technology Acceptance and Usage Theory (UTAUT) and network theory, remains in a narrow scope when organizational, environmental, and inter-firm relations considered.

## 2. THEORETICAL FRAMEWORK

Models that are used extensively in the literature and examine the technology acceptance behavior of the users are generally shaped in two different dimensions, namely individual user acceptance and organizational acceptance. As will be explained in the following sections, in this study, since the acceptance of blockchain technology is the focal point throughout the supply chains, the model that will be used to explain the acceptance of blockchain technology within the supply chains is emphasized by focusing on organizational acceptance behaviour models. Therefore, in the following sections, the relationship between the supply chain and the blockchain is established with various positive and negative aspects and in this context, what factors stand out in terms of organizational acceptance. In addition,

Innovation Diffusion Theory (IDT) was examined in the framework drawn in addition to the reasons for the proposed model.

### 2.1 Blockchain Technology

Blockchain's ability to guarantee the reliability, traceability, and authenticity of information as well as smart contract-based relationships for an insecure environment, reflects an important rethinking of supply chain management (Saber *et al.*, 2019). Blockchain means a database or shared public/private ledger, which distributes and stores data (Wang *et al.*, 2020), of all digital events executed and shared between blockchain agents (Crosby *et al.*, 2016). The blockchain core is associated with a distributed and synchronized database (Ledger) that processes information in a shared and synchronized environment, that is, the chain (Queiroz and Wamba, 2019). First, a party creates a transaction to be added to the blockchain in the system. This is a publication to be verified and moderated based on the new transaction. When the vast majority of nodes in the chain validate this process under various rules, this new process is added to the chain as a new block (Saber *et al.*, 2019). The record of this new transaction is stored in various distributed nodes for security reasons. While each "block" stores a measurable process and dataset, the chain links the blocks in a certain order. The current data set is determined by tracking the chain from the first block to the last block and re-analysing the process in each block (Verhoeven *et al.*, 2018). As a result, the blockchain can not only keep track of the current data set, but also an entire transaction history. Meanwhile, the smart contract enables reliable transactions without the involvement of third parties as a critical feature of blockchain technology.

The smart contract in Blockchain technology paves the way for this technology not only to be used for financial transactions, but also for systems such as the supply chain (Hidayanto and Prabowo, 2019). A smart contract is called a computerized transaction protocol that automatically fulfils contract terms on the blockchain (Wang *et al.*, 2019). The main purpose of smart contracts is to reduce the delays and costs of traditional contracts, while at the same time to ensure mutual satisfaction of conditions based on common contracts (Gupta, 2017). As it is known, supply chain is an integrated management process where suppliers, manufacturers, wholesalers, and distributors work together. At this point, blockchain technology offers various opportunities in terms of supply chain management with invariance, decentralization, asymmetric encryption, and smart contract features (Zheng *et al.*, 2018). As a result, smart contracts play an important role in the integration of blockchain and supply chains and benefit in matters such as ensuring transparency and security in the supply chains, increasing visibility, reducing transaction costs and start times (Queiroz *et al.*, 2019).

Decentralization on the blockchain means that users don't have to rely on a single company or service point to provide and disseminate information. Thus, while providing the ability to hide sensitive information from a particular transaction to relevant stakeholders who have a valid key to access it, this capability is done through mixed functions and encryption (Savirimuthu, 2017). Decentralization increases the verification of the information, as it means control of any

mistake in the information. Otherwise, a more central database is more vulnerable to hacking, corruption, and external attacks (Saber *et al.*, 2019).

## 2.2 The Benefits of Blockchain Technology

In a typical supply chain, material, cash, and information flow are provided by vendors, factories, and distribution centers. Many transactions take place at these interfaces mentioned in the supply chains and problems related to trust may arise in keeping records. Thus, the blockchain can operate as a single source of information and can help integrate all the functions of the chain. With the use of blockchain, many value-creating activities such as recording, sharing information, and monitoring can take place more quickly and measurability can be achieved without any delay (Kamble *et al.*, 2019). Through a blockchain-enabled supply chain, organizations can easily perform real-time digital transactions for all stakeholders in the supply chain network.

