Blockchain for business management: Applications, challenges and potentials

Abhinav Pal [a], Chandan Kumar Tiwari [a,*], Nivedita Haldar [b]

[a] Symbiosis Centre for Management Studies, Noida, Symbiosis International University, Pune, India
[b] Jindal Global Business School, O.P Jindal Global University, Sonipat Narela Road Sonipat, Haryana 131001, NCR of Delhi, India

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ABSTRACT

Blockchain technology has emerged as one of the most vital and encouraging technology in Industry 4.0. It is said to have the potential to majorly transform the way the business world and the economic system functions; it offers numerous possibilities to flourish existing businesses and also to grow entirely new ones along with severe disruptions to the traditional businesses. The present study is an attempt to understand the applications of blockchain technology in managing business. Through systematic literature review, it intends to study the applications in different key functions of business. Furthermore, it highlights the key challenges in blockchain implementation and the potentials of blockchain in managing business. The study will be useful to the practitioners as well as to the scholars around the globe. Blockchain adoption can help in securing business transactions, reduction in errors, improving organizational functions and procedures, and prevention of fraud. The smart contract as a feature of blockchain technology can be applied to all transactions involving movement of resources namely finance, material and people. This will lead to effective tracking, visibility, security enhancement and cost reduction in the overall business process.

1. Introduction

Blockchain is the central and the underlying technology of cryptocurrencies, is one of the examples of innovations that is pivotal to the business management revolution movement and is an emerging and an utilitarian technology that has the potential to have a significant impact on the functioning of a large number of business organizations (Bai, Hu, Liu, & Wang, 2019; Li, Barenji, & Huang, 2018; Li, Marier-Bienvenue, Perron-Brault, Wang, & Paré, 2018; Tapscott & Tapscott, 2016; Tapscott & 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 start of the cryptocurrency revolution Bitcoin in 2009, which emerged as the world's first digital currency, which didn't require and 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, Xie, Dai, Chen, & Wang, 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 set of information, which is very similar to an information systems 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 vital and encouraging technology in Industry 4.0 (Kim, Park, & Lee, 2020). It is said to have the potential to majorly transform the way the business world and the economic system functions; it offers numerous possibilities to flourish existing businesses and also to grow entirely new ones along with severe disruptions to the traditional businesses (Morkunas, Paschen, & Boon, 2019; Viriyasitavat & Hoonsopon, 2019). While Blockchain has mostly been witnessed as a technology that facilitated usage and adoption of cryptocurrencies like bitcoin, its value proposition extends beyond cryptocurrencies to various business transactions, thus having the potential to spread to various other business applications as well (Chong, Lim, Hua, Zheng, & Tan, 2019; Hughes, Park, Kietzmann, & Archer-Brown, 2019; Lindman, Tuunainen, & Rossi, 2017). The fraud-proof characteristic of the blockchain technology due to the high cryptographic encryption, continuous verifications of transactions by n members and distributed transactions data makes it very difficult and cumbersome to modify any transactions within the system (Chang et al., 2020; Beck, Avital, Rossi, & Thatcher, 2017; Antonopoulos, 2014; White, 2017; Viriyasitavat, Da Xu, Bi, & Sapsomboon, 2018). This feature of Blockchain makes it a very secure and safe technology which can be adopted to spur innovations and majorly increase productivity in various business areas like healthcare, supply-chain management, digital art management, entrepreneurship and financial industry. Apart from business management for the society, the technology has immense potential in educational management by stream ling various administrative functions of an educational institutions and also in dissemination of educational content (Bhaskar, Tiwari, & Joshi, 2020). A very useful feature of the blockchain technology is 'Smart contracts' which is an executable code that precedes the blockchain to facilitate and implement an agreement between untrusted parties without the need or involvement of a third party (Alharby & Van Moorsel, 2017; Staples et al., 2017; Watanabe et al., 2016). Unlike traditional contracts, smart contracts does not require a third party to function and operate, this makes it a very cost-efficient feature due to its very low transaction costs (Kosba et al., 2016; Christidis and Devetsikiotis, 2016). The secure and safe nature of blockchain technology enables smart contracts to enhance transaction credibility between two unknown parties without the involvement of a third party (Allam, 2018).

