EVOLUTION OF PRACTICAL USE OF BLOCKCHAIN TECHNOLOGIES BY COMPANIES

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Abstract. *The article examines the main stages of evolution of blockchain technologies in the activities of various companies from 1991 to the present. The aim of the article is to study the evolution of the use of blockchain technologies in the practice of different companies. The research methodology includes the use of the historical method to study the main stages of development of blockchain technologies and the study of blockchain use practices by different companies. The relationship between the stages of evolution and Tiers of Blockchain has been established: 2008-2013 (Blockchain 1.0); 2013-2015 (Blockchain 2.0); 2015-2018 (Blockchain 3.0); From 2018 to now (Generation X). The main types of blockchain (public blockchains; private blockchains; semi-private blockchains; sidechains; permissioned; distributed ledger; shared ledger; fully private of proprietary blockchains; tokenized blockchains; tokenless blockchains) are systematized. Peculiarities of practical implementation of blockchain technologies in the activity of companies of different sectors of the economy are studied. A SWOT-analysis was conducted, which revealed that blockchain technologies will undoubtedly continue to develop, affecting many industries, including public administration, retail, information technology, travel, health, education, agriculture and entertainment. One of the ways to improve the use of blockchain technologies should be: increasing the confidentiality of operations; scaling of chains of blocks; establishing compatibility between different blockchain systems; strengthening the security of blockchain operations; individual approach to the use of blockchain technologies.*

Keywords: *blockchain technology; tiers of blockchain; types of blockchain; company.*

JEL Classification: C80; D74; E44; G30

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Introduction. The modern world is impossible to imagine without information technology, which actively accompanies our whole life. Unfortunately, along with their development, there are technologies that can use information about you for their own purposes. Blockchain technologies have been developed to counter such operations. Blockchain technology is a "chain of blocks", where each block is unique and has a specific reference to the previous one, which provides great difficulty in changing and / or deleting data elements.

Blockchain technology is one of the greatest innovations of the 21st century, given the impact it has on various sectors of the economy, including medicine, logistics, financial calculations, education, public administration and other areas.

Literature review. According to S. Makridakis, A. Polemitis, G. Giaglis and S. Louca (2018), due to the significant number of benefits that blockchain can bring to each industry, its level of importance is compared with the role of the Internet in the early 1990s [1]. Researchers of the blockchain claimed that it was actively used in various fields. So, K. Fanning & D. P. Centers (2016), I. Eyal (2017), A. Simpson (2018) and others studied the use of blockchain in the financial sphere [2-4]. A. Reyna, C. Martín, J. Chen, E. Soler and M. Díaz (2018), S.-C. Cha, J.-F. Chen, C. Su and K.-H. Yeh (2018), K. Yeow, A. Gani, R. W. Ahmad, J. J. P. C. Rodrigues and K.

Ko, (2018), C. Qu, M. Tao and R. Yuan (2018), S. Huckle, R. Bhattacharya, M. White and N. Beloff (2016), Y. Zhang and J. Wen (2017) and others studied the use of blockchain in the Internet of Things [5-10]. J. Zhang, N. Xue and X. Huang (2016), C. Esposito, A. De Santis, G. Tortora, H. Chang and K.-K. R. Choo (2018), M. A. Engelhardt (2017) studied the possibilities of using blockchain in health care [11-13]. R. Dennis and G. Owen (2015), A. Schaub, R. Bazin, Omar Hasan and L. Brunie (2016), R. Dennis and G. Owenson (2016) in their works describe the impact of blockchain on business reputation [14-16]. The use of blockchain in supply chain management deserves special attention [17-18].

The rapid growth of Blockchain technology in recent years has opened up many gaps and directions for further research. However, in our opinion, it is necessary to study the study of effective practices of using blockchain technologies by companies in various industries.

Aims. The aim of the article is to study the evolution of the use of blockchain technologies in the practice of different companies.

Methodology. The research methodology includes the use of the historical method to study the main stages of development of blockchain technologies and the study of blockchain use practices by different companies.

Results. We propose to begin the study of the practice of using blockchain technology by studying the main stages of its development (Fig. 1).

Throughout these five years, there was a growing interest in using blockchain for applications other than cybercurrency. This trend continues into 2021 as governments and enterprises look to blockchain to handle a variety of use cases. This includes voting, real estate, fitness tracking, intellectual rights, the internet of things and vaccine distribution.

Each of the described stages of development of blockchain technologies is associated with Tiers of Blockchain (table 1).

Table 1. The ratio of the main stages of development of blockchain technology and Tiers of Blockchain

Periods	Tiers of Blockchain	Description
2008-2013	Blockchain 1.0	This Blockchain is basically used for cryptocurrencies and it was introduced with the invention of bitcoin. All the alternative coins as well as bitcoin fall into this tier of blockchain. It also includes core applications as well.
2013-2015	Blockchain 2.0	Blockchain 2.0 is used in financial services and industries which includes financial assets, options, swamps and bonds etc. Smart Contracts was first introduced in Blockchain 2.0 that can be defined as the way to verify if the products and services are sent by the supplier during a transaction process between two parties.
2015-2018	Blockchain 3.0	Blockchain 3.0 offers more security as compared to Blockchain 1.0 and 2.0 and it is highly scalable and adaptable and provides sustainability. It is used in various industries such as arts, health, justice, media and in many government institutions.
From 2018 to now	Generation X	This vision the concept of singularity where this blockchain service will be available for anyone. This blockchain will be open to all and would be operated by autonomous agents

Source: systematized by the author on the basis [16-19]

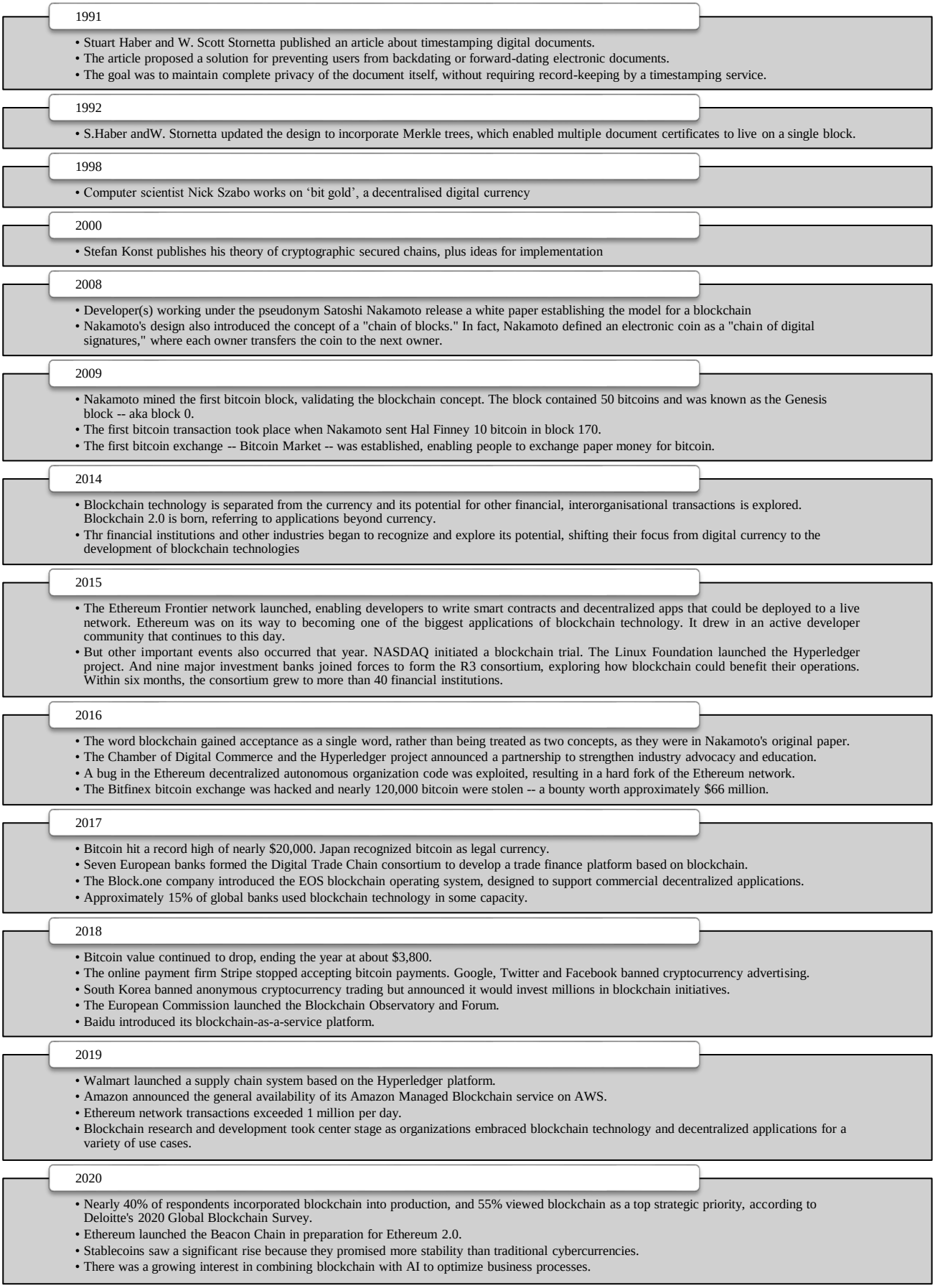

Figure 1. The main stages of development of blockchain technologies

Source: systematized by the author on the basis [16-26]

The most scholars distinguish three main types of blockchain: public blockchain, permissioned blockchain, private blockchain [16-18, 20-23]. However, Blockchain has evolved greatly in the last few years and based on its different attributes, they can be divided into multiple types.

The most complete classification of blockchain types is given by Simanta Shekhar Sarmah (2020) [19]:

1. *Public Blockchains.* Public blockchains are open to the public and any individual can involve in the decision-making process by becoming a node, but users may or may not be benefited for their involvement in the decision-making process. No one in the network has ownership of the ledgers and are publicly open to anyone participated in the network. The users in the blockchain use a distributed consensus mechanism to reach on a decision and maintain a copy of the ledger on their local nodes.

2. *Private Blockchains.* These types of blockchains are not open to the public and are open to only a group of people or organizations and the ledger is shared to its participated members only.

3. *Semi-private Blockchains*. In a semi-private blockchain, some part of the blockchain is private and controlled by a group or organizations and the rest is open to the public for anyone to participate.

4. *Sidechains.* These blockchains are also known as pegged sidechains where coins can be moved from blockchain to another blockchain. There are two types of sidechains naming one-way pegged sidechain and two-way pegged sidechain. One-way pegged sidechain allows movement from one sidechain to another whereas two-way pegged sidechain allows movement on both sides of two sidechain.

5. *Permissioned.* Ledger In this type of blockchain, the participants are known and already trusted. In permissioned ledger, an agreement protocol is used to maintain a shared version of the truth rather than a consensus mechanism.

6. Distributed Ledger. In a distributed ledger blockchain, the ledger is distributed among all the participants in the blockchain and it can spread across multiple organizations. In distributed ledger, records are stored contiguously instead sorted block and they can be both private or public.

7. *Shared Ledger.* Shared ledger can be an application or a database that is shared by public or an organization.

8. *Fully Private of Proprietary Blockchains.* These types of Blockchains are not a part of any mainstream applications and differ the idea of decentralization. These type of blockchains come in handy when it is required to shared data within an organization and provide authenticity of the data. Government organizations use private of proprietary Blockchains to share data between various departments.

9. *Tokenized Blockchains.* These are standard blockchains which generate cryptocurrencies through consensus process using mining or initial distribution.

10. *Tokenless Blockchains.* These blockchains are not real blockchains as they do not have the ability to transfer values, but they can be useful when it is not required to transfer value between nodes and there is only the need to transfer data among already trusted parties.

Figure 2. Classification of the main types of blockchains by Simanta Shekhar Sarmah

Source: systematized by the author [19]

Blockchain's transparent and decentralized platform has become attractive to companies in many industries that tend to use blockchain for a variety of business purposes. The list of companies that have implemented blockchain technologies in their activities is shown in Table 2.

Banking and payment systems have begun to use the blockchain to make their transactions more efficient and secure. The use of blockchain technologies in financial calculations allows you to efficiently and securely transfer funds using decentralization technology.

Blockchain is also becoming increasingly popular in the healthcare industry, as it is able to restore lost trust between clients and healthcare facilities. With the help of the blockchain, authorization and identification of patients has become easier, and fraud with prescriptions and medical data, as well as the loss of records can now be avoided.

Thanks to the blockchain's ability to efficiently store and verify documents, the legal industry has begun to use the blockchain to securely verify records and documents. Blockchain can significantly reduce litigation and battles by providing an authentic means of verifying and validating legal documents.

Industries such as Insurance, Education, Private transport and Ride sharing, government and public benefits, retail, real estate etc. have started implementing blockchain to reduce costs, to increase transparency and to build trust.

Blockchain technologies have also begun to be used in the public sector, for example during elections. Rigging of election results can be avoided with an effective use of blockchain. Voter registration and validation can be done using blockchain and ensure the legitimacy of votes by creating a publicly available ledger of recorded votes.

Table 2. List of Enterprises Implementing Blockchain

Company	Sector	Blockchain Solution
Ford	Auto	Leveraging blockchain technology to enhance the mobility technologies
Toyota	Auto Industry	Planning to use blockchain technology to enhance autonomous driving technology
HSBC	Bank	Using blockchain technology to fully digitize their record keeping and increasing the security of vault system
Anheuser Busch InBev	Beverage	Using blockchain for their beverage supply chain and increasing transparency
Alibaba	e-commerce	Using blockchain technology to track luxury goods in its e-commerce platforms
Tencent	e-commerce/ retail	Solution for verifying invoice authenticity and for ensuring tax compliance
UnitedHealthcare	Healthcare	Using blockchain technology to improve doctors directories to enable accurate insurance claim fillings
Metlife	Healthcare	Using blockchain technology for storing patients medical records for insurance purposes
AIA Group	Insurance	Launched the first of its kind bancassurance for sharing policy data
Prudential	Insurance	Unveils a blockchain powered trading platform for small and medium-sized enterprises
BHP Billiton	Mining	Leveraging blockchain technology for supply chain management
Shell	Oil	Planning to use blockchain for crude oil trading to get rid of corruption
Pfizer	Pharmaceutical	Tracking records and managing the digital inventory of pharmaceutical products
JLL	Real Estate	Exploring blockchain for Spanish commercial real estate valuation
Walmart	Retail	Using blockchain technology to track product movement from farmers to stores
Nestle	Retail	Using blockchain technology in supply management to track baby food products
Baidu	Search giant	Using blockchain to enhance intellectual rights management
Maersk	Shipping	Blockchain system for tracking movement of shipments between ports
UPS	Shipping	Blockchain powered logistics monitoring and management solution
FedEx	Shipping	Working on blockchain solution for settling customer disputes
Samsung	Tech	Intends to use blockchain technology to enhance supply chain management when it comes to electronics shipments
Facebook	Tech	Exploring the use of blockchain to enhance data security and users privacy
Apple	Tech	Patented blockchain technology for time stamping data
Google	Tech	Exploring the use of blockchain technology to enhance cloud service security and for data protection
British Airways	Travel Industry	Implementing blockchain to manage flight data as well as verifying traveler's identity

Source: systematized by the author [21]

SWOT-analysis of the practical use of blockchain in companies has shown that this technology has sustainable prospects.

Discussion. Blockchain technology will no doubt continue to evolve, affecting many industries, including government, retail, information technology, travel, healthcare, education, agriculture and entertainment.

One of the ways to improve the use of blockchain technologies should be:

- increasing the confidentiality of operations;
- scaling of chains of blocks;
- establishing compatibility between different blockchain systems;
- strengthening the security of blockchain operations;
- individual approach to the use of boccein technologies.

Based on the scientific research on the practical use of blockchain in various fields SWOT-analysis was performed (Fig. 3).

Strengths	**Weaknesses**
- One of the biggest advantages of Blockchain is dissemination which allows a database to be shared without a central body or entity. - Users are empowered to control their information and transaction. - Blockchains provide complete, consistent and up to date data without accuracy. - Since blockchain does not have any central point of failure due to its decentralized network, it can withstand any security attack. - As no central authority is required, users can be assured that a transaction will be executed as protocol commands.	- Blockchains are expensive and resource intensive as every node in the blockchain repeats a task to reach consensus. - In blockchain, users verify a transaction based on certificate authentication, land titles, cryptocurrencies, etc. But there is no way to reverse a transaction even if both the parties involved in the transaction are ready to do so or if the transaction go sour due to some reason. - One of the disadvantage of blockchain is its complexity and complicacy to understand for a general human being. Blockchain is full of complex concepts and processes which is not yet refined so that common man can easily digest and consume the information on how to use it and hence it's not yet ready for mainstream use.
Possibilities	**Threats**
- Blockchains provide transparency and immutability to the transactions as all the transactions cannot be altered or deleted. - Blockchain's peer-to-peer connections help to identify fraud activities in the network and distributed consensus. - By using blockchain, sensitive business data can be protected using end to end encryption. - Users in a blockchain can easily trace the history of any transaction as all the transactions a blockchain are digitally stamped. - Blockchain are resilient to cyber-attacks due to peer-to-peer nature and network would operate even when some of the nodes are offline or under security attack. - Multiple copies of the data can be stored in the blockchain and hence users can avoid storing sensitive data in one place	- A transaction in the blockchain is settled only when all the nodes in the blockchain successfully verifies the transaction. This could be a very slow process as the block inserted needs to be verified to mark the transaction as authentic by all the nodes. - The size of blockchain grows with an addition of a block. A node needs to store the entire history of the blockchain to be a participant in validating transactions, causing the blockchain to grow continuously. - In blockchain, all the transaction related information is available publicly which can become a great liability when distributed ledgers are used in sensitive environments such as dealing with government data or patients medical data. The ledgers need to be altered and access should be limited with proper clearance only.

Figure 3. SWOT-analysis of the practical use of blockchain in companies

Source: developed by the author [20-25]

Conclusions. According to the results of the study, the following conclusions can be drawn:

1. The article examines the main stages of evolution of blockchain technologies in the activities of various companies from 1991 to the present.

2. The relationship between the stages of evolution and Tiers of Blockchain has been established: 2008-2013 (Blockchain 1.0); 2013-2015 (Blockchain 2.0); 2015-2018 (Blockchain 3.0); From 2018 to now (Generation X).

3. The main types of blockchain (public blockchains; private blockchains; semi-private blockchains; sidechains; permissioned; distributed ledger; shared ledger; fully private of proprietary blockchains; tokenized blockchains; tokenless blockchains) are systematized.

4. Peculiarities of practical implementation of blockchain technologies in the activity of companies of different sectors of the economy are studied. A SWOT-analysis was conducted, which revealed that blockchain technologies will

undoubtedly continue to develop, affecting many industries, including public administration, retail, information technology, travel, health, education, agriculture and entertainment.

5. One of the ways to improve the use of blockchain technologies should be: increasing the confidentiality of operations; scaling of chains of blocks; establishing compatibility between different blockchain systems; strengthening the security of blockchain operations; individual approach to the use of blockchain technologie.

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