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Review Article

## Re-establishment and Regarding Trust and Transparency, Blockchain's Contribution to the Solution of a Thousand-Year Problem

 Koray ADIGÜZEL <sup>a,\*</sup>,  Natallia KRASNOKUTSKA <sup>a</sup>

<sup>a</sup> Department of Management & Taxation, Institute of Economics, Management, and International Business,  
National Technical University, Kharkiv, UKRAINE

\* Corresponding author's e-mail address: koray.adiguzel@emmb.khpi.edu.ua

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### ABSTRACT

Trust is the most important key element in the history of humanity and its success. We see and witness an emerging and exciting technology called Blockchain, eliminating losses caused by anti-trust and relieves pain in our social-build environment. Although the atmosphere in business, management, and society today has been heavily altered and involved, trust stays the same. This requirement leads companies in various industries to use new techniques to ensure their customer's business is in safe hands. Unfortunately, most of the current research is heavily based on the Bitcoin currency rather than its underlying technology, which focuses on revealing and improving Blockchain's limitations from managerial value perspectives. Many of the proposed solutions lack a concrete evaluation of their effectiveness. Many other Blockchain scalability related challenges, including throughput and latency, have been left unstudied. In this study, enabling functions is studied, and Blockchain's contribution to organisations' management is discussed. Besides, applicability in today's economic environment in various industries is studied. It is understood that after the development of technologies that eliminate centralised structures such as Blockchain, the business world is keen to adapt to this change. In this context, it is concluded that including new technologies such as Blockchain increased trust in various industries, and in the majority of the studies, Blockchain considered being an element to reduce costs and create a more transparent environment. It can be said that this technology contributes to the development and better understanding of the application area of the industries mentioned in the study.

**Keywords:** Trust, Transparency, Blockchain, Organization, Industries, Applications.

## Güven ve Şeffaflığın Yeniden Tesis Edilmesi ve Gözetilmesi, Blokzincirin Bin Yıllık Bir Sorunun Çözümüne Katkısı

### Öz

Güven, insanlık tarihinin ve başarısının en önemli anahtar unsurudur. Güvensizliğin neden olduğu kayıpları durdurmak ve sosyal yapı ortamımızdaki sancılıları hafifletebilmek amacına yönelik olarak geliştirilen ve blokzincir olarak tanımlanan heyecan verici yeni bir teknolojinin doğuşuna tanık oluyoruz. Günümüzde her ne kadar işletme-yönetim ve sosyal toplum arasındaki ilişki ve atmosfer büyük ölçüde değişmiş birebirleri ile oluşan ilişkileri kurallar ile entegre olsa da güvene karşı gereksinim aynı kalmaktadır. Bu gereklilik, çeşitli sektörlerdeki şirketlerin müşterilerinin kendileri ile oluşturduğu ticari bağ ve işlemlerin emin ellerde olmasını sağlamak adına yeni teknolojiler kullanmaya yönlendirmektedir. Ne yazık ki, mevcut bilimsel araştırmaların çoğu, blokzincirin yönetsel değer perspektiflerinden sınırlamalarını ortaya çıkarmaya ve iyileştirmeye odaklanan temel teknolojilerden ziyade bitcoin para birimine dayanmaktadır. Önerilen çözümlerin çoğu, etkinliklerinin somut bir

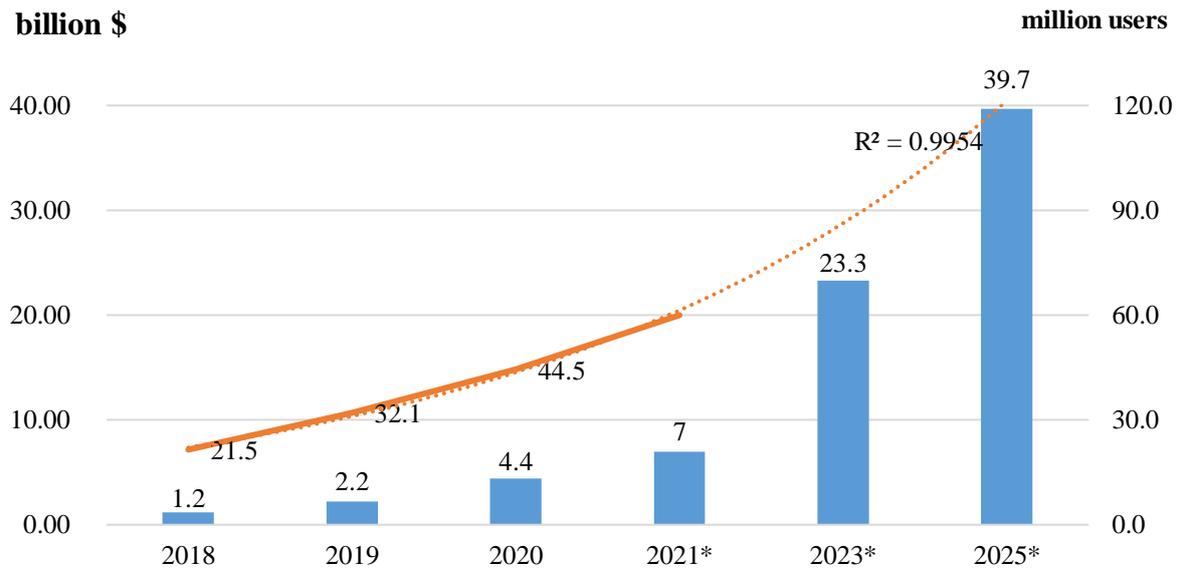
değerlendirmesinden yoksundur. Verimlilik ve gecikme dahil olmak üzere, diğer birçok blokzincir ölçeklenebilirliği ile ilgili zorluklar incelenmeden bırakılmıştır. Bu çalışmada, etkinleştirici işlevler incelenmiş ve blokzincirin kuruluşların yönetimine katkısı tartışılmıştır. Ayrıca günümüz ekonomik ortamında çeşitli endüstrilerdeki uygulanabilirliği incelenmektedir. Blokzincir gibi merkezi yapıları ortadan kaldıran teknolojilerin gelişmesinden sonra iş dünyasının da bu değişime uyum sağlamaya istekli olduğu anlaşılmaktadır. Bu bağlamda, blokzincir gibi yeni teknolojilerin dahil edilmesinin çeşitli sektörlerde güveni artırdığı ve çalışmaların çoğunda blokzincirin maliyetleri düşürmek ve daha şeffaf bir ortam oluşturmak için bir unsur olarak değerlendirdiği sonucuna varılmıştır. Bu teknolojinin çalışmada adı geçen sektörlerin uygulama alanlarının gelişmesine ve daha iyi anlaşılmasına katkı sağladığı düşünülmektedir.

*Anahtar Kelimeler: Güven, Şeffaflık, Blokzincir, Organizasyon, Sektörler, Uygulamalar.*

## **I. INTRODUCTION**

Trust is the most important key element in the history of humanity and its success. From private to public or family to business needs, every relationship form and asks for trust. It becomes more critical when whatever temporary or permanent parties involved in the relationship are poly and foreign to each other. We see and witness an emerging and exciting technology called Blockchain, which stops losses caused by anti-trust and relieves pain in our social build environment. A blockchain can study a distributed database organised as a list of consistent blocks, where the committed blocks are immutable. One can see that this is ideal in the banking sector as banks can cooperate under the identical Blockchain and push their customers' transactions. This way, beyond transparency, Blockchain facilitates transactions' auditing. Companies bedeck in this technology as they see the potential of their architectures decentralised and minimising their transaction suffering as they become inherently safer, translucent and in some inclose faster. When Satoshi Nakamoto, whose real personality is still unknown, issued this whitepaper Bitcoin: The Peer to Peer electronic payment organisation in 2008 reported the "strictly peer-to-peer edition of electronic cash" known as Bitcoin, blockchain technology made its public debut. Blockchain, this application that goes Bitcoin, has evolved around this last decade into one of the day's most significant ground-breaking technologies with the potential to change every industry from business to manufacturing to educational institutions [1]. Although the understating is that Blockchain technology is new and exciting by its nature, its roots have been established before thousand years ago. Its founders have successfully utilised them in the "Island of Yap." The island with the never-seen stone disks was used as an immutable distributed ledger to save the information and build trust in their community for their assets' mutual transactions. For centuries, Yapese islanders in what is now understood as Micronesia, wing hundreds of kilometers to mine limestone, fashioned into monumental stone sculptures assumed as rai and used as currency. Those stone coins were so weighty that islanders drilled holes through the core to move on extended poles [2].

Although blockchain technology is a concept that is still developing, the technology continues to grow (see Figure 1). Thanks to the trust it offers, today, when many industries try to discover this technology somehow, it is taken for granted that many industries or businesses will be affected by the Blockchain in some way sooner or later. Since financial services are among the first industries to embrace this technology in recent years, this area's applications are pretty advanced. Banking and payments are still the only places where we can benefit from the Blockchain, but there is much more to it. The promise that all manual paper transactions can be recorded, tracked, and stored using blockchain technology and the records are verifiable and secure, providing an environment that can reduce human errors.



**Figure 1.** Blockchain technology market size [3], [4]

Last publications show the growing interest in this topic and change focus from technical or financial aspects of Blockchain to its impact on sustainability where the definition has been developed and introduced by United Nations as the Three Dimensions of Sustainability [5] (see Figure 2), Social, economic, and environmental constitute the triple bottom line on sustainability development. Today more researchers claim that Blockchain can be an instrument for accomplishing the United Nations Sustainable Development Goals [6]. In fact, some practices carried out in a traditional way are no longer sustainable, and digital tools such as Blockchain are required to reform environmental, economic and social sustainability [7].



**Figure 2.** Three Dimensions of Sustainability [5]

In this study, we are willing to break down Blockchain's historical and critical points and emphasise Blockchain's usage in various industries and its contribution to sustainability. Arguably, as trust in the system is improved through practice, blockchain technology will evolve longevity and cause precious contributions to the circular economy through sustainability and social responsibility [8].

Section two presents what Blockchain Technology is, its history and milestones of evolution, how it functions, what it is for, and where it is headed to. Section three details Blockchain Technology use cases and provides examples of how it can add value to business, economy, trust, transparency and sustainability in diverse industries and belonging applications. Section four contributes as a literature review and reveals how Blockchain Technology and its main futures are utilized in various industries. Section five explains the literature review results whilst contributing by idealizing potential future use cases and the Blockchain Technology evolution.

## **II. THE CONCEPT OF BLOCKCHAIN**

Blockchain was first developed for Bitcoin for recording data and transactions, and it is a decentralised data management technology where it is kept. In his article titled "Bitcoin: Peer-to-Peer Electronic Cash System", published in 2008, Satoshi Nakamoto mentioned a system where two parties can directly transact without a reliable third party are based on cryptography [1].

Bitcoin is the pioneer and first application of blockchain technology and one of the most significant shareholders in its spread. The fact that blockchain technology enables transactions to be made without third parties means that this technology can be used in many sectors and applications.

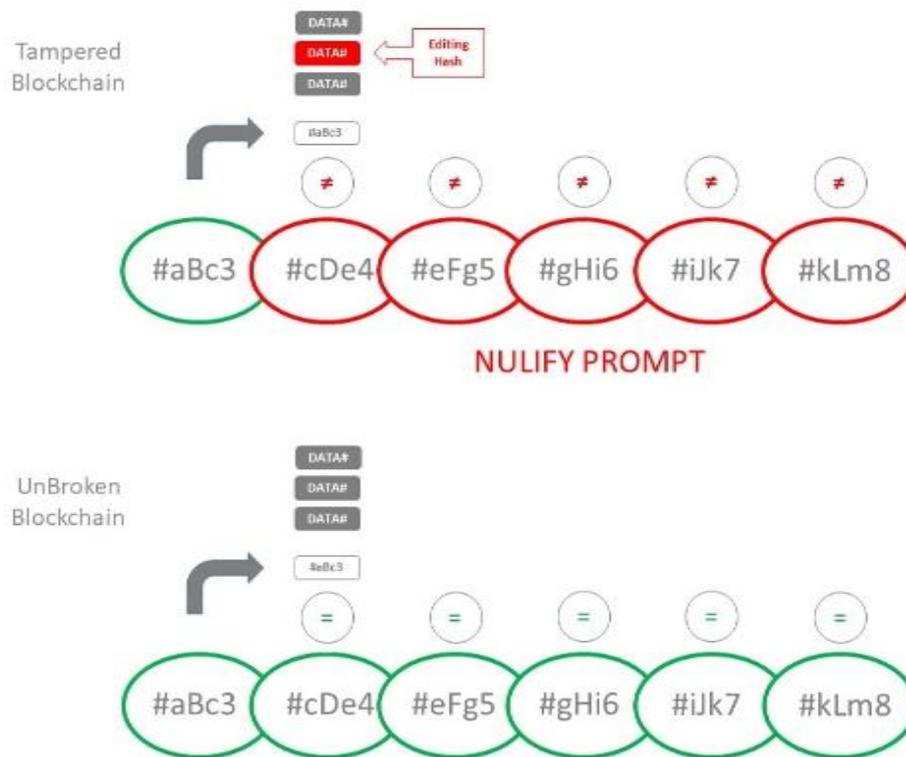
Blockchain technology is a technology where transactions are made using the cryptography method, and the records of the data are kept scattered. Haber and Stornetta created the first study on cryptic blocks used in blockchain technology [9], and later work by Satoshi Nakamoto in 2008 is accepted as the turning point of the Blockchain [10].

It is expected that the technology will affect many areas of transactions, thanks to the fact that transactions can be performed reliably without the need for third parties. Allowing third parties to disappear can be considered as a cost-benefit for both companies and customers. Some terms, such as peer-to-peer information transfer, confidentiality, trust, and irreversibility provided by blockchain technology, mean that all responsibilities undertaken by third parties can be fulfilled with this technology without any intermediaries [11].

Blockchain has enabled many applications to be further developed, implemented, and used with the technology and infrastructure it offers. While Blockchain is a technology that will pave the way for economic and financial changes globally, it also supports the rapid and safe implementation of new applications in various fields. It is expected to bring significant innovations in many areas, such as health, supply chain, logistics, finance, and accounting [12].

To briefly state various features of Blockchain, irreversibility can be mentioned. Any transaction on a blockchain cannot be reversed or cancelled once other nodes approve it. Blockchain technology uses the distributed registration mechanism, and all nodes involved in the system contain a copy of the entire Blockchain.

Below a figure (see Figure 3) containing the Blockchain mechanism illustrating a non-tempered versus a tempered chain. It is quick to notice that the data has been tempered, and the content has been changed in the continuum, resulting in a complete change in the chain. This illustrates that a single data entry cannot be changed until a difference in all datasets will occur.



**Figure 3. Immutability of Blockchain**

Therefore, a transaction cannot be undone after the users included in the chain approve it. Apart from this point of view, it is understood that due to the principle of the Blockchain's irreversibility, the payments made and some similar transactions have definite results. It can also be said that this situation increases the confidence in the transactions to be made in the system [13].

In its peer-to-peer communication model, communication takes place directly between peers without any central regulator. Each peer stores the available information and directs it to other peers [14]. Therefore, data is transmitted between peers rather than from a single centre. The data are distributed and stored between peers. The peer-to-peer communication model offers advantages such as obtaining resources in an interoperable way, decreasing sustainability and distribution costs, and providing privacy and security to peers [15]. Blockchain technology also uses the peer-to-peer communication model. Distributed registration mechanisms, not the need for central authority and confidentiality, characteristic of blockchain technology, are compatible with the peer-to-peer communication model. Today, the development of the Blockchain can be defined in three phases [16].

Blockchain 1.0, also known as the digital money phase, refers to crypto money with money transfer and digital payment applications. Blockchain technologies such as mining, encryption, and block structure are used in crypto coins. Bitcoin, the first cryptocurrency, has preceded the theory as an application [17]. Bitcoin requires minimal transaction fees compared to traditional methods for money transfer and electronic purchases. Bitcoin accounts provide more privacy than credit cards. Traditional currencies rely on a central bank for transactions such as financial regulation and issuing, whereas Bitcoin and other digital currencies use cryptography to secure a fixed money supply. In this way, digital currencies are protected against inflation [18].

Blockchain 2.0, also referred to as the digital economy, covers a wide range of economic and financial applications beyond simple payments and money transfer transactions. Such applications include traditional banking instruments such as loans and mortgages, instruments such as stocks, bonds, futures, and contracts. Smart contracts are used for complex transactions based on such rules. Smart contracts can be expressed as computer programs with specific rules on the blockchain network. Smart contracts

are a blockchain technology whose use has become widespread in recent times. One of the most promising and exciting applications of blockchain technology is smart cities, which include all concepts such as smart management, smart transportation, smart living, smart use of natural resources, and smart economy [19]. It is possible to gain significant opportunities from blockchain technology in the machine to machine communication in the scope of the internet of things [20].

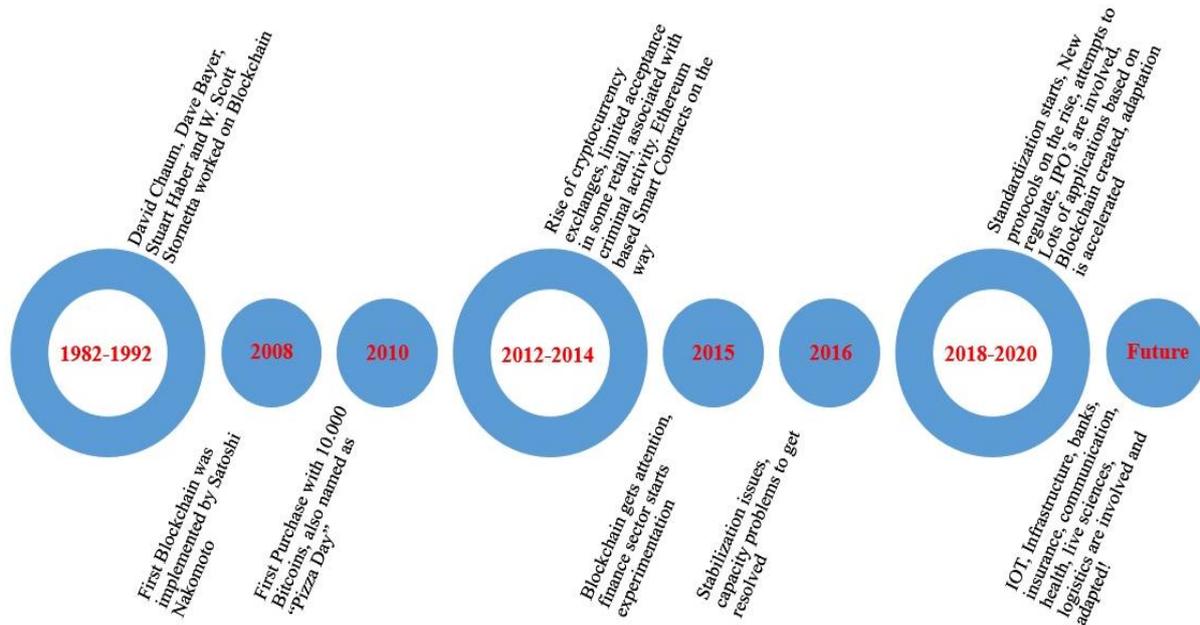
Blockchain 3.0, with significantly broader and more complex applications beyond currencies, is currently emerging [21]. With Blockchain 3.0, people who started developing applications in a wide range of business lines began to encounter a problem over time. Although Smart Contracts provide an excellent convenience in software, it was troublesome to use this data because the data that this software should use was in the outside world, i.e. in systems outside the current blockchain network. With the introduction of alternatives that can be integrated with the data in existing external systems, the concept of Distributed Applications has become apparent. With Blockchain 3.0, a blockchain understanding closer to real-life applications has come up today. Dapps, which we can describe as end-user interaction, smart contracts and blockchain network at the back, will continue to be important topics of the future [22].

Blockchain 4.0, When contemplating and comparing to the older generations historically (see Figure 4), this generation is principally centred on services such as public ledger and distributed databases in real-time. This level has seamless integration of Industry 4.0-based applications. It uses the smart contract, deduces the necessity for paper-based contracts and regulates within the network by its consensus [23].

A business with an immense conception but without a lot of Blockchain exercise can frame, instrument and conduct business Decentralised Applications (Dapps) on a 4.0 Blockchain, without comprehensive Blockchain programmer skills.

That signifies it can frame applications that enclose permissions hierarchies, tolerate to prefer who gets to see what; it can make and take payments inside the app, entirely safe and immutably, automatically recorded; it can enact self-executing contracts for anything from stage deliverables in-house to undertaker payments, and it can do it all inside an app that appears and feels as serviceable and runs as fast as anything noticed on the web.

Those capabilities empower and cause Blockchain 4.0 technology to serve and assist the United Nations Sustainability goals as its urgent need and an engineering challenge in the modern world. Developing smart technologies is an accurate journey to ensure that coming systems are sustainable. Blockchain is a next-generation evolution of information technology for realising sustainability in businesses and industries. Much investigation on blockchain-empowered sustainable manufacturing in Industry 4.0 has been conducted from technical, commercial, organisational, and operational perspectives[24].



**Figure 4.** History of Blockchain

From an academic point of view and consideration, when evaluated, it is being observed that the academic publications were quite limited in the year 2015 for both subjects "Bitcoin" and Blockchain. Additionally, the majority of the publications were for "Bitcoin" rather than the technology "Blockchain", which was empowering it (Table 1).

**Table 1.** Academic keyword search for "Bitcoin" and "Blockchain" 2015-2020

Academic Database	Bitcoin			Blockchain		
	2015	2020	Growth, %	2015	2020	Growth, %
Google Scholar	4.940	16.500	334,0	1790	44300	2.474,9
Science Direct	94	954	1.014,9	19	1862	9.800,0
Jstor	62	93	150,0	17	178	1.047,1
Springer Link	204	2.017	988,7	39	4756	12.194,9

When we consider that five years is a timeframe generally accepted to see changes and evaluations, it is interesting to see and witness the evaluation of the background technology itself, the "Blockchain", instead of its first and most successful application, Bitcoin only now. In the year 2020, we observe that publications containing the subject "Blockchain" definitely increase over the subject "Bitcoin", which is an indicator that the academic and enterprise tension is rising and is heading in the right direction to understand and evaluate the technology to build a sustainable and trustful future.

### **III. RESEARCH**

#### **A. USE OF BLOCKCHAIN IN VARIOUS INDUSTRIES**

There are various academic studies in the literature on the applications of blockchain technology. Pilkington [25], by transferring the most advanced applications of Blockchain technology and the basic principles of new application areas, showed the potential of Blockchain to change the nature of the

interface between economic intermediaries as the biggest reason for the disruption of technology and drew attention to the social interest. Davidson et al. [26] argued that Blockchain is more than information and communication technology innovation, and they have put forward the idea that it facilitates a new type of economic organisation and control.

The study suggests that the control approach based on the current corporate economy and the public choice economy is more promising. Catalini and Gans [27] argued that the two significant costs affected by technology are verification and network costs, arguing that the first is related to the ability to verify the properties of a transaction in a cost-friendly way, and the second to the ability to operate a marketplace without the need for a traditional intermediary. They also concluded that the Blockchain offers clear opportunities for new approaches to existing revenue models, reputation systems, and established knowledge. Wust and Gervais [28] analysed three use cases, Supply Chain Management, Interbank and International Payments, and Decentralized Autonomous Organizations, with a structured methodology, examining whether Blockchain is a suitable technical solution for a specific application scenario.

Oh, and Shong [29], in the case study for Blockchain technology, in which they stated that financial institutions in Korea are still in the proof-of-concept phase and they stated that there is not enough accurate measurement data, they revealed that the distributed features of Blockchain could not be fully implemented when developing financial services. Blemus [30] discusses and explains the legal projects that examine Blockchain regulations in the United States and the European Union regarding virtual currencies, smart contracts and initial money offers (ICO). Some of the industries where Blockchain and smart contracts can be helpful will be further discussed in detail below to define the main benefits of their usage in academic papers.

## **B. SUPPLY CHAIN AND LOGISTICS APPLICATIONS**

Recently, Blockchain emerged as a renovated journey of exchanging currency. However, the mechanisms that such technology uses are revolutionising companionable and economic dynamics. Indeed, Gartner ranked Blockchain as one of the top ten strategic technologies for 2020 [31]. However, in that report, the technology-related as in the “Trough of Disillusionment” state, since interest had reduced as proof and implementations failed to realise significant achievement. Despite this, Blockchain can weigh a fresh model of information and data interchange, which is considered crucial in several regions [32]. Therefore, interest has full-grown in many sectors that contain supply chains. One of the most significant considerations for using Blockchain within supply chains is its capableness to have a continually updated, transparent and safe distributed ledger on product tracking [33,34].

The concept of transparency is defined as any information that counter-observers can easily use in its current state. In the idea of a supply chain, the concept of transparency referred to the information contained in a supply network and presented to stakeholders. In this context, the supply chain's information flow can be transformed into a more reliable and transparent form with blockchain technology [35]. One of the underlying reasons blockchain technology attracts excellent attention in sectors such as the supply chain is that it emerges as a solution to the trust problem encountered in classical commercial relations [36].

Blockchain systems make supply chain applications more transparent, reliable, and independent from a central authority. If smart contracts are used in these applications, it will be possible to provide automatisations, transparency, and security. A supply chain is a structure in which many physical flows involving more than one actor and information sharing supporting these flows occur. Throughout this structure and flow, many activities are carried out, starting with the order's receipt and delivering the right product in the correct quantity, in the right conditions, at the right place and time.

The blockchain structure and the supply chain's application architecture show many similarities in these aspects [37]. Blockchain technology provides the opportunity to reduce production and logistics costs significantly, speed up production processes, reduce intermediaries in production processes, and also

prevent fraud in documents and processes. It is also imperative to implement blockchain architecture in the logistics sector in digital document management and product tracking.

This foundational – disruptive - technology does not utilise a central trusted agent for coordination but still grant a shared digital past and register updating between participator who might not unavoidably trust each other. It has been explained to maintain a trustless relationship[38].

Also, the concepts of immutability, transparency, traceability, and trust of blockchain technology can be easily applied in the logistics sector, and the control of products, materials, data, and processes with Blockchain will make outstanding contributions to the logistics industry [39]. (See Figure 5)

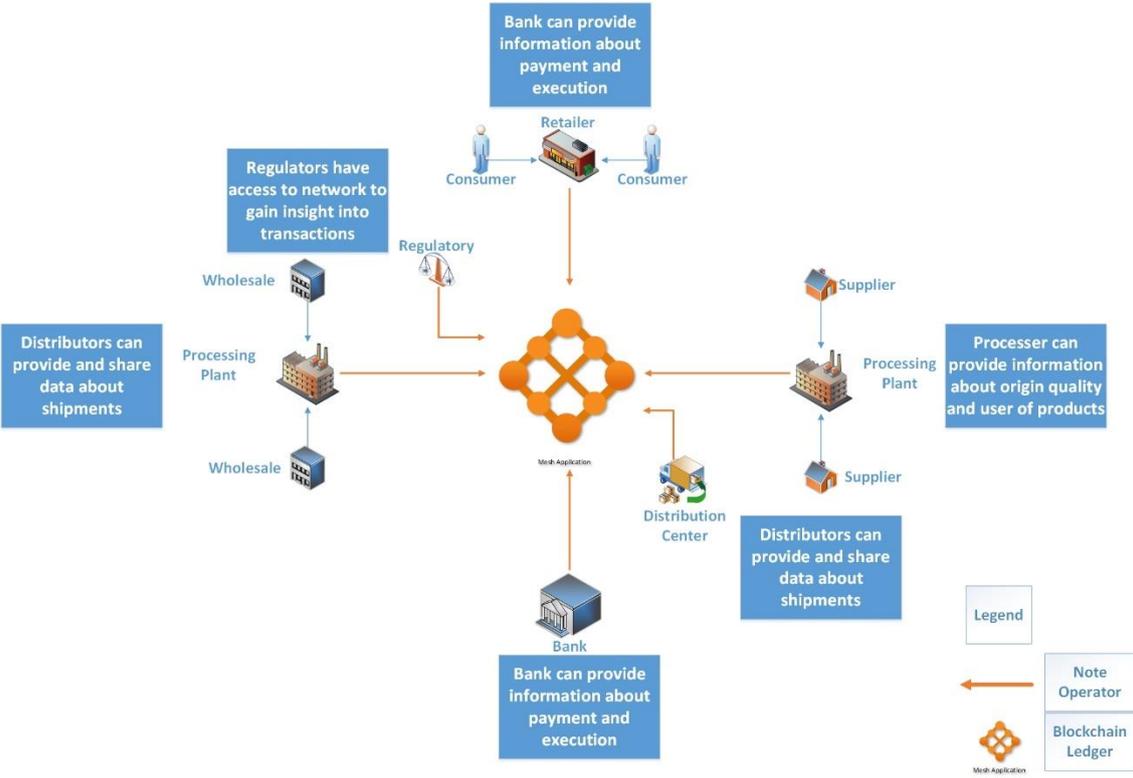


Figure 5. Logistics blockchain ecosystem

With the prominence of traceability, it has been observed that the applications in the supply chain for tracking products such as food, drugs, hazardous materials, sensitive electronic devices that have the risk of deterioration, theft, or forgery in the supply process will also benefit, and various studies have been carried out in this regard. In Jabbar and Bjørn [40] research, the first accepted that Blockchain might not incorporate the shipping area directly.

They suggest using the Infrastructure Grind feature with Blockchain. In this way, they expect an increase in consolidation, permeability, and speed factors compared to traditional methods. Alangot and Archa [41] suggested using Blockchain transportation of drugs. With Blockchain, all parties can hold immutable records of medicines. This way, it is ensured that all records and transactions are correct and in place.

Imeri et al. [42] suggested the use of blockchain transportation and supply chain management. They concluded that the use of this technology would increase information safety and traceability. Mackey and Nayyar [43] also suggested the use of Blockchain in medical transportation. They mentioned that this technology would provide a complementary solution to information sharing and data collection matters. Blockchain not only improves the issues mentioned, and the technology is also designed to solve existing barriers of adoption and implementation.

They concluded that Blockchain investment is essential to ensure the future security and integrity of supply chain management. Madhwal and Panfilov [44] also suggested the use of Blockchain in the aircraft industry. They indicated a transparent network of the supply chain for aircraft's parts would be achieved and decrease the black-market activity risk.

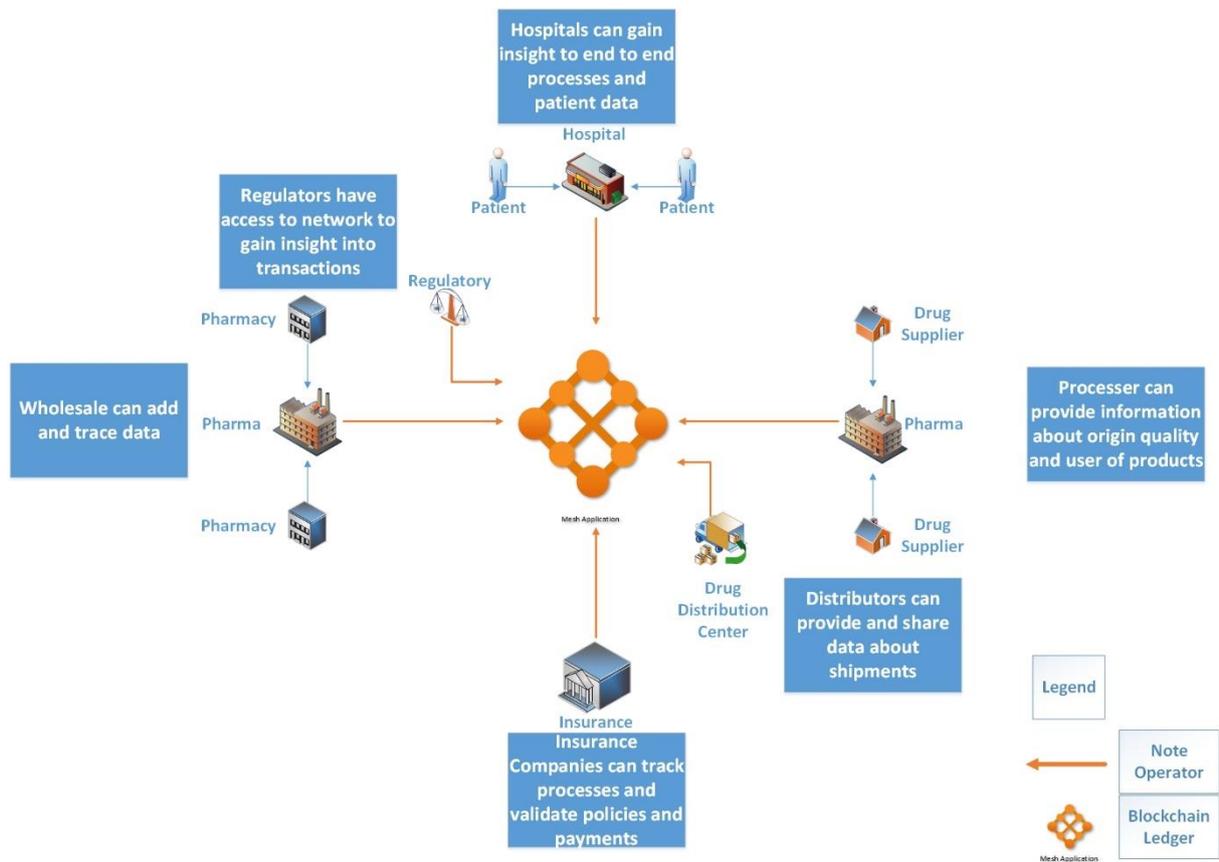
Sadouskaya [45] examined blockchain technology's effects on the supply chain and logistics sectors in her study. In the study in question, some advantages of blockchain technology on the supply chain were providing reliable information about the product to consumers, enabling all parties' participation with a decentralised structure, reducing fraud, minimising product returns, and facilitating payment systems. In the study of Meng et al. [46], investigations were made on intrusion detection systems in the supply chain processes of blockchain technology. The study mentioned that the Blockchain could be used in the supply chain area and that blockchain technology will go beyond the systems currently used and be more efficient to protect against cyber-attacks.

### **C. HEALTH APPLICATIONS**

Recently, thanks to the developed devices and assistive technologies, people can monitor their health from their homes. Blockchain technology is useful in the areas of patient privacy and information storage in a distributed structure. Smart contracts can be used to make these systems more reliable and automated. Depending on the health data results collected or the emerging situations, the necessary actions can be triggered automatically.

Yang et al. [47] suggested using blockchain technology in medical decision-making. They have brought together the patient, cured patient, doctor, and insurance company's experience, skill, and collaborative success rate to bring out a local reference-based consortium via Blockchain. Wang and Song [48] mentioned using Blockchain to achieve confidentiality, authentication, medical data integrity, and support fine-grained access control. They suggested a secure electronic health record (EHR) system based on facilitating the system's management and ensuring the integrity and traceability of medical data. Fan et al. [49], in turn, focused on bringing a standard to data management and sharing policy.

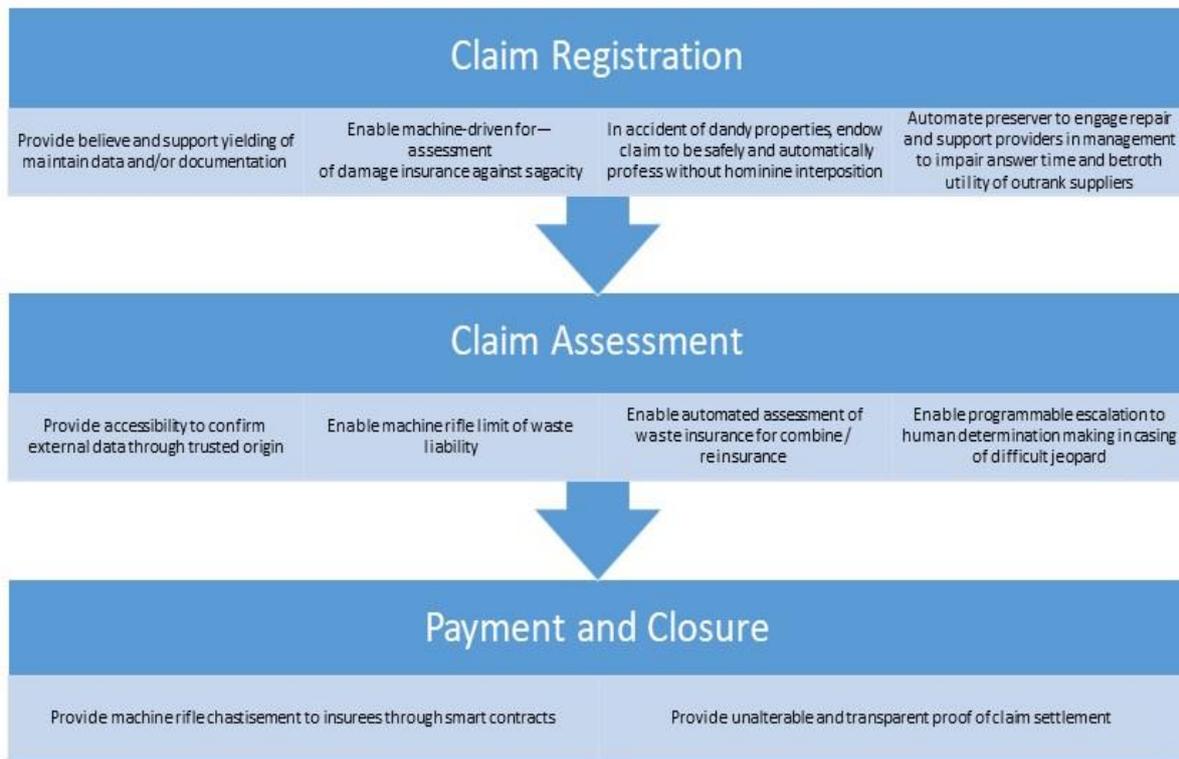
In this way, they would like to ease the process for pharmaceutical scientists to develop precise medicines. They concluded that Blockchain could play a vital part in sensitive medical information sharing. Hyla and Pejaś [50] suggested that Blockchain can promote transparency in data transactions in the medical industry. Blockchain provides a cure that does not necessarily need trusted third parties, works in a distributed environment. (see Figure 6)



*Figure 6. Healthcare blockchain ecosystem*

## D. INSURANCE APPLICATIONS

Traditional insurance solutions have uncertainties and prolonged results. If smart contracts are implemented by removing delays in the processes, speedy and transparent results can be obtained without a third party's intervention. Kunde et al. [51] and Davis et al. [52] suggested using Blockchain either to solve the problem of unemployment insurance in terms of underwriting or peer-to-peer insurance models to reduce costs and avoid double-spending (Figure 7).



**Figure 7.** Insurance blockchain ecosystem

## E. ACCOUNTING APPLICATIONS

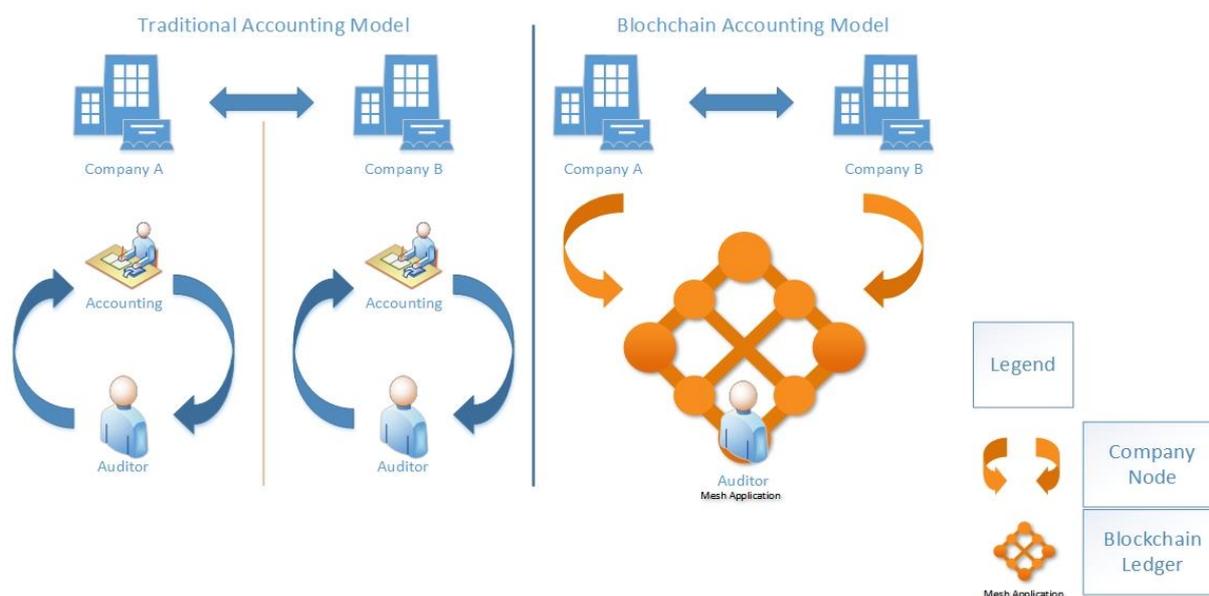
Due to its structure, smart contracts can be used in many financial areas such as checks, loans, and leasing. For the first time, the applicability of the blockchain accounting system was explained by Lazanis [53]. It has been emphasised that if a company voluntarily publishes its transactions on the Blockchain, the Blockchain, in particular, eliminates the need for trust in an intermediary, such as a bank or insurance company.

Another concept used in connection with blockchain accounting is the "worldwide ledger" (WWL). Tapscott and Tapscott [54] defined WWL as a final implementation of a verifiable, auditable and searchable blockchain accounting system where international companies publish all their transactions and make them suitable for regulators, managers, and key stakeholders.

Dai and Vasarhelyi [55] and Hambiralovic and Karlsson [56] suggested that although different concepts related to the blockchain-based accounting system serve the same outputs, the idea of "tripartite accounting system" will be a correct use in practice and the accurate perception of the public. The literature is associated with the tripartite accounting system concept (Triple-Entry Accounting System)

related to the blockchain-based accounting system. In the blockchain-based accounting system, distributed and public records will be created instead of central accounting records. Records will be placed at three different points due to the third accounting record, decentralised and open to everyone, in the Blockchain and the buyer and seller. This decentralised and agentless system also allows the creation of financial statements at any time [57].

A real-time blockchain accounting system will undoubtedly provide transparency, immutability, and accessibility to achieve all technology capabilities for companies and their stakeholders. In this context, the use of Blockchain as a source of trust in accounting processes and the inclusion of the transparency level in the financial regulation and control system will change many aspects of modern accounting. In particular, it will allow data to be easily accessed by many stakeholders and multiple control mechanisms (Figure 8).



*Figure 8. Accounting blockchain ecosystem*

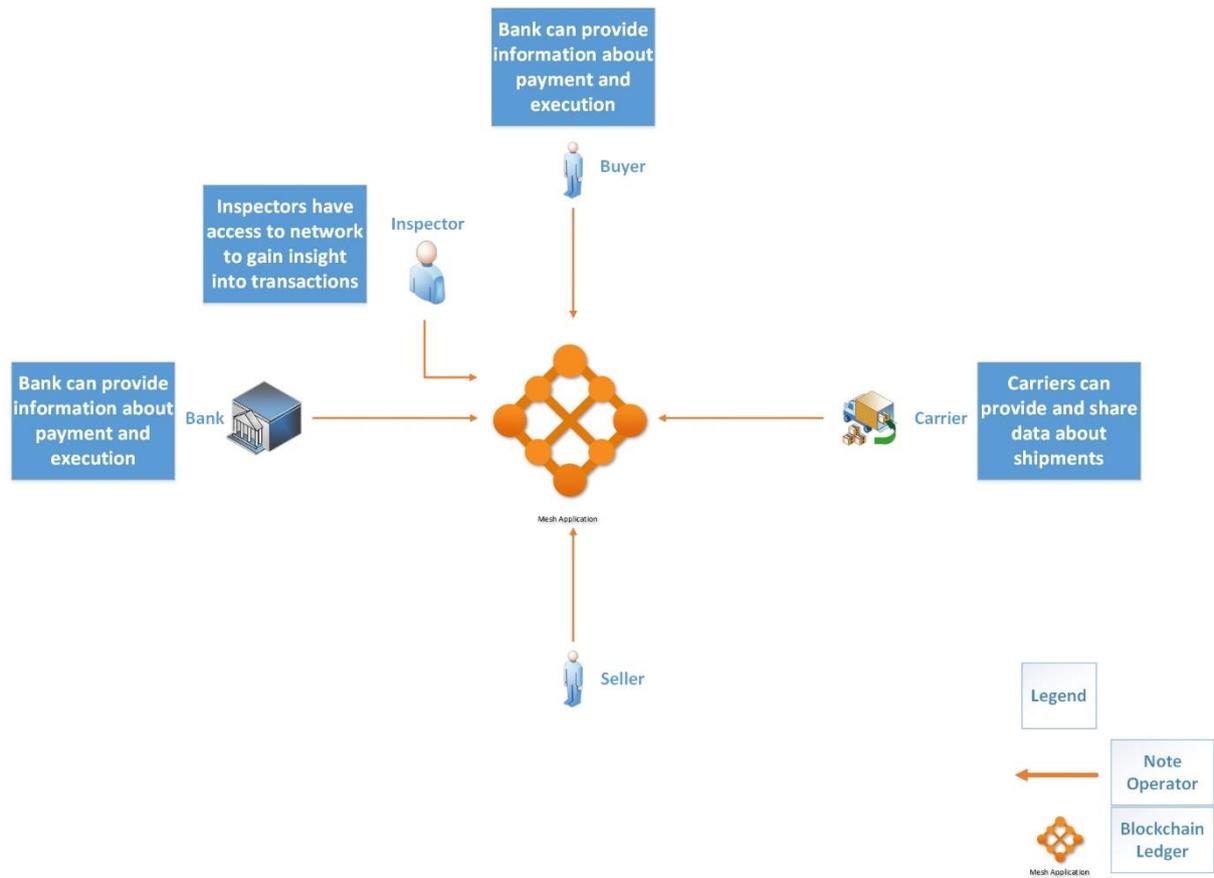
## F. FINANCE APPLICATIONS

These days, blockchain technology is used for various financial fields, including business, financial assets, foreseeing markets, and transactions [58]. With Blockchain, it is planned to sustain the global economy's development, consumers benefit, more efficient banking system [59].

Peters and Panayi [60] suggested using a financial system for blockchain-enabled applications for financial assets, such as securities, fiat money, and derivative contracts. They mentioned that blockchain technology could be used for central bank treasury ledgers, retail and investment bank ledgers, trading, settlement, and clearing processes.

Although they emphasise the need for blockchain technologies to be carefully considered, they believe that the Blockchain will play an integral part to revolutionise the finance sector. Beck et al. [61] suggested a blockchain technology that offers a significant shift to capital markets and a more utilised method for performing operations like securities and derivatives transactions.

Poon and Buterin [62] proposed a way to use decentralised autonomous applications to promote globally available data services, creating an option for centralised server farms. Lewis et al. [63] suggested that distributed ledger increases the efficiency and security of financial markets. They also added that it could better cooperate between the public and private sectors via improving transparency, trust, information sharing, and audit trails (Figure 9).



*Figure 9. Finance blockchain ecosystem*

Blockchain adoption to the financial sector will finally lead to cost savings in financial reporting, compliance, centralised, and business operations [64].

## IV. RESULTS

The studies' summary with their contribution to the literature on the advantages of the Blockchain usage of mentioned industries is shown below (Table 2).

*Table 2. Summary of the advantages of blockchain usage in some industries (compiled by authors)*

Industry	Author	Advantages of the Blockchain usage			
		Transparency	Cost Reduction	Immutability	Trust (Security)
Logistics	Awaysheh et al. [35]	+			
	Hawlitschek et al. [36]				+
	Bross [39]	+		+	
	Jabbar and Bjørn [40]		+	+	
	Alangot and Archa [41]		+	+	
	Imeri et al. [42]				+
	Nayyar [43]				+
	Madhwal and Panfilov [44]				+
	Sadouskaya [45]		+		+
	Meng et al. [46]		+		+
Health	Yang et al. [47]			+	
	Wang and Song [48]			+	+
	Fan et al. [49]		+		+
	Hyla and Pejaś [50]	+	+		
Insurance	Kunde et al. [51]		+		
	Davis et al. [52]		+		
Accounting	Lazanis [53]				+
	Tapscott and Tapscott [54]	+			
	Dai and Vasarhelyi [55]	+			
	Hambiralovic and Karlsson [56]	+			
	Potekhina and Riumkin [57]	+		+	
Finance	Beck et al. [61]		+		
	Poon and Buterin [62]	+			+
	Lewis et al. [63]				+

In the summary table above, most of the studies in that research considered the advantages of Blockchain: transparency, cost reduction, immutability, trust, and security. As for openness, especially for the studies in the accounting field, everyone can see both their transaction status and the details of all transactions on the Blockchain, ensuring transparency. Cost reduction is also underlined for the health and logistics industry because it increases efficiency, reducing costs. From the aspect of immutability, Blockchain can provide advantages for the logistics industry since it creates a solid frame, especially data records.

It should also be noted that the environmental circumstances of technology and the requirement of new business processes and systems that will be enabling new opportunities require extreme and cutting edge technologies. Those will melt into each other to take complete control of privacy whilst providing total transparency and independence to centrally managed systems and business management.

We do witness that “Artificial Intelligence” and the “Internet of Things” already interface with Blockchain technology to deliver business examples of intelligent sensors providing control and data to business processes and maintaining their privacy totally under control by not belonging to any central authority or control mechanisms. Those inter systems will provide a data flow and exchange between all interconnected systems and tools and help create an “automated decision execution system” without human intellectual and physical contribution, which will stop manipulations.

For example, there is very little notice on the application of this technology to control social sustainability. Social sustainability administration is tough and faces unmatched challenges. For instance, SCC prescribes manufacturer suppliers to keep a faithful record of data on their employees' safety and good. However, when buyers and their auditing agencies recognise potentially egress in suppliers' register, such as wage and leave data, suppliers often handle data to hide noncompliance. Blockchain technology, being used together with the Internet of Things and big data analytics, can transverse such opportunist behaviours by automatise data gathering and recording updates and building tamper-proof record blocks that intercept data manipulation [65].

Finally, for trust and security, Blockchain can provide benefit for logistics, health and finance industries since, as it was stated before, in Blockchain technology, each participant keeps a copy of all records from the start. Since changing these records will cause the summaries to change, most may notice this when the records are changed.

Therefore, the need for a central database is eliminated in a reliable environment. With a distributed database system where everyone can verify, it can be proven that the correct information is kept.

## **V. CONCLUSION**

Blockchain can be expressed as the beginning of a new era in information technologies thanks to its transparency and distributed structure that eliminates central authority. Press, social media, international organisations, the private sector, and public institutions show great interest in Blockchain. When the literature is examined, it is seen that the number of studies on Blockchain has increased rapidly in the last decade. As academic studies and applications in the market grew, some limitations of blockchain technology emerged. Despite the performance and security problems encountered in the widespread use of new technology, Blockchain, the solutions developed to lead to this technology's maturation. Blockchain appears to have more research potential in terms of its current structure, mode of operation, application areas, and the opportunities it promises. It is understood that blockchain technology can change the way the business world does business; it will support removing borders in countries and speak a common language.

Blockchain contributed to the industries in various ways. In this study, the literature has reviewed, and the dimensions of transparency, cost reduction, immutability, security and trust are underlined. It is seen that the majority of the studies emphasised the trust dimension of Blockchain, and also, it clearly stated that it would reduce costs and will create a more transparent environment on both the industry side and even customer side.

Concepts like Circular Economy, Social Sustainability, Servitization, Social Manufacturing, Shared Economy will expand and will be realised with the support of Industry 4.0 and its underlying new generation Blockchain, Internet of Things ad Artificial Intelligence Technologies. In the familiar IoT-enabled world, there is a blast of data present for businesses. Insufficient capabilities of current decision-making techniques limit the abilities of businesses to utilise big data fully. New software tools and techniques should be integrated with intelligent factories and CPS to enable real-time quantification of the ecological impacts of production processes from ubiquitous sources. Sensors can help collect appropriate data, and protocol development for data integration is vital for successfully integrating sustainability principles [66].

This bundle of concepts and technologies will strategically and tactically improve Business and its Sustainability with the data they produce and provide to decision-making systems and respective management levels.

It is understood that after the emergence and development of transparent and accountable technologies that eliminate centralised structures such as Blockchain, the business world must adapt to this change,

and countries need to rearrange themselves, their governments, and laws accordingly. In this context, including new technologies such as Blockchain contribute to developing and better understanding the industries' application area mentioned in the study.

We are highly optimistic about a coming blockchain utopia that leads and protects humanity with what we define as DPoSEGr “Decentralised Privatisation of Social, Economic, and Governmental Relationships” This will enable us to set duplex relationships “between our private and safe ourselves“ with the remaining social surrounding what we call “trustless others“.

This future and disrupting technology will govern privacy and anonymity as information and data will become the main economic driver. We assume that more and more beings will realise the truth and value of their own “naturally self-generated data“ and its importance and keep private data safe and available only for the ones that permission is given for a reason.

A robust, shared, circular economy will form around this idea; it will gain soft control of regulations and transform it to SSR & SSI “Social-Self-Regulation“ and “Self-Sovereign Identity“, which will boost the economy, create a new “p2p“ ecosystem, support sustainability and transparency as well reform trust in society.

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