There is no shortage of applications blockchain adoption that can help in securing 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 business management sector.

Previous studies have highlighted the advantages, limitations, effectiveness, and challenges of employing blockchain technology in various business processes. However, since both, blockchain technology and the global business landscape are rapidly evolving, it is important and pertinent to have an overview of the developments and applications of the blockchain technology in the realm of business s and management. Moreover, there is a need to understand and highlight the use of blockchain technology in leading to creation of value in business organizations. The study will help in providing a holistic framework that would highlight the current state of the Blockchain in key important functions of businesses and their management. The research is structured in the following manner: Section 1 provides a brief introduction to the topic of the research paper. Section 2 discusses the objectives and research methodology employed in the study. Section 3 outlines the related literature. Section 4 presents the results and discussion and addresses the research questions of the study. Section 5 highlights the main contribution of the study along with the practical implications. Section 6 concludes and presents the future direction of research.

Fig. 1 illustrates the functioning of the blockchain process. Blockchain is an organised sequence of blocks which holds a complete list of transactions like a conventional public ledger. The data structure of the blockchain highlights a linked list of blocks containing transactions. Each element of the list has a pointer to the previous block and each pointer of the block has a hash of the previous block. The hash is the most vital and key aspect of the blockchain security.

2. Methodology

The purpose of the study is to understand the applications of blockchain technology in managing business. It intends to study the applications in different key functions of business. There are cost and benefits associated with the innovation and there exist resistance to change. Therefore, the authors would like to highlight the challenges associated with blockchain implementation.

The management of business deals with planning and controlling its crucial business functions including marketing, operations,
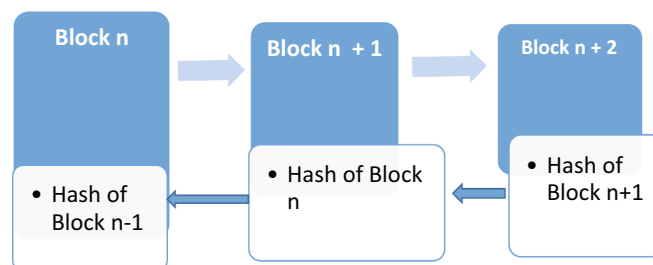

Fig. 1. An overview of blockchain architecture.

supply chain, human resource and finance. The technology innovation is the part and parcel of businesses in modern times. Blockchain is expected to transform the ways the business is done. It is going to create value for all the stakeholders. Thus, to understand the present applications of blockchain in managing business, the following research question is formulated.

R1. What are the present applications of blockchain in business management?

There are cost and benefits associated with the innovation and technological advancement. Also, there exist resistance to change. Therefore, to explore further, authors would like to highlight the challenges associated with blockchain implementation. Thus, the following research question is forumulated.

R2. What are the challenges associated with blockchain application in business?

Apart from its use in business operations, potentials and the barriers ahead, what lies ahead for the researchers and business is another area of study. Thus, the following research question is formulated.

R3. What is the future of blockchain in business management?

In order to address these three research questions, the following steps have been followed. This study used academic databases like google scholar and scopus to extract and select peer reviewed articles on the blockchain use in business management. The search was made in using the keywords including "Blockchain in Business Management", "Blockchain in Marketing" "Blockchain in Human Resource", "Blockchain in Manufacturing and Operations", "Blockchain in Finance". The paper systematically reviews studies in all areas of business management namely marketing management, operations and supply chain management, financial management and human resource management. The tables included under the literature review section highlights the top 5 articles cited in the area of blockchain in different business functions namely, marketing, human resource, supply chain, manufacturing and operations and finance. The articles discussing the applications, challenges and potentials of blockchain in managing various areas of business were included. To the best of authors knowledge, this is the first kind of study covering all important functions of business and role of blockchain in managing these functions.

3. Review of literature

3.1. Blockchain in business management

The blockchain technology due to its various applicative and useful features offers pleatheora of opportunities to dramatically change the way businesses would function with its adoption. There is significant potential in the blockchain technology to completely transform the way businesses work by significantly revolutionizing traditional market structures due to rapid technologicala and digital advancements (Bai, Cordeiro, & Sarkis, 2020; Weking et al., 2019). The applications of the same can be used to tackle various business problems and optimise many business processes (Chong et al., 2019).

The current study as depicted in Fig. 2 will focus on the applications and value creation of blockchain in the areas of marketing,
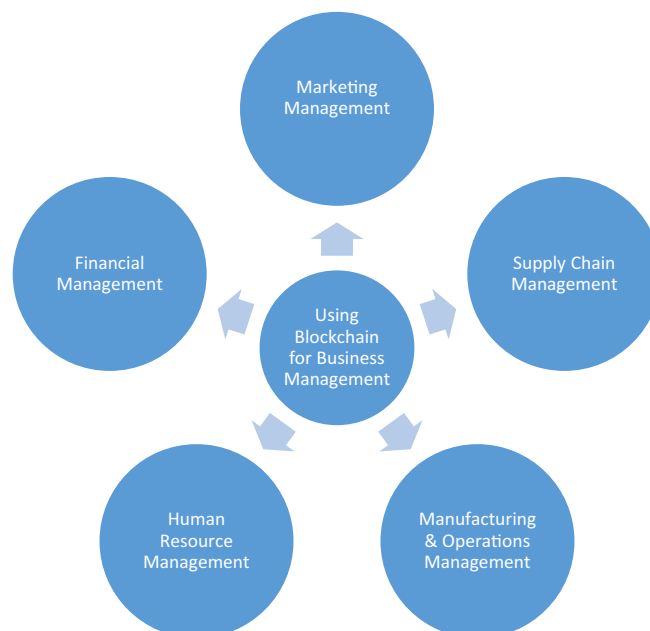

Fig. 2. Using blockchain in managing different business functions.

supply-chain, operations, human-resource and finance.

3.2. Blockchain in marketing management

According to Kotler and Keller (2011) Marketing management is "the art and science of choosing target markets and getting, keeping, and growing customers through creating, delivering, and communicating superior customer value".

Thus managing marketing function deals with identify right target customers and improving the market share by delivering higher customer value.

Available literature on the topic has suggested the applications of blockchain in different areas of marketing management. As a promotional tool, the technology has become a part of advertising (Tian, 2019: Pärssinen, Kotila, Rumin, Phansalkar, & Manner, 2018), Sales promotion (Agrawal et al., 2018; Ghose, 2018) and digital marketing (Ertemel, 2018; Harvey, Moorman, & Toledo, 2018).

Marketers are leveraging the use of information technology services using social media and social networking sites to promote their offerings. With the help of block chain platforms, management of different elements of marketing mix is possible (Antoniadis, Kontsas, & Spinthiropoulos, 2019). The promotional aspect like advertisement can be more customised where by middlemen can be eliminated thereby reducing unnecessary cost. Advertisement management could be more toward target segments and Sales process can be automated and monitored in real time and transparent manner. The technology can facilitate disintermediation and faster delivery of marketing communications at lower cost. Digital marketing and email marketing as a part of marketing communications would be more effective and less prone to fraud.

Due to the silent features of blockchain like anonymity and immutability, the transparency and privacy and security concerns are addressed for the consumers. They have to choice to share their personal data with the marketers of their choice. With the help of internet, marketers buy data from the intermediary like social network site. However, using blockchain, the personal data can be tokenised and sold to the marketers by customers directly without the intermediary. These tokens can be further converted into other loyalty points in the form of rewards (Ghose, 2018). Further special promotions or customised offering can be made to the selected users. Tokenization will improve customer engagement with a particular brand as all loyalty points would be integrated under one platform. All interaction and transactions of a customer with the brand will be easily tracked and monitored in a transparent way.

From a customer perspective, buyers would not receive unnecessary communication through email or spam which will reduce the fraud (Forbes, 2018). This will further enhance the brand image of the companies and make selected users more loyal to the brand. By applying smart contracts, customers and marketers can be brought together easing the process and making market survey economical for companies. All sort of communications including rewards can be directly communicated and transfer to the customer wallet (Harvey et al., 2018). The blockchain has the potential to disrupt the Google- Facebook duopoly in the present digital advertising industry (Harvey et al., 2018). The direct access of customer's profile to marketers will reduce the overall cost and improving the operating efficiency of the marketing campaigns.

Thus blockchain will help business choose right target markets and grow customers through creating, delivering, and communicating superior customer value. (See Table 1)

3.3. Blockchain in human resource management

According to Desler (2001), "Human Resource Management is the process of acquiring, training, appraising, and compensating employees, and attending to their labour relations, health, safety and fairness concerns."

Managing Human Resource deals with recruiting, selecting, training, developing, placing and compensating the right employee for the right job. It further relates to creating the conducive work environment.

Table 1
Most cited studies on blockchain in marketing.

Authors	Title	Year	Source title	Key findings
(Kumar et al., 2021)	Influence of new-age technologies on marketing: A research agenda	2021	Journal of Business Research	The technology is likely to impact firms, customers, intermediaries and further research is required on the area
(Tozanlı et al., 2020)	Trade-in-to-upgrade as a marketing strategy in disassembly-to-order systems at the edge of blockchain technology	2020	International Journal of Production Research	Using IoT-embedded products in a blockchain-enabled disassembly-to-order system to determine the optimal trade-in-to-upgrade policy
(Liu et al., 2019)	Anonymous reputation system for IIoT-enabled retail marketing atop PoS blockchain	2019	IEEE Transactions on Industrial Informatics	Revolutionizing retail industry by improving operational and channel efficiency between suppliers, manufactures and customers
(Grewal et al., 2018).	The Evolution and Future of Retailing and Retailing Education	2018	Journal of Marketing Education	Transparency in business transactions and closer connections with customers using technology will benefit retailing
Parssinen M.A., Kotila M., Cuevas Rumin R., Phansalkar A., Manner J.	Is Blockchain Ready to Revolutionize Online Advertising?	2018	IEEE Access	Blockchain is not yet ready to revolutionize online advertising industry

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As a part of human resource management, blockchain platforms are used for recruitment (Jeong & Choi, 2019; Onik, Miraz, & Kim, 2018); selection (Bunduchi, Tursunbayeva, & Pagliari, 2020; Rhemananda, Simbolon, & Fachrunnisa, 2020), training and development (Fachrunnisa & Hussain, 2020), compensation & payroll (Viriyasitavat & Hoonsopon, 2019; Wang 2017), personnel data management (Chen, Lv, & Song, 2019).

Blockchain technology provides consistent verification of all data in human resource department using public and private key encryption. The human resource information management is strong and tamper resistance (Wang et al., 2017). This facilitates sound storage of all essential information and enhances the security of the entire human resource function. (See Table 2).

3.4. Blockchain in supply chain management

According to the Council of Supply Chain Management Professionals, "Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies" Council of Supply Chain Management Professionals (CSCMP) (2021).

Managing supply chain deals with planning and controlling the network of entities facilitating movement of goods and rendering of services from suppliers to ultimate customers thereby integrating the supply and demand management across companies.

Scholars around the globe have studied the use of blockchain in supply chain management (Dubey, Gunasekaran, Bryde, Dwivedi, & Papadopoulos, 2020; Kshetri, 2018; Queiroz, Telles, & Bonilla, 2019; Saberi, Kouhizadeh, Sarkis, & Shen, 2019). Using smart contracts in supply chain process can facilitate trade between producer and consumer without an intermediary. Recent studies have highlighted the applications to various segments of supply chain management including transportation, security improvement and distribution (Mollah et al., 2020; Rouhani & Deters, 2019; Wang & Qu, 2019; Wu et al., 2017). Blockchain has found SCM application in intelligent transport systems (Balasubramaniam, Gul, Menon, & Paul, 2020) healthcare systems (Hasselgren, Kralevska, Gligoroski, Pedersen, & Faxvaag, 2020), agriculture (Kamilaris, Fonts, & Prenafeta-Boldú, 2019), Shipping and logistics systems (Ar et al., 2020; Bavassano, Ferrari, & Tei, 2020) and also in booming e-commerce industry (Kumar et al., 2020; Liu & Li, 2020).

Research has shown that the technology has signification applications in the electric power industry (Mengelkamp, Notheisen, Beer, Dauer, & Weinhardt, 2018; Pop et al., 2018). Based on blockchain, smart grids offer a market where energy producers and consumers can negotiate on different terms and conditions with other parties without any middlemen (Mengelkamp et al., 2018; Queiroz et al., 2019). The disintermediation and market decentralization performed with the help of smart contract leads to effective tracking, visibility, security enhancement and cost reduction in the overall process. Peer to peer shipment tracking helps the suppliers and buyer in improving physical distribution visibility (Hackius & Petersen, 2017; Wu et al., 2017). Blockchain can facilitate supply chain information sharing more trustworthy and secure. (Mackey & Nayyar, 2017; Si, Sun, Li, Qiao, & Shi, 2019; Wang et al., 2020). The technology can strengthen the procedures for detecting fake products in international trade.

The smart contracts due to its benefits is being applied in various industries (De Giovanni, 2020; Zheng et al., 2020 Nanayakkara, Perera, & Senaratne, 2019; Shermin, 2017). Using smart contract, firms can improve visibility, security, transparency and more trust in the supply chain network leading to lead-time reduction and cost reduction. Due to tracking enhancement, there is real-time visibility of the goods in transit. Moreover, traceability features would overcome counterfeiting challenges faced by the parties to the trade (Kamble, Gunasekaran, & Sharma, 2020; Sunny, Undralla, & Pillai, 2020). (See Table 3).

3.5. Blockchain in manufacturing & operations management

Manufacturing and operations management consists of all the activities involved in converting a product idea into a finished product, as well as those involved in planning and controlling the technology and systems that produce goods and render services.

Table 2
Most cited studies on blockchain in human resource.

Authors	Title	Year	Source title	Key findings
(Kim et al., 2020)	A privacy preserving distributed ledger framework for global human resource record management: The blockchain aspect	2020	IEEE Access	The technology can help in maintaining the data privacy under human resource management
(Kadadha et al., 2020)	SenseChain: A blockchain-based crowdsensing framework for multiple requesters and multiple workers	2020	Future Generation Computer Systems	A decentralized crowdsensing framework can overcome the challenges of a centralized personnel management system
Chen J., Lv Z., Song H	Design of personnel big data management system based on blockchain	2019	Future Generation Computer Systems	A prototype containing personnel information with query, add, modify, and track can verify the feasibility of applying
(Michailidis, 2018)	The challenges of AI and blockchain on HR recruiting practices	2018	Cyprus Review	The technology can impact employment scenario and may bring income equality to our society
(Yli-Huumo et al., 2016)	Where is current research on Blockchain technology? - A systematic review	2016	PLoS ONE	Blockchain provides anonymity, security, privacy, and transparency to all its users which is important to business and human resource management

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Table 3

Most cited studies on blockchain in supply chain.

Authors	Title	Year	Source title	Key findings
Saberi S., Kouhizadeh M., Sarkis J., Shen L.	Blockchain technology and its relationships to sustainable supply chain management	2019	International Journal of Production Research	Blockchain enables creation of secured and trustworthy ledgers. Further, it eliminates middleman in the supply chain network.
(Casino et al., 2019).	A systematic literature review of blockchain-based applications: Current status, classification and open issues	2019	Telematics and Informatics	Blockchain has found applications in several industries and has become more efficient, scalable and durable
(Ivanov et al., 2019)	The impact of digital technology and Industry 4.0 on the ripple effect and supply chain risk analytics	2019	International Journal of Production Research	The study establishes the relationship business, information, engineering and analytics perspectives and digitalisation along with supply chain risks
(Kim and Laskowski, 2018)	Toward an ontology-driven blockchain design for supply-chain provenance	2018	Intelligent Systems in Accounting, Finance and Management	Using ontologies to develop blockchain applications for evaluating supply chain provenance and improving the supply chain performance
(Kshetri, 2017)	Blockchain's roles in strengthening cybersecurity and protecting privacy	2017	Telecommunications Policy	Blockchain's decentralized feature will result in low manipulation and forgery by malicious participants. The technology can address the key challenges associated with IoT security

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According to Slack, Chambers, and Johnston (2010), operations management is the activity of managing assets dedicated to the manufacturing and supply of products and services.

Employing four major factors of production as in economics, the organizations produces output. To effectively manage business all major functions of business organization must work in co-ordination. With the help of marketing department, operations managers can identify what to produce? Through finance functions, operations department can budget for the investments in fixed assets and human capital. Using logistics and supply chain functions, operations can move raw materials into semi-finished and finished goods to ultimate customers. At all levels people are needed to complete move the product from one stage of supply chain to another and deliver products to final customers.

As a part of operations management, blockchain is being applied to production planning (Herrgoß, Lohmer, Schneider, & Lasch, 2020; Leng et al., 2019) production control (Pan, Pan, Song, Ai, & Ming, 2020; Wamba & Queiroz, 2020) and quality control (ElMessiry & ElMessiry, 2018; George, Harsh, Ray, & Babu, 2019).

Using blockchain in operations management offers the benefits of visibility, aggregation, validity and automation (Babich & Hilary, 2018). The movement of inventories during the process of production is visible during the entire production activity. Further all sources of movements can be aggregated and validated. With the help of smart contracts, manufactures can make payments to suppliers for their supplies on the fulfilment of stipulated terms and conditions. The disintermediation feature of blockchain leads to cost reduction, direct and faster communication between entities involved in production process. Moreover, all data pertaining to operations and legal contracts can be stored permanently and used at the time of legal recourse if needed (Lohmer & Lasch, 2020). The real time transparency of data measuring all activities of manufacturing and operations are available to the interest parties building trust

Table 4

Most cited studies on blockchain in manufacturing and operations.

Authors	Title	Year	Source title	Key findings
.(Yu et al., 2020)	Blockchain-based shared manufacturing in support of cyber physical systems: concept, framework, and operation	2020	Robotics and Computer-Integrated Manufacturing	Blockchain based shared manufacturing is a solution to the trust problem in shared manufacturing
(Olsen and Tomlin, 2020)	Industry 4.0: Opportunities and challenges for operations management	2020	Manufacturing and Service Operations Management	Industry 4.0 technologies including blockchain can provide remote and real time monitoring and control of geographically dispersed assets
Bai L., Hu M., Liu M., Wang J.	BPIIoT: A Light-Weighted Blockchain-Based Platform for Industrial IoT	2019	IEEE Access	Blockchain-based platform using smart contract can address security, trust, and island connection problem with IoT in manufacturing and maintainence
(Rane and Narvel, 2019)	Re-designing the business organization using disruptive innovations based on blockchain-IoT integrated architecture for improving agility in future Industry 4.0	2019	Benchmarking	The decentralization, trust and security features of blockchain can improve the agility in industry 4.0
Li Z., Barenji A.V., Huang G. Q.	Toward a blockchain cloud manufacturing system as a peer to peer distributed network platform	2018	Robotics and Computer-Integrated Manufacturing	The development of distributed peer to peer network architecture that improves the security and scalability of the cloud manufacturing

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and creating long- term partners. Blockchain thus facilitates automation in the manufacturing and operations processes delivering value to key stakeholders. (See Table 4)

3.6. Blockchain in financial management

The blockchain technology is majorly concerned with recording and executing transactions in a safe and secured manner, therefore the applicability of this technology is sufficiently broad and can be applied to most areas of finance (Chuen & Deng, 2017; Garzik & Donnelly, 2018; Zhang et al., 2020). The technology and smart contract is applied into banking, insurance, seed capital, trade finance and capital markets. Also, for financial reporting, auditing, and assurance the blockchain platforms have been developed by firms and regulators around the world.

Tokenization of fiat-money is one of the most powerful potential applications of the blockchain technology in the realm of finance. Since finance is mostly concerned with money, if fiat-currency and money can be directly transacted on the chain. There are various ways by which the blockchain technology can achieve this, and this would result in significant increase in liquidity and scale (Varma, 2019).

Reliability and security is one of the most important traits of an accounting information. Investors, auditors and accountants share the desire of having reliable and trust-worthy accounting information from a company. This also has an implications for the financial market, as more reliable the financial reporting, more efficient will be the financial markets (Fuller & Markelevich, 2020). This is also beneficial to the auditors as the auditor would have to invest lesser time in determining the veracity of the accounting information (Andersen, 2016).

Adoption of blockchain technology in financial processes and systems would also mitigate the risks of financial frauds and cyber attacks aimed at stealing money. The blockchain technology provides great security and defence against such cyber attacks and financial frauds due to its tamper-proof nature (Varma, 2019). The blockchain technology also lay down an excellent foundation for smart contracts, which can lead to massive efficiency gains in the area of finance. Smart contracts can lead to automation of transactions and reduce the transactions costs significantly. Apart from transactions. Smart contracts can also lead to automation is contract implementation and enforcement (Brammertz & Mendelowitz, 2018; Parizi & Dehghantanha, 2018; Rahim, Mohamad, Bakar, Mohsin, & Isa, 2018; Subramanian, 2019). (See Table 5)

4. Results and discussion

In this section, we have addressed the research questions of our study.

R1. What are the present applications of blockchain in business management?

As highlighted in the above sections, the blockchain technology has immense potential to generate value and transform the way businesses and organizations function (Kemmoe, Stone, Kim, Kim, & Son, 2020). It can have significant positive impact on businesses, strategies, operations and supply chains.

The technology can also prove to be helpful in advancing sustainability of various business organizations (Cong & He, 2019). The book-keeping involving numerous business transactions and contracts are stored using the blockchain network. The significant and key traits of the blockchain technology of security, transparency and integrity makes blockchain a very attractive option for firms and businesses to positively transform their business strategies and processes (Hewa, Ylianttila, & Liyanage, 2020; Lauslahti, Mattila, & Seppala, 2017).

Table 5
Most cited studies on blockchain in finance.

Authors	Title	Year	Source title	Key findings
(Fisch, 2019)	Initial coin offerings (ICOs) to finance new ventures	2019	Journal of Business Venturing	Determinants of amount raised during ICOs (whitepaper, source code quality, token supply) helps investors in taking more informed decisions.
(Gomber et al., 2018)	On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services	2018	Journal of Management Information Systems	Fintech revolution and application of blockchain is leading to transformation of process in the lending, markets, investments and financial services space
(Treleaven et al., 2017)	Blockchain Technology in Finance	2017	Computer	Blockchain technology is making the banking and financial service industry resilient and enhancing the integrity of the involved parties
(Li and Wang, 2017)	The technology and economic determinants of cryptocurrency exchange rates: The case of Bitcoin	2017	Decision Support Systems	Bitcoin exchange rate against USD is affected by the changes in economic and market and technological factors
.(Zhao et al., 2016)	Overview of business innovations and research opportunities in blockchain and introduction to the special issue	2016	Financial Innovation	Blockchain is considered to be the most exciting invention after internet helping the trust issue in transactions covering banks, finance providers, governments and other business corporations

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In the context of marketing, the marketers are reaching to end customers accessing the benefit of low cost promotion. Further, consumers are also not overloaded with too much of marketing campaigns. They get access to access and test the product of their choice. In supply chain management, the disintermediation and market decentralization performed with the help of smart contract leads to effective tracking, visibility, security enhancement and cost reduction in the overall process. The activity of peer to peer shipment tracking helps the suppliers and buyer in improving physical distribution visibility. As a part of human resource management, blockchain platforms are used for recruitment, selection, training and development, compensation & payroll, personnel data management. Under operations management, Blockchain is being applied to production planning, production control and quality control offering the benefits of visibility, aggregation, validