

# Blockchain technology in financial services: a comprehensive review of the literature

Blockchain  
technology in  
financial  
services

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## Abstract

**Purpose** – The purpose of this study is to thoroughly review studies that have used blockchain technology in financial services. This study will help provide a holistic framework that would highlight the current state and challenges of the blockchain in the financial services sector.

**Design/methodology/approach** – The objective of this study is to systematically examine and organize the current body of research literature that either quantitatively or qualitatively explored the use of blockchain technology in financial services. The study uses PRISMA-guided systematic review along with bibliometric analysis to achieve the purpose.

**Findings** – This study contributes to the existing literature by exploring and analyzing systematic studies available on blockchain with special reference to financial services sector. With blockchain based on five principles, namely, computational logic, peer-to-peer transmission, irreversibility of records, distributed database and transparency with pseudonym has immense potential to unleash and transform the financial service industry. With increasing blockchain-based operations of decentralized banking, insurance, trade finance, financial markets and cryptocurrency market, the subject is rapidly growing and seeking considerable contribution from scholars from around the world.

**Research limitations/implications** – This study uses systematic literature review approach, which has its own demerits. Like other studies based on Systematic Literature Review, this study also suffers from a certain bias such as sample selection bias, publication bias, data interpretation and the combination of quantitative and qualitative studies in the population. Further, the adoption and resultant benefits of blockchain have not been empirically tested.

**Practical implications** – This study can help policymakers and institutions in determining their future course of action, as it highlights the state of research in the area of blockchain technology and financial services.

**Originality/value** – Very few studies have done a comprehensive review of literature on blockchain in financial services.

**Keywords** Finance, Qualitative, Technology, Financial services, Blockchain, Financial inclusion, Both

**Paper type** Literature review



## 1. Introduction

The recent decade has witnessed rapid advances in technology and the global financial landscape. The term “Financial Technology,” or FinTech, refers to the applications of technology in providing business solutions. It is the technology used to provide financial

markets a financial product or financial service, characterized by sophisticated technology relative to existing technology in that market (Knewtson and Rosenbaum, 2020). The use of the word “FinTech” is traced back to the beginning of the 1990s (Cai, 2018; Hochstein, 2015). The Fintech movement has had a significant impact on the evolution of the financial services sector, along with regulatory implications. Fintech encompasses various digitally driven innovations and technology-intensive advancements in the financial sector of the global economy (Philippon, 2016). Such improvements and business model innovations have a significant disruptive impact on the financial industry, improve access to financial services and revolutionize the products and services provided by the firms. However, these innovations also lead to various regulatory, legal and privacy challenges for government bodies (Du *et al.*, 2019). Multiple examples of FinTech innovations include cryptocurrencies and blockchain, Robo-advisory in wealth management, mobile payment systems, peer-to-peer lending, crowdfunding, algorithmic trading systems and artificial intelligence in financial schemes (Lee and Shin, 2018; Buchak *et al.*, 2018; Arner *et al.*, 2016).

Blockchain, the underlying technology of cryptocurrencies, is one of the examples of innovations that is central to the Fintech movement and is an emerging financial technology that is poised to have a significant impact on the functioning of various financial service organizations (Tapscott and Tapscott, 2016; Tapscott and Tapscott, 2017). The origins of this technology can be traced back to 2008 when Satoshi Nakamoto (2008) wrote a white paper that introduced bitcoin, an electronic version of cash, which facilitated online payments between two parties without going through centralized financial intermediaries. Nakamoto, to implement bitcoin, also devised a ledger that would support this electronic version of cash, which he termed “a chain of blocks” and was later called “blockchain” (The Economist, 2015). The conceptualization and use of blockchain technology were vital to the emergence of the cryptocurrency bitcoin in 2009, which emerged as the world’s first digital currency, which did not warrant a trusted authority. Blockchain refers to a technology of distributed ledger in which every transaction and related information is encrypted by hashing, and all network members have access to the same (Zheng *et al.*, 2017). For every transaction, there is a data transformation that occurs, which negates any chances of arbitrary manipulation, along with this, every network member continuously checks the integrity of data, making it a very reliable technology. According to Swan (2015), a blockchain is a decentralized store of information, similar to an information system database that is updated in real-time, and the users have access to it for authentication and record-keeping.

Blockchain technology has emerged as one of the most core and promising technologies in Industry 4.0 (Kim *et al.*, 2020). It is said to have the potential to completely transform the way the global economic system functions; it offers myriad of possibilities to flourish existing businesses and to grow entirely new ones in tandem with severe disruptive threats to the traditional companies (Morkunas *et al.*, 2019; Viriyasitavat and Hoonsoopon, 2019). While blockchain has mostly been witnessed as a technology that facilitated usage and adoption of cryptocurrencies such as bitcoin, its value proposition extends beyond cryptocurrencies to various economic and social transactions, thus having the potential to spread to various other business applications as well (Hughes *et al.*, 2019; Lindman *et al.*, 2017; Chong *et al.*, 2019). The fraud-proof characteristic of the blockchain technology due to the high cryptographic encryption, continuous scrutiny of transactions by network members and distributed transaction data make it highly challenging to manipulate or tamper any transactions within the system (Chang *et al.*, 2020; Beck *et al.*, 2017; Antonopoulos, 2014). This trait of blockchain makes it a very reliable and trustworthy technology that can be adopted to steer innovations and significantly increase productivity

in various business domains such as health care, supply-chain management, digital art management, entrepreneurship, financial industry, etc. There is no dearth of applications and use cases of blockchain adoption that can help secure business transactions, reduction in errors, improving organizational functions and procedures and prevention of fraud. However, there are regulatory and technical bottlenecks in the mass adoption of the same. The current study will focus on the applications of blockchain technology in the financial services industry.

According to [Fanning and Centers \(2016\)](#), blockchain technology will be disruptive and will completely transform the way the global financial system functions ([Pollari, 2016](#)). While most minds closely associate blockchain with cryptocurrencies, it is pertinent to point out that application of the distributed ledger technology, which is at the core of blockchain has various other uses apart from currency applications and can provide solutions to various challenges that the financial industry faces ([Zachariadis et al., 2019](#)).

Scholars in the area of finance have defined financial services as types of functions performed by financial service firms. Notable among them is the definition provided by [Hatzakis et al. \(2010\)](#). According to them, financial services firms are those “primarily firms in retail banking, commercial lending, insurance (other than health), credit cards, mortgage banking, investment advisory, and asset management (mutual funds, hedge funds, etc.).” Advances and innovations in distributed ledger technology can prove to be useful in various areas of financial services performed by firms such as delivery of financial solutions, design of investment products, settlement and clearance of securities, payments across geographic locations, financial inclusion, etc ([Schuetz and Venkatesh, 2020](#); [Chang et al., 2020](#); [Zachariadis et al., 2019](#)).

Although there are a plethora of opportunities in the financial services space for blockchain technology to be of great use to the industry, there are legitimate concerns about technical, regulatory and privacy headwinds that might hamper the use of the same, as it is difficult to imagine these innovations occurring on a public blockchain, which provides access to all with negligible checks or screening. This has led to private blockchain garnering more attention from practitioners, researchers and experts of the financial sector and pilots are underway in the area of banking, insurance, consumer finance, investments in venture capital, trade finance, housing finance, entrepreneurship, etc. ([Hileman and Rauchs, 2017](#); [Jaag and Bach, 2017](#)).

Studies in the past have highlighted the advantages, limitations, effectiveness and challenges of using blockchain technology in the financial sector. However, since both, blockchain technology and the financial industry are rapidly evolving, it is of vital significance to have a broad overview of the developments and applications of the blockchain technology in the sphere of financial services. Moreover, there is a need to understand and highlight the use of blockchain technology in generating value in the financial services sector. The current research thoroughly reviews studies that have used blockchain in finance. The study will help provide a holistic framework that would highlight the current state of the blockchain in the financial services sector. The research is structured in the following manner: Section 1 provides a brief introduction to the topic of blockchain in financial services. Section 2 discusses the objectives and research methodology used in the study. Section 3 outlines the review of literature and the bibliometric analysis of the studies. Section 4 highlights the various challenges that blockchain faces in its path for mass adoption. Section 5 discusses the various implications of the research study. Section 6 concludes the research study.

2. Objectives and methodology

The objective of this study is to systematically examine and organize the current body of research literature that either quantitatively or qualitatively explored the use of blockchain technology in financial services. This paper highlights the use of blockchain in the area of financial services including banking, insurance, trade finance and other financial services provided in a financial system with the help of a comprehensive review of the literature. The purpose is to explore the extent to which the technology has been put to use and the resultant benefits derived in the field of financial services.

The systematic literature review was supported by the following research questions:

- R1. How has blockchain technology been defined under financial services?
- R2. How the technology was examined (i.e. the methodology)?
- R3. What were the results of using blockchain technology in a financial system?

The steps in conducting a systematic literature review as covered by previous studies (Frizzo-Barker *et al.*, 2020; Parris and Peachey, 2013; Okoli and Schabram, 2010) have been followed.

The preferred reporting items for systematic reviews and meta-analyses (PRISMA) methodology were adopted to achieve the research objectives and address the research questions of the study (Figure 1).

- Stage 1: searching the academic database

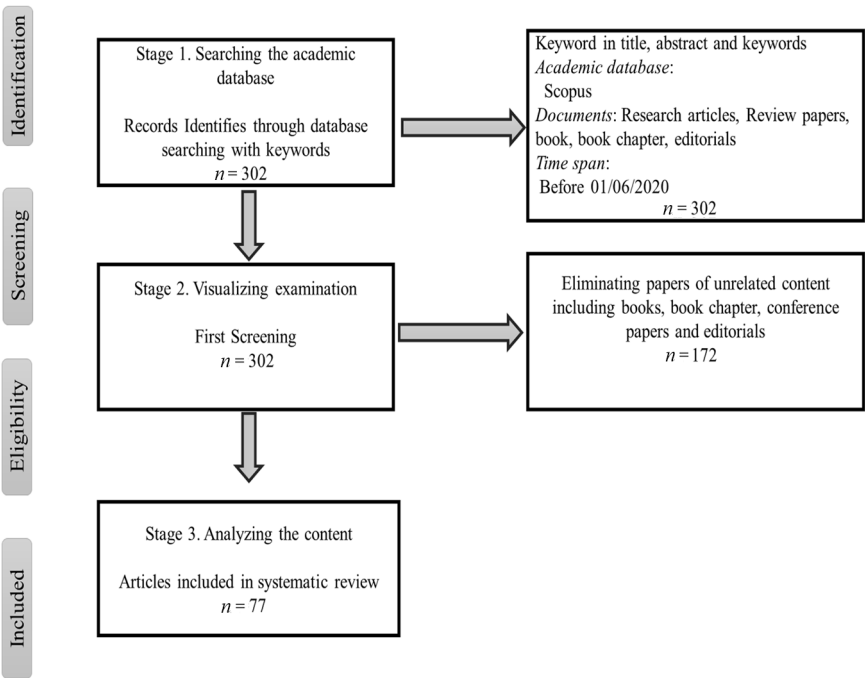


Figure 1.  
Research stages for  
systematic literature  
review

Source: Compiled by authors

To meet the study objectives, record identification through database search was conducted. At this stage, records were identified by searching for accessible Scopus database through the authors' university library system. The Scopus being a largest database being interdisciplinary in nature have been selected for extracting of related documents. All results were limited to English only. The initial search was made using the keywords i.e. "blockchain" in "financial services." Also, no restriction was placed on a year of publication. In total, we retrieved 302 documents containing the article, review paper, books, book chapters, editorials and conference papers. The number of documents containing the mentioned keywords was recorded (Figure 2).

- Stage 2: visualizing examination

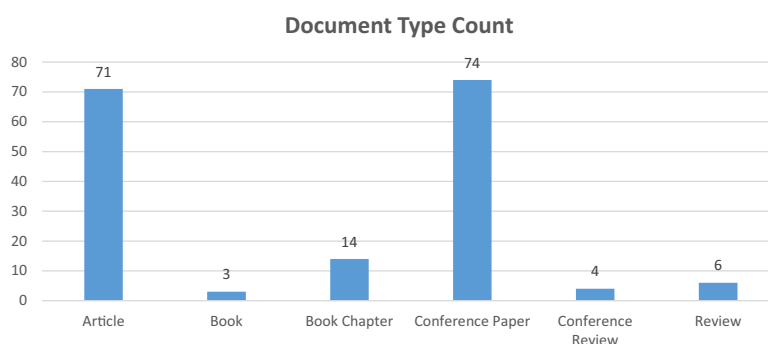
Next, we identified the articles related and excluded the article not related to the topic. The inclusion criteria for the articles to be considered for further study were as follows:

- the article had to be in the English language
- be a part of the article, the article in press and review paper (under document type) and not covered under conference review, conference paper, book chapter and editorial;
- the article discusses blockchain technology in different financial services as the main theme; and
- examines the use of blockchain technology under banking, insurance, trade finance, housing and consumer finance and capital market.

Articles were excluded if any of these four components were not addressed in the abstract, objectives, methodology, results and discussion sections of the respective studies. All articles were carefully screened based on the above-stipulated inclusion criteria. Finally, 77 articles meeting the inclusion criteria were selected from 61 peer-reviewed journals for the period 2016 – 2020. Under the section literature review, Table 4 presents a list of those journals.

- Stage 3: analyzing the content

In the final stage, we performed the content analysis of major articles by systematically reviewing the selected research articles and review papers by examining the objectives, methodology and findings of the paper. We also present the year-wise and geography-wise



**Source:** Compiled by authors

**Figure 2.**  
Count of document  
type retrieved from  
the database

publications along with article wise citations of publications to better understand the existing state of literature.

3. Literature review and bibliometric analysis

Blockchain technology as a part of the fourth industrial revolution is new to this world. The subject started gaining attention among researchers post-2016 after the introduction of cryptocurrency exchanges and acceptance of cryptocurrencies as a mode of digital payment in some major economies of the world. Blockchain technology has been widely applied in all major areas of research including the Internet of Things (Novo, 2018; Panarello *et al.*, 2018; Dorri *et al.*, 2017), banking (Cocco *et al.*, 2017; Buitenhok, 2016), financial services (Jessel and DiCaprio, 2018; Trautman, 2016), supply-chain (Dubey *et al.*, 2020; Kamble *et al.*, 2019), defense (Kulshrestha and Navy, 2018; Udokwu *et al.*, 2018) governance (Atzori, 2015), education, healthcare, etc. However, studies have also found that the application of blockchain is extremely immature and lacks public or even expert knowledge, making it difficult to have a clear strategic vision of its true future potential. Presently, there are issues with scalability, the security of smart contracts and user adoption (Radanović and Likić, 2018). Regarding finance, studies have found that there has been increasing applications of blockchain in all areas of finance, including banking, insurance, trade finance, financial markets and cryptocurrency market. The table below presents the major studies in different areas of finance, including financial services (Table 1).

To better demonstrate, some of the significant contributions made by the existing literature is presented in Table 2.

To conduct further bibliometric analysis, the year-wise distribution of articles, citation count and country-wise publications is presented next.

It can be observed from Figure 3 that the blockchain technology has recently emerged and started seeking attention from researchers since 2016. There has been an upward trend in the frequency of publications since 2016 and this seeks to grow continuously in the years to come considering its immense potential in all areas of financial services. Further, Figure 4 depicts the year wise count of citations in this field.

Table 1.  
Application of block  
chain in various  
fields of financial  
services

Fields	References
Banking	Cocco <i>et al.</i> (2017), Eyal (2017); Holotiuk <i>et al.</i> (2017), Crosby <i>et al.</i> (2016); Guo and Liang (2016), Peters and Panayi (2016); Buitenhok (2016)
Insurance	Gatteschi <i>et al.</i> (2018), Raikwar <i>et al.</i> (2018); Crawford (2017), Hans (2017)
Trade finance	Jessel and DiCaprio (2018), Bogucharskov <i>et al.</i> (2018); Collomb and Sok (2016), Collomb and Sok (2016)
Housing finance	Nasarre-Aznar (2018); Yeoh (2017), Nam and Yang (2017); Trautman (2016)
Consumer finance	Yoo (2017); Lundqvist <i>et al.</i> (2017), Trautman (2016); Nguyen (2016)
Equity, debt and derivatives markets	Rohr and Wright (2018), Surujnath (2017); Trautman (2016), Malinova and Park (2016)
Cryptocurrency market	Corbet <i>et al.</i> (2020), ElBahrawy <i>et al.</i> (2017); Chuen <i>et al.</i> (2017), Eyal (2017); Scott (2016), Yli-Huuma <i>et al.</i> (2016)
Fintech	Buchak <i>et al.</i> (2018), Lee and Shin (2018); Puschmann (2017), Philippon (2016). Schueffel (2016), Arner <i>et al.</i> (2015)
Regulatory compliance	Meunier (2018); Yeoh (2017), Lootsma (2017); Treleven and Batrinca (2017), Mainelli and Smith (2015)
Source: Compiled by authors	

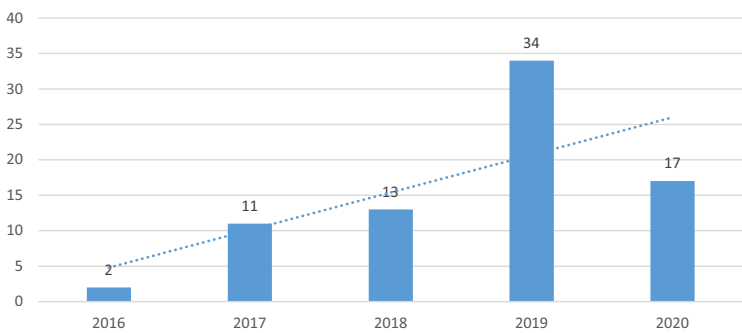
Authors	Purpose	Methodology	Findings	Cited by
Zheng <i>et al.</i> (2018)	Identify the opportunities and challenges with blockchain	Qualitative, survey-based study	Blockchain has immense applications in finance public and social services, into data security and privacy	268
Dai and Vasanthelyi (2017)	Study the prospects of blockchain-based accounting and assurance	Qualitative study	Blockchain will improve present auditing practices, ensuing in a more precise and timely automatic assurance system	81
Gomber <i>et al.</i> (2018)	Examine the Fintech innovation and forces in transforming financial services	Qualitative review of literature	The technology has been used in payments settlement, cryptocurrencies, cross-border payment services P2P lending and Robo-advisory	70
Treleven <i>et al.</i> (2017)	Study the application of blockchain technology in finance	Qualitative study	For banking and financial service markets such systems are resilient and enhance the integrity for parties in different financial transactions	59
Cocco <i>et al.</i> (2017)	Explore the advantages of using blockchain-based technology in the financial system	Quantitative and exploratory study	Based on its advantages, the bitcoin system and blockchain technology can address the issues faced by the present financial system	42
Yeoh (2017)	Identify the regulatory changes based on distributed ledger technology	Qualitative study, case study	The minimum regulatory brakes for greater value-adding and efficiency advancement will enhance adoption of financial services and thereby improve financial inclusion	36
Larios-Hernández (2017)	Explore the blockchain entrepreneurship opportunity in unbanked region	Fuzzy-set qualitative comparative analysis	The blockchain-based technology has promoted disintermediation financial services	35
Hyvärinen <i>et al.</i> (2017)	Assess the potential of blockchain as a solution for managing dividend flows to overcome the current double-spending problem in the public taxation sector	Qualitative study	Blockchain provides a comprehensive solution that can be adapted with relatively less effort by tax authorities, financial institutions, individual in fraud detection	32
MacDonald <i>et al.</i> (2016)	Explore the role of blockchain in modern banking	Review of literature	With low-cost, error-free and faster transaction benefits, the blockchain technology has immense uses in banking	30
Egelund-Müller <i>et al.</i> (2017)	Under the way financial institutions, regulators and individuals interact in a financial system based on distributed ledgers	Qualitative study	The share ledger can benefit financial institutions, regulators and individuals in monitoring financial activities in a system	27
Manski (2017)	Understand the role of blockchain in shaping the global economy	Review of literature	Blockchain applications allow for democratization of finance, services, agriculture and governance, however, they may also deepen inequality and weaken democracy	26
Morkunas <i>et al.</i> (2019)	Study the role of blockchain in various business	Qualitative study	Beyond its applications, majorly in finance, the technology is applied in logistics, health care, public sector projects, entertainment and media industry	24
Milian <i>et al.</i> (2019)	Systematically review studies on Fintech	Systematic literature review	For improved security and other financial losses the technology is widely used in business environment	17
Ducas and Wilner (2017)	Examine the security and financial implications of blockchain technology	Review of studies	The technology aids in regulations, maintaining public safety and securing the integrity of financial systems	15

Source: Compiled by authors

**Table 2.**  
Major studies with  
the highest number  
of citations

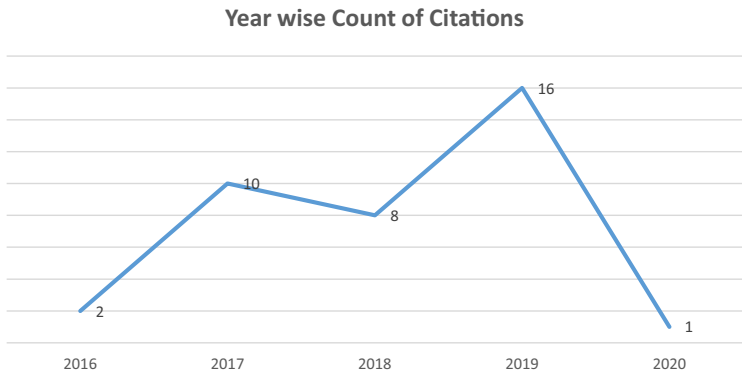


**Figure 3.**  
Year-wise  
distribution of  
articles published



**Source:** Compiled by authors

**Figure 4.**  
Year wise count of  
citations (compiled by  
authors)



**Source:** Compiled by authors

Considering the above [Figure 4](#), the citations on this field of study are not impressive as it is a new and emerging field of study. This field of study has started seeking attention from scholars, which may result in the citations to grow in the times to come.

To understand the contribution of researchers from various parts of the world, the country wise number of publications is shown below in [Table 3](#) and [Figure 5](#).

[Table 3](#) and [Figure 5](#) present country-wise publications in this emerging field of study. It can be observed here that the researchers from India (15) have the highest number of publications followed by USA (9), China (8), Russia (6) and UK (5). The table shows that major contributions to this field from scholars of emerging economies such as India, China and Russia along with developed countries from Europe and North America. The contributions have been significant from different parts of the world; however, the contribution from the continents such as Oceania and Middle East is very less.

The publications on blockchain and financial services from emerging economies such as India accounts for around 50% of the publications worldwide, as depicted in [Figure 5](#). This could be majorly due to the financial inclusion initiatives taken by the government of the



		Blockchain technology in financial services
Country	No. of publications	69
India	15	
USA	9	
China	8	
Russian Federation	6	
UK	5	
Germany	4	
Australia	2	
Canada	2	
Croatia	2	
Denmark	2	
Italy	2	
Netherlands	2	
Romania	2	
Spain	2	
Brazil	1	
Egypt	1	
France	1	
Ghana	1	
Greece	1	
Iraq	1	
Ireland	1	
Japan	1	
Malaysia	1	
Mexico	1	
South Korea	1	
Sweden	1	
Switzerland	1	
Ukraine	1	
Grand Total	77	

**Table 3.**  
Country-wise  
publications

**Source:** Compiled by authors

country coupled with digital India initiative in the recent years. Considering its potential benefits to society in general, this field of study is certainly going to attract more contributions from the researchers worldwide.

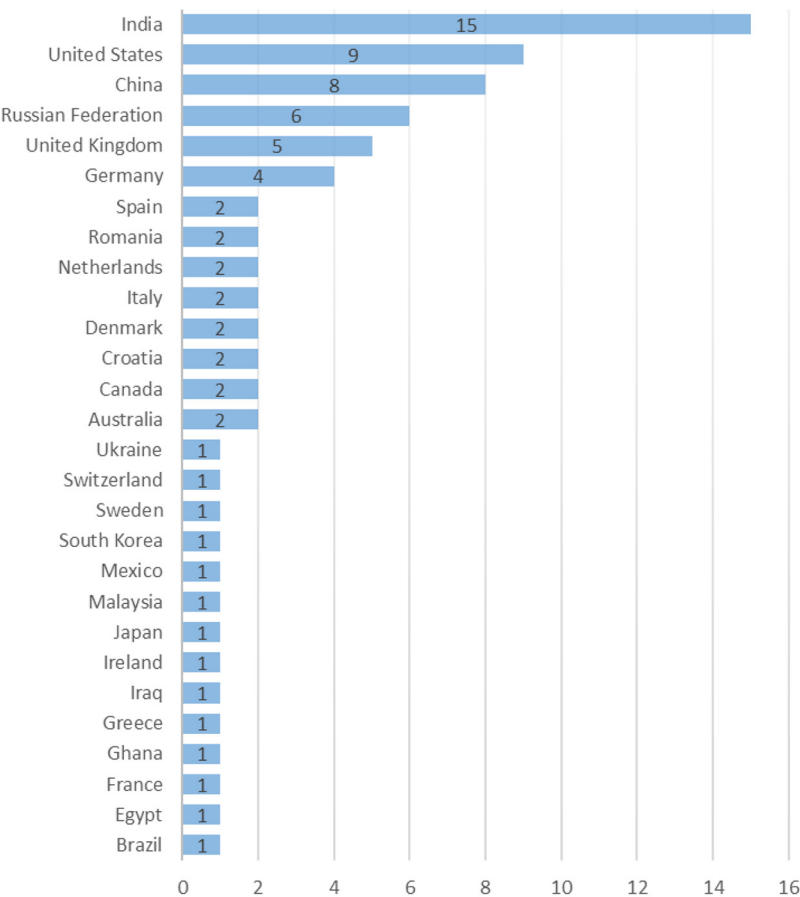
Table 4 presents the list of journals covering articles published in the area of blockchain technology in financial services.

Table 4 shows that most of the published work is included in the journals from the stream of engineering, information systems, research and technology. Moreover, journals from the area of business, finance and economics also covered the research related to this study. This suggests that block technology and its application in financial services is a multidisciplinary area of research. Further, the number of publications is limited to a maximum of four publications per journal. This suggests a need to explore the area further for publications broadly covering the studies of blockchain and its application in accounting and auditing, banking and insurance, financial markets and financial inclusion.

#### 4. Challenges

The above section has amply highlighted that there are various applications and use cases for the blockchain technology in the area of financial services. There is no

COUNTRY WISE NUMBER OF PUBLICATIONS



**Figure 5.**  
Country-wise  
distribution of  
publications

Source: Compiled by authors

shortage of opportunities that can be tapped if the blockchain innovation is properly channelized and harnessed. Ever since Satoshi Nakamoto released his white paper on blockchain technology and the subsequent launch of the cryptocurrency bitcoin, there have been successive evolutions in the blockchain technology, and multiple other cryptocurrencies have come into existence since bitcoin, the market cap of the cryptocurrency trading instruments has touched highs US\$300bn (Mougayar, 2016; Taskinsoy, 2019). There is no doubt that blockchain technology has several benefits, and its applicability can have far-reaching consequences that will positively impact the growth and transformation of the financial services industry (Osmani *et al.*, 2020). In spite of the great potential and benefits of the blockchain technology, it has not reached its full potential, due to various challenges it faces in the form of scams, mass adoption and usage, volatility and regulatory headwinds (Chen and Bellavitis, 2020;

List of source title	No. of publications
<i>Journal of Advanced Research in Dynamical and Control Systems</i>	4
<i>International Journal of Recent Technology and Engineering</i>	3
<i>International Journal of Scientific and Technology Research</i>	3
<i>Business and Information Systems Engineering</i>	2
<i>Business Horizons</i>	2
<i>European Business Organization Law Review</i>	2
<i>IEEE Transactions on Engineering Management</i>	2
<i>International Journal of Engineering and Advanced Technology</i>	2
<i>International Journal of Innovative Technology and Exploring Engineering</i>	2
<i>Journal of Financial Regulation and Compliance</i>	2
<i>Managerial Finance</i>	2
<i>New Economic Windows</i>	2
<i>Analysis and Metaphysics</i>	1
<i>CIRIEC-Espana Revista de Economia Publica, Social y Cooperativa</i>	1
<i>Communications in Computer and Information Science</i>	1
<i>Computer</i>	1
<i>Computers and Security</i>	1
<i>Economy of Region</i>	1
<i>Ekonomicheskaya Politika</i>	1
<i>Electronic Commerce Research and Applications</i>	1
<i>Espacios</i>	1
<i>European Company and Financial Law Review</i>	1
<i>Future Generation Computer Systems</i>	1
<i>Future Internet</i>	1
<i>Global Networks</i>	1
<i>IEEE Access</i>	1
<i>IEEE Consumer Electronics Magazine</i>	1
<i>IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences</i>	1
<i>Industrial Management and Data Systems</i>	1
<i>Information and Organization</i>	1
<i>Information Systems and e-Business Management</i>	1
<i>Information Technology for Development</i>	1
<i>Intereconomics</i>	1
<i>InterEULawEast</i>	1
<i>International Journal</i>	1
<i>International Journal of Advanced Computer Science and Applications</i>	1
<i>International Journal of Advanced Science and Technology</i>	1
<i>International Journal of Advanced Trends in Computer Science and Engineering</i>	1
<i>International Journal of Applied Decision Sciences</i>	1
<i>International Journal of Economics and Business Administration</i>	1
<i>International Journal of Engineering and Technology (UAE)</i>	1
<i>International Journal of Intelligent Systems Technologies and Applications</i>	1
<i>International Journal of Production Research</i>	1
<i>International Journal of Web and Grid Services</i>	1
<i>Journal of Business Venturing Insights</i>	1
<i>Journal of Information Systems</i>	1
<i>Journal of Management Information Systems</i>	1
<i>Journal of Reviews on Global Economics</i>	1
<i>Journal of Risk Finance</i>	1
<i>Maastricht Journal of European and Comparative Law</i>	1
<i>Mathematics</i>	1
<i>Periodicals of Engineering and Natural Sciences</i>	1
<i>Proceedings of the Romanian Academy Series A - Mathematics Physics Technical Sciences Information Science</i>	1
<i>Quality - Access to Success</i>	1
<i>Robotics and Computer-Integrated Manufacturing</i>	1
<i>Sensors (Switzerland)</i>	1
<i>Strategic Change</i>	1
<i>Sustainability (Switzerland)</i>	1
<i>Tilburg Law Review</i>	1
<i>Turkish Online Journal of Educational Technology</i>	1
<i>Wirtschaftsdienst</i>	1
Total	77

Source: Compiled by authors

**Table 4.**  
List of journals

[Tasatanattakool and Techapanupreeda, 2018](#)). The current section of the paper will discuss in detail these challenges that prevent blockchain from realizing its true potential and hence impacting its mass adoption. Subsections 4.1, 4.2, 4.3 and 4.4 will discuss challenges pertaining to transparency and privacy, security, scalability and regulatory issues, respectively.

#### *4.1 Transparency and privacy*

Even though the cryptographic encryption and logic are one of the central features of the blockchain technology, which ensures that users are pseudo-anonymous and make transactions through user-created addresses that prevents them from revealing their real identities, hence making the technology very safe and reliable for users ([Feng et al., 2019](#)). There can be multiple generation of user addresses to prevent any form of information leakage ([Zheng et al., 2018](#)). However, in the past it has been proven that transaction privacy is not always protected by blockchain as transactions on public are accessible by the public ([Kosba et al., 2016](#); [Zyskind and Nathan, 2015](#)).

#### *4.2 Security*

It is evident that there are multiple uses and various applications of this technology in the financial sector. Despite so many positive uses, the adoption of blockchain has suffered due to its close association and identification with bitcoin in the eyes of the government bodies and policymakers. Blockchain is infamously tied to various bitcoin frauds and scandals that have taken place in the cryptocurrency market ([De Filippi, 2014](#); [Trautman, 2014](#)). These bitcoin scandals and frauds have severely dented the credibility and reliability of blockchain among regulators and societies across the globe. Although blockchain systems are inherently designed in a manner to make it tamper resistance and fraud-proof, certain systems can still be susceptible to attacks and attempts of fraud by the collusion of a large number of network members ([Yeoh, 2017](#)). [Eyal and Sirer \(2014\)](#) showed that even a small percentage of hashing power can suffice to successfully cheat a blockchain network. These security concerns can prove to be detrimental in wide-scale adoption of blockchain in financial services.

#### *4.3 Scalability*

The number of transactions is rapidly increasing with time, which puts a strain on the capacity of existing blockchain systems. Given the design of the blockchain, every transaction needs to be stored for authentication and record-keeping. This problem is further compounded due to capacity constraints of bitcoin blockchain in processing transactions ([Eyal et al., 2016](#)). Because of the restrictions on the size of the block and time interval of processing transactions, it will render these systems inefficient in processing a huge number of transactions in a limited time ([Karame, 2016](#); [Zhou et al., 2020](#)). There is a dire need to improve the transactional capability of blockchain. This scalability problem has to be addressed so that potential benefits of blockchain can be fully realized in the area of financial services.

#### *4.4 Regulatory issues*

The growing popularity, potential benefits and a wide range of applications of blockchain has led to various regulators, government bodies and international bodies expressing interest in regulating the blockchain, specifically the cryptocurrency market. However, the regulatory aspects that cover blockchain are also fraught with complexities as given the

technical nature of the technology and the legal implications that can arise. Owing to security concern, it would require multiple agencies to properly regulate the blockchain-related activities (De Filippi and Hassan, 2018; Shanaev *et al.*, 2020). The regulatory issues of the government bodies will be very sensitive and cumbersome as it will also need to ensure that the technology is not abused for criminal activities. So, there will be considerable legal aspects to address as well (Higgins, 2016).

## 5. Results and discussion

In Section 5, we present the analysis in the form of discussion for each identified research questions. Further, in Section 6, we outline the limitations and validity of this study and implication of future research.

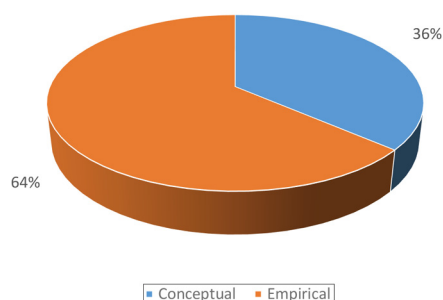
### R1. How blockchain technology has been in defined under financial services?

Scholars around the world have defined blockchain considering various features of the technology. For example, blockchain has been defined as a public ledger, in which all committed transactions are stored in a chain of blocks (Zheng *et al.*, 2018; Treleaven *et al.*, 2017). Earlier studies have linked blockchain to the functions of cryptocurrencies such as bitcoin used for electronic transfer payments (Brühl, 2020; Diniz, 2019; Nikbakht *et al.*, 2019). Scholars have classified blockchain innovations into three generations. The applications in cryptocurrency such as bitcoin have been a part of Blockchain 1.0 (Chang *et al.*, 2020; Swan, 2015). The technology has wider applications in the financial world covering smart contracts and transactions pertaining to bonds and loans categorized into Blockchain 2.0. Beyond cryptocurrencies, blockchain can be used for global remittances without any intermediary, cross-border online payments, foreign exchange transaction platforms and in the form of digital assets under banking, financial markets, insurance in the financial service sector (Gomber *et al.*, 2018; Zheng *et al.*, 2018; Dai and Vasarhelyi, 2017). Blockchain 3.0 is the latest innovations with universal application and can be used in governance, science, health, culture, art and literacy (Chang *et al.*, 2020; Swan, 2015) (Figure 6).

### R2. How the technology was examined (i.e. the methodology)?

Studies on blockchain in financial services domain have been conducted both conceptually and empirically. To clarify the methodology, we have classified studies into two parts;

#### Conceptual Vs Empirical Studies



Source: Compiled by authors

**Figure 6.**  
Classification of  
relevant studies

namely, conceptual and empirical (Frizzo-Barker *et al.*, 2020). Empirical papers focused on observable or measurable blockchain activities and processes in a financial services sector through various qualitative and quantitative approaches, where primary or secondary data sector data was collected or analyzed. Conceptual papers, on the other hand, discussed ideas, applications, theories, benefits and challenges of blockchain in the financial services environment. Of the 77 articles included for systematic review, conceptual studies covering theoretical aspect and review-based studies were 36% ( $n = 28$ ) and majority of the studies 64% ( $n = 49$ ) were empirical in nature based on the collection and analysis of primary or secondary data in the context of blockchain in financial services. For example, the most cited article by Zheng *et al.* (2018) from China identified the opportunities and challenges with blockchain in the financial, public and social services space based on qualitative survey. Also, one of the earliest studies from the UK explored the emergence of crowdfunding, peer-to-peer lending, decentralized banking and remittances through qualitative analysis (Biggs, 2016). The conceptual studies in this paper discussed the definition, role, opportunities, challenges of blockchain and how technology can be adopted in the financial services system, though exploratory research (Brühl, 2020; Ferrari, 2020) and literature review approach (Brophy, 2019).

### R3. What were the results of using this technology in a financial system?

This study found that using blockchain in the financial system can benefit all key stake holders of financial service industry. Through blockchain technology, business can simplify processes while creating safe, trustworthy records of agreements and transactions (Treleaven *et al.*, 2017). The credibility and transparency feature of blockchain technology can further help small- and medium-sized enterprises to use self-guarantee to obtain loans from financial institutions. Through the ease of access and low-cost accessibility of innovative financial products, the technology can reach to the unbanked and underbanked masses and, thereby overcoming the challenges of financial inclusion (Schuetz and Venkatesh, 2020; Varghese and Viswanathan, 2018). In a lending function, the technology can mitigate credit risk caused by a low-credit customer (Yu *et al.*, 2020). Furthermore, technology is adding value to the financial service industry through innovative product offerings and solutions *vis-à-vis* real-time transaction and credit monitoring, transitioning to branchless banking, P2P lending, the increasing use of robo-advisory services and adoption of social trading platforms in investments (Gomber *et al.*, 2018). Beyond, business, trade, banking and investments, vibrant introduction and implementation of smart contracts in various domains of insurance, such as peer-to-peer insurance, policy underwriting, marine and travel insurance has immensely benefited the insurance industry (Brophy, 2019).

## 6. Conclusion and future research

This paper explores the fact that the financial industry is on the edge of a new financial era using a new destructive system based on blockchain. The previous products and services proposed by the finance sector were considered as costly and inefficient. However, with the passage of time advancement in technologies through Fintech and blockchain has catered to the varied needs of key stakeholders. This emerging technology must offer certain benefits to society along with some challenges. The study has profound insights into various studies and research papers that have explored the applications of blockchain technology in the financial service domain, this can prove to be useful for both academicians and practitioners. There is a dearth of studies that have systematically explored and synthesized literature on the applications of blockchain technology in the financial service domain, this study becomes even more pertinent against the backdrop that financial sector is rapidly evolving

and the blockchain technology can completely revolutionize this sector as it is an emerging technology with a huge potential to various stakeholders of the financial services sector.

This study contributes to the existing literature by exploring and analyzing systematic studies available on blockchain with special reference to financial services sector. With blockchain based on five principles, namely, computational logic, peer-to-peer transmission, irreversibility of records, distributed database and transparency with pseudonym has immense potential to unleash and transform the financial service industry (Tapscott and Tapscott, 2017). With increasing blockchain-based operations of decentralized banking, insurance, trade finance, financial markets and cryptocurrency market, the subject is rapidly growing and seeking a considerable contribution from scholars around the world. The subject started gaining prominence post-2016 after the introduction of cryptocurrency exchanges and acceptance of cryptocurrencies as a mode of digital payment in some major economies of the world. Moreover, to boost financial inclusion and serve the masses, there has been a significant contribution from emerging economies such as India, Russia and China, which is encouraging.

This study uses systematic literature review approach that has its own demerits (Frizzo-Barker *et al.*, 2020). Like other studies based on Systematic Literature Review, this study also suffers from a certain bias such as, sample selection bias, publication bias, data interpretation and the combination of quantitative and qualitative studies in the population. Further, the adoption and resultant benefits of blockchain have not been empirically tested. This study concludes that most of the research related to blockchain and underlying technology in financial services are empirical either qualitative or quantitative analyzing the process, benefits and potential challenges of blockchain adoption. However, empirically testing the impact of blockchain adoption on a particular industry's top line, bottom line, overall performance and on the key stakeholders has been limited. This is because technology is emerging and is new to the various stakeholders of financial industry. Thus, the future study can be conducted empirically testing the impact of blockchain implementation on the banking, nonbanking, insurance and other financial services companies. Blockchain technology is in the development stage and is being tested into different business environment. Like any other technology, blockchain will also bring benefits and inherent risk into business, trade and society.

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