Since blockchain can help organizations achieve accurate demand forecasts, effectively manage resources, and reduce inventory handling costs, supply chains can reduce risk at a lower cost compared to traditional supply chains with high stock, excess capacity, and third-party backups (Ivanov *et al.*, 2019). The main goal of using blockchain in the supply chain is to increase supply chain visibility and transparency based on record-keeping functions (Ivanov *et al.*, 2019). However, this depends on the ability to capture accurate data, store data, analyse data and analyse big data, including real-time decision-making capabilities (Kamble *et al.*, 2019).

Blockchain technology is a candidate to create added value in supply chains in terms of products' visibility and traceability (Wang *et al.*, 2019). Lack of transparency may cause difficulties in verifying the real value of the links in the chain and especially in the eyes of consumers and testing their validity (Sivula *et al.*, 2021). Unlike supply chains using traditional and central information technologies, transactions based on blockchain technology offer transparency to participating businesses. A block can be created for each transaction that follows the footprints of the product, from production to distribution and sales (Patel *et al.*, 2017). This level of transparency and visibility are essential for the tracking of the product and thus the accuracy and authenticity of the product to make it also easier to track the purchasing volume regardless of who started the purchasing activity (Casey and Wong, 2017). Real-time tracking is based on the integration of blockchain with sensors on the field. At this point, blockchain technology is often used with RFID (Radio Frequency Identification) technology, which is a useful tool for effectively managing supply chain activities (Kgobe and Ozor, 2021), to increase the tracking of the product (Dujak and Sajter, 2019). While the RFID system enables the transfer of product information to digital format, it also provides the simultaneous reading of the information obtained from a large number of products and the addition of new information which can give organizations a chance to negotiate better with suppliers and benefit from quantity reductions. Tracking the product can prevent the production of various counterfeit and illegal products. This is a feature from the transaction history that

the traceability blockchain offers. According to this transaction history, the authenticity of the product can be easily verified by the users and thus counterfeit products can be prevented thanks to transparent and reliable information.

Finally, apart from the main benefits of the blockchain technology to supply chains, some other benefits such as invariance of data (Sharma and Mishra, 2014), ensuring the security and validity of data (Ivanov *et al.*, 2019), and helping environmental sustainability (Saber *et al.*, 2019) have been proposed to the literature.

## 2.3 Barriers to Acceptance of Blockchain Technology in Supply Chains

Although blockchain technology has many potential benefits, there are also some challenges in adopting and implementing these technologies. Organizations' not being ready, technical expertise or infrastructure deficiencies, problems with measurability, and limited investment possibilities for blockchain technology are considered as the main problems encountered (Min, 2019).

In their theoretical studies, Saber *et al.*, (2019) examine the barriers that stand out in the adoption of blockchain technologies in supply chains in 4 different groups, namely intra-organizational, inter-organizational, system-related, and external barriers. Accordingly, intra-organizational barriers mainly stem from activities within the organization itself. Especially the leadership of senior management plays a key role in the implementation of blockchain technology in the supply chain. However, most of the time, top management may show deficiency in ensuring long-term stability and adapting new technologies to existing systems (Saber *et al.*, 2019). Therefore, the lack of commitment of the top management may hinder the sustainability of the practices that will take place along the supply chain (Govindan and Hasanagic, 2018). In addition, the adoption of a new technology may cause various changes in the organizational culture. Because the adoption of blockchain technology will require new rules to be addressed, a review of responsibilities, and the emergence of different specialties within the framework of the adopted technology (Mendling *et al.*, 2017).

When the barriers between organizations are considered, it is understood that these barriers emerge from the relationships of the partners in the chain. Although the partners in the chain try to create value for their stakeholders, when it comes to the integration of a new technological system, the relationships between the partners can cause various difficulties. As an example, blockchain technology requires sharing information along the chain, as mentioned earlier. However, Sayogo *et al.*, (2015) emphasize that some partners may be timid at the point of sharing since they see the information they have as a competitive advantage. According to Sayogo *et al.*, (2015), having different policies regarding information and data usage may also cause difficulties in sharing information among partners. At this point, the structure of blockchain technology that requires transparency requires defining various policies and rules and applying them throughout the chain. Therefore, lack of sustainable rules may cause problems among supply chain partners in the point of information sharing.

System-related obstacles arise from the need for new information technology tools at the point of integration of blockchain technology with the supply chain. Naturally, all actors within an integrated supply chain structure provide access to the information necessary to turn the advantage in terms of value creation into opportunities. Therefore, if there is limited technology access to reach real-time information in the supply chain, problems in the implementation of blockchain technology may be encountered (Saber *et al.*, 2019). Accordingly, after an error to be made at the first entry of the data, this will cause the erroneous data to remain in the chain and be updated with additional information.

Apart from all these, some external factors can also be an obstacle to the integration of blockchain technology. These include governments' regulations, uncertainty in demand, various industrial pressures, etc.

## 2.4 Blockchain and Supply Chain Integration Studies

It can be seen from the literature that the researchers have started to get an interest in blockchain and supply chain integration. At this point, the studies deal with the subject from different points. For example, Saber *et al.*, (2019) examine the blockchain technology in terms of the application of it through supply chain. They define which factors could be effective and which factors could be barriers in this subject and how the application of blockchain will improve the supply chain sustainability. Madhwal and Panfilov (2017) focus on having decentralized system based on distributed data-driven application technologies such as Blockchain to show how this integration assists maintaining inventory of the aircraft's parts and also monitoring performance and usage. Kim and Shin (2019) investigate how the use of blockchain in supply chain activities can influence partnership efficiency and growth, thus affecting total performance outcomes. Results show that information transparency, information immutability and smart contracts have significant positive effects on partnership growth and efficiency.

In addition, studies mostly focus on some other related subjects such as usage of distributed ledger (Gao *et al.*, 2018), implication areas for supply chain (Verhoeven *et al.*, 2018; Dujak and Sajter, 2019), chain resilience (Min, 2019), traceability and transparency (Sander *et al.*, 2018). These studies contribute to the literature and the findings can shed light on our understanding of blockchain integration within supply chain in the organizational level.

However, when it comes to adoption of blockchain technologies in the supply chain, the literature lacks implementations in such regard. There are only a few studies examining the adoption of blockchain technologies in the supply chains (Francisco and Swanson, 2018; Kamble *et al.*, 2019; Queiroz and Wamba, 2019). Queiroz and Wamba (2019) also state that the blockchain adoption behavior and the drivers for such adoption in organizations remain scarcely investigated. However, as Asare *et al.*, (2016) state, theories such as TAM and UTAUT are mostly used to explain technology adoption at the basis of individual-level in voluntary situations. They also continue by stating that "In *intra- and inter-firm environments where technology adoption is sometimes mandated and usually involves complex technologies, other models and theories, including*

*the attributes of innovation model, have more commonly been used to explain technology adoption in more complex environments*" (Asare *et al.*, 2016, p-3). Thus, it is understood that new models explaining the adoption of new technologies by the organizations need to be created to provide better understanding of the subject.

## 2.5 Technology Acceptance

The rapid development in information and communication technologies has also affected the adoption and use of these technologies. Technological developments are of great importance in this sense by the business community. According to Sharma and Mishra (2014), adoption and acceptance of technologies will also ensure the spread of these technologies. Therefore, it is important for businesses to understand the adoption and diffusion behaviour of technologies. Technology acceptance is a rather complicated process and shows the willingness of the person or an organization to use technology for their own benefit. Based on this complex structure, which has been mentioned in the past literature, many studies have shown that not only the technological features but also the personality traits, social impact, trust, and regulatory conditions of the users are effective in acceptance behaviour (Ajzen and Fishbein, 1980; Thompson *et al.*, 1991; Gefen *et al.*, 2003).

### 2.5.1 Innovation Diffusion Theory (IDT)

IDT is a communication theory that creates a wide range of applications for behavioural change models on social sciences (Valente and Rogers, 1995). Innovation is defined as an idea or practice that is perceived as new (Hoffmann *et al.*, 2007). Diffusion is the process of spreading this new perceived idea, application, or products (innovation) among members of a social system through certain communication channels (Rogers, 2004). According to Wonglimpiyarat and Yuberk (2005), potential adopters are affected by the perception of innovation, communication channels, the nature of the social system, and promotional efforts for change. The social system in which potential adopters are involved provides the flow of information regarding the existence of current innovation and its characteristics. Therefore, information search can be realized by these potential adopters in order to learn the results of using innovation or to have an idea. This can be interpreted as an explanatory indicator of adoption behaviour, as the acquisition and evaluation of information show the belief in innovation.

When the general structure is examined, IDT; it is seen that it consists of innovation, communication system, time, and social system dimensions. At this point, Lee *et al.*, (2011) list that innovation has various features as follows:

- **Relative Advantage:** The degree of being better than the application, idea, or product that an innovation replaces,
- **Compatibility:** The degree to which innovation is consistent with the current needs, previous experiences, and expectations of potential users,
- **Complexity:** The perceived difficulty of potential users in understanding the ease of use and use of innovation,
- **Trialability:** The degree to which innovation is fundamentally testable,

- **Observability:** The extent to which the results of innovation are visible to other people.

These listed features are used to explain the end user's adoption of new technologies and decision-making processes. Based on all this, in summary, IDT tries to explain the adoption rate factors and the innovation decision process that determines the different user categories (Lou and Li, 2017). However as stated by Tornatzky and Klein (1982), future studies should also emphasize the adoption of innovation in organizations. Furthermore, Asare *et al.*, (2016) state that IDT is criticized for focusing too much on for individual adopters and lacking examining the adoption of innovations by organizations. Considering the features given about IDT and these criticisms, the authors decided to examine the IDT in an organizational context in the present study.

### 2.6 Inter-Firm Perspective

IDT may be successful in explaining good portion of individual technology adoption, but as stated by Damanpour (1991) this theory may lack of explaining power when it comes to organizational and inter-firm environments since decision making requires more variables than individual technology adoption. Following this, Asare *et al.*, (2016) emphasize that since the literature still contains individual adoption factors, it has remained in a narrow framework in explaining the inter-firm acceptance behaviour.

From our understanding, to explain the integration of blockchain and supply chain, more and different variables which will be able to shed light in the nature of this integration should be examined. Gibbs *et al.*, (2007) examined the technology acceptance characteristics of small enterprises. They found that top management support, compatibility, perceived usefulness, perceived ease of use, organizational readiness and social network variables are well chosen in explaining adoption behaviour. Applying different approach, Tsai *et al.*, (2013) investigate the adoption intention of RFID by retailer's suppliers. They criticized IDT for ignoring organizational and environmental factors and analysed the adoption behaviour with a new model consisting of coercive, mimetic, and normative powers and organizational readiness within the scope of institutional theory. Those power factors affect the relational investment which explains RFID adoption together with organizational readiness.

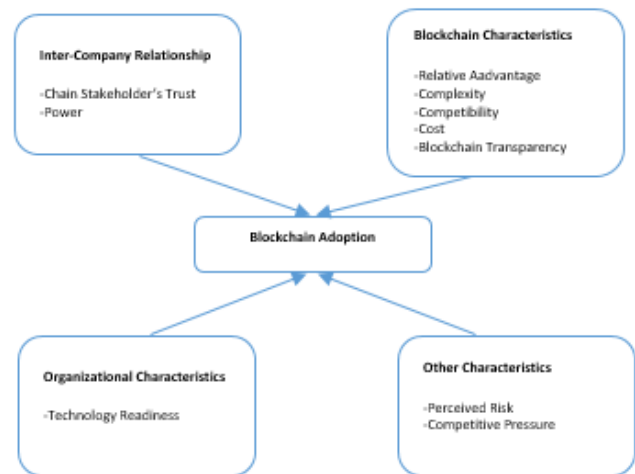
Chou *et al.*, (2017) examine inter-firm relational resources for cloud service adoption by developing a model based on resource-advantage theory. These sources are defined as reliability, cost, compatibility, and customer orientation. Except for customer orientation, all other variables had positive effects on firms' cloud service adoption.

As a brief summary, there are many studies in the literature that have been carried out from the perspective of the inter-firm relationships. These studies explain the technology acceptance behaviour of firms with different theories and approaches. Comprehensive models developed at this point contribute to our understanding in relation to the subject. However, when it comes to blockchain and supply chain integration, the literature seems to be silent in such regard. The present study is designed to create a

comprehensive model that tries to explain blockchain acceptance in supply chains by scanning the literature on blockchain, supply chain and inter-firm relationships. In this context, many variables were obtained from the models in various studies and many other variables were added to the model as a result of the literature review within the framework of the basic features of blockchain technology. In the next section, information about why these variables is added will be given and hypotheses will be defined.

## 3. RESEARCH MODEL AND HYPOTHESES

When analysed on the basis of technology acceptance theories, the model proposed in the research is formed as shown in **Figure 1**. Model has four key determinants in terms of adoption of blockchain technology namely technology characteristics, organizational characteristics, inter-company relationships and other characteristics. Related to these four determinants, we also listed 10 attributes in the **Figure 1**.



**Figure 1** Blockchain Acceptance Model in Supply Chains  
 (Derived from Asare *et al.*, 2016)

Drawing on the literature on technology acceptance and innovation diffusion, blockchain and supply chain, we derived a model (**Figure 1**) to examine and understand the blockchain adoption in supply chain. In this vein, except for blockchain transparency, blockchain technology characteristics are adopted from Asare *et al.*, (2016). At this point, we excluded observability and trialability from our model. Observability means the visibility of the innovation (Moore and Benbasat, 1991). In other words, it implies that the result of the technology can be easily demonstrated. However as stated by Queiroz and Wamba (2019), blockchain technology is still new and it has not attracted significant degree of awareness and that will make it difficult for firms to observe the result of the technology. This is why we excluded observability and trialability for the same reasons from our model. We added blockchain transparency to the model as it means how information in the chain is communicated to stakeholders (Morgan *et al.*, 2018). The literature reviews also showed that blockchain transparency is an important factor for the technology itself and might be strong predictor of the adoption in supply chains.

New technologies often bring risks with them, and these are generally related to the technology's failure to deliver on its promises (Kumpajaya and Dhewanto, 2015) and uncertainty (Bauer, 1960). Especially when it comes to uncertainty, issues such as security, privacy and protection of personal data come to mind. However, it is understood that the technology acceptance literature for the supply chain is lacking in examining the risk. Although it is assumed that it will have a negative impact on the blockchain technology adoption, the authors included this risk in the model because it is thought to be an important explanatory.

Other variables used in the present study were added to the model as a result of examining inter-firm technology adoption studies. Chain's stakeholders trust (Cabanillas *et al.*, 2017), power (Zhang and Dhaliwal, 2009), technology readiness (Tsai *et al.*, 2013), competitive pressure (Asare *et al.*, 2016) seem to be important factors in explaining firm's adoption behaviour.

### 3.1 Blockchain Technology Characteristics

When it comes to the acceptance of a technology to be used in supply chains, the various features of this technology are important at the point of acceptance among companies (Russell and Hoag, 2004). Asare *et al.*, (2016) determined the characteristics of innovative technologies that will be accepted in the supply chain as a Relative Advantage, Complexity, and Compatibility in their studies where they develop a model in the acceptance of B2B technologies in supply chains, they also added the cost variable. These features, which are listed at the point of acceptance of blockchain technologies in the supply chain by following a similar approach in the current study, are accepted as basic technological characteristics. Also, since the technology discussed is blockchain, blockchain transparency, which is an important feature of this technology, has been studied under this category differently.

#### 3.1.1 Relative Advantage

Where firms believe that the new technology to be adopted over existing technologies or methods used under similar activities is better, their tendency to adopt this new technology also increases (Zablah *et al.*, 2005). In this context, Asare *et al.*, (2016) define the relative advantage as the degree of perception of being better than the idea or technology that an innovation replaces. Relative advantage is used in the same sense with the perceived benefit in the technology acceptance literature. Hence, the hypothesis related to the movement was established as follows, since the literature has found the relative advantage as a strong explanatory in the relationship between the relative advantage and the adoption of new technologies (Rogers, 2003):

**H1:** *Relative advantage has a positive effect on intention in the adoption of blockchain technologies in supply chains.*

#### 3.1.2 Complexity

According to (Rogers, 2003), complexity becomes a difficulty in implementing, using, and understanding innovation. Highly complex technologies are often seen as an obstacle to adoption behaviour (Lin and Ho, 2009) Because these technologies are often difficult to implement

and since this can also be costly, the adoption and use of these technologies is becoming more difficult for decision-makers. Studies have found that complexity has a negative effect on the adoption of technologies in an organizational context (Sia *et al.*, 2004) and therefore the associated hypothesis is determined as follows:

**H2:** *Complexity has a negative effect on intention in the adoption of blockchain technologies in supply chains.*

#### 3.1.3 Compatibility

Rogers (2003) defines compatibility as the degree of conformity of technology or innovation to individual / social parts. However, when it comes to compatibility between companies, a unique compliance problem arises. At this point, technology should not only be compatible with the capabilities of the organization, but also have to be compatible with existing technological systems. From this perspective, system compatibility requires the suitability of technology and the existing software, hardware, computer systems and other technological systems and resources of the organization (Lin and Ho, 2009). Organizational compatibility means the suitability of the internal culture, business processes and management practices of the organization that adopts innovation (O'Callaghan *et al.*, 1992). Since compatibility shows a positive relationship with adoption behaviour in studies conducted (Premkumar and Ramamurthy, 1995) related hypothesis is formed as follows:

**H3:** *Compatibility has a positive effect on intention in the adoption of blockchain technologies in supply chains.*

#### 3.1.4 Cost

Cost will be one of the most important determining factors among supply chains in the adoption of blockchain technologies. The adoption cost of blockchain technology, which is a new technology, will affect the acquisition cost of this technology and the indirect costs that will be incurred in the use, application, and maintenance of the technology. With this feature, as Tornatzky and Klein (1982) suggested, the cost should be examined as a technological feature. At this point, as there is a negative relationship between the cost of a new technology and the adoption behaviour (Wejnert, 2002), related hypothesis is formed as follows:

**H4:** *Cost has a negative impact on intention in the adoption of blockchain technologies in supply chains.*

#### 3.1.5 Blockchain Transparency

Transparency is about how information is conveyed to stakeholders within the supply chain (Morgan *et al.*, 2018). Blockchain transparency means transmitting reports about an organization's communication and activities across the chain and therefore supporting the visibility of operations at all levels. When looked at the supply chain longitude, it can be said that blockchain technology will increase transparency and reliability (Lu and Xu, 2017). From this point of view, it is inevitable that blockchain transparency will be an important determinant in the adoption of this technology. In addition, blockchain transparency is important in terms of ensuring the solidarity of the members in the chain and thus a significant transformation in the

industry (Queiroz and Wamba, 2019). In the light of all these, the related hypothesis is formed as follows:

**H5:** *Blockchain transparency has a positive effect on intention in the adoption of blockchain technologies in supply chains.*

### 3.2 Inter-Organization Variables

#### 3.2.1 Chain Stakeholders' Trust

Trust can generally be defined as the degree of belief that one party will not be deceived as a result of actions performed by the other party in mutual relations. Queiroz and Wamba (2019), on the other hand, define stakeholders' trust within the supply chain as the willingness of two or more organizations in the chain to be sensitive to each other and to be aware of each other's expectations. In many studies conducted for the acceptance of new technologies, it has been revealed that trust is an important variable (Cabanillas *et al.*, 2017). Supply chains are shaped by multiple relationships and a certain level of confusion and as a result, solidarity throughout the network is essential for all organizations. However, in general, supply chains lack transparency between members, which is a major challenge for organizations (Lamming *et al.*, 2001). Furthermore, since trust is at the heart of cooperative alliances, without having trust may harm building or sustaining long-term relationships (Batwa and Norrman, 2021). In this context, the integration of blockchain technology across the chain can minimize uncertainty and ensure transparency across the entire chain. Therefore, the successful integration of blockchain technology will also improve trust among members in the chain. At this point, the related hypothesis is formed as follows:

**H6:** *Chain Stakeholders' Trust has a positive effect on intention in the adoption of blockchain technologies in supply chains.*

#### 3.2.2 Power

Power in the context of supply chain can be interpreted as the impact of one firm on another firm. At the point of adoption of the technology that will take place between the firms, since a firm will try to influence another firm towards acceptance behavior, the power level of the initiator will affect the decision to adopt the technology (Asare *et al.*, 2016). At this point, with a persuasive approach, influencing can take place to adopt the technology that will benefit the company. Actually, the use of force in establishing long and short-term relationships and adopting relevant technology may be necessary for persuasion. According to Zhang and Dhaliwal (2009), the power of one partner generally has a positive effect on the other partner's acceptance of new technology. Related hypothesis is formed as follows:

**H7:** *Power has a positive effect on intention in the adoption of blockchain technologies in supply chains.*

### 3.3 Organizational Variables

#### 3.3.1 Technology Readiness

According to Asare *et al.*, (2016), it is easier for businesses that have the required culture level within the

scope of information technologies to accept new technologies. The most important reason for this is that the mentioned organizations are more likely to have the necessary expertise and the necessary resources to ensure the adoption behavior (Qu and Wang, 2011). Considering the intra-organizational features, having the information systems infrastructure and the necessary culture at this point will affect the acceptance of the organization's blockchain technology. Therefore, the related hypothesis is formed as follows:

**H8:** *Technology Readiness has a positive effect on intention in the adoption of blockchain technologies in supply chains.*

### 3.4 Other Variables

#### 3.4.1 Perceived Risk

Privacy, security, transaction risk, and overall risks associated with the overall blockchain system are various risks that can be effective at the adoption of blockchain technology. Generally speaking, uncertainty in perceived risk (Bauer, 1960) and the risk of owned technology not delivering desired results (Kumpajaya and Dhewanto, 2015) are considered as main factors. The perceived risk is particularly important in the context of online transactions due to limited possibilities and potential interventions from third parties to control the quality of goods and services in advance and therefore seems indispensable in the context of the blockchain (Knauer and Mann, 2019). The perceived risk will also reduce the relative impact of the advantage because it will cause blockchain technology to increase the risk in the operational context. In the light of all these, the related hypothesis is formed as follows:

**H9:** *The perceived risk has a negative effect on intention in the adoption of blockchain technologies in supply chains.*

#### 3.4.2 Competitive Pressure

When competing companies or partner companies that are traded adopt a new technology, various organizations can come under the pressure that they will lag behind the race. In their study, Chwelos *et al.*, (2001) determined that competitive pressure alone is the most important factor in the acceptance of information technologies. According to Premkumar and Ramamurthy (1995), when competitors adopt a new technology, companies may tend to adopt that technology even if they do not really need this technology. On the other hand, companies tend to adopt new technologies in order to keep their customers and provide strategic flexibility in the markets where competition is intense. In addition, the wishes of the trade partners can be effective in the adoption of new technologies. In the light of all these, the related hypothesis is formed as follows:

**H10:** *Competitive pressure has a positive effect on intention in the adoption of blockchain technologies in supply chains.*

## 4. CONCLUSION

The aim of this study is to reveal the importance of blockchain technology in terms of supply chains and to reveal which constructs can be effective in the acceptance of this technology along the chain. Resulting from the literature

review, the number of models developed in terms of acceptance of blockchain technologies in supply chains is quite low. In addition, while the overall studies focused on system features in the context of compliance with blockchain technology and supply chains, it is seen that most of these studies exclude the adoption behavior of blockchain technologies. A large part of the direct work on the adoption of blockchain technologies cannot go beyond the TAM model (Lou and Li, 2017; Knauer and Mann, 2019; Kamble *et al.*, 2019) and therefore ignore many factors that can be effective in the context of the supply chain.

In the light of the aforementioned problems, in this study, a model showing the constructs affecting the acceptance of blockchain technology has been created in the supply chain. The basis of this model is based on the model developed by Asare *et al.*, (2016) examining the acceptance behavior of B2B technologies in the supply chain from an intercompany perspective. We expand the understanding of blockchain adoption in supply chain by adding technological features, inter-firm relations, organizational features, and external environmental factors to contribute to the blockchain literature.

This paper also examines the various benefits and barriers to adoption of blockchain technologies by supply chains. As a result of the adoption of blockchain technologies, it is understood that there are many benefits related to visibility and transparency issues and these are ultimately important for supply chain agility and trust between stakeholders. On the other hand, it is obvious that there are still barriers at the point of acceptance of these technologies and these problems are not only caused by internal relations but also external relations. In this context, the present study is in the position of a guide through the network of relations defined in terms of obtaining the benefits mentioned within the framework of the developed model and overcoming existing problems.

Finally, the model put forward in the adoption of blockchain technology in supply chains has the features that will help the successful acceptance of blockchain technology along the supply chains for both practitioners and academic community. Within this model an approach to adoption among firms is tried to be given. It is also expected that practitioners will be able to achieve successful results in the context of adopting blockchain technology by learning more about the factors shaping their environments and learning how to maximize their productivity in system, which will enable them to have a more competitive understanding.

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**Haldun Çolak** works as a research assistant at Anadolu University, Faculty of Economics and Administrative Sciences. He has been in charge of his duty for 4 years. His research focuses on operations management, new technologies such as IoT and Blockchain, innovation management, consumer behavior, supply chain management. He still continues his education as a PhD student.

**Celal Hakan Kağmıoğlu** works as a professor at Anadolu University, Faculty of Economics and Administrative Sciences. He has been working for Anadolu University for 30 years including 12 years as deputy director in school of industrial arts and 3 years' dean of faculty of business administration. His research mainly focuses on production management, management science, quantitative methods, supply chain management and logistics. His current projects include The Fourth Industrial Revolution (Industry 4.0) and innovation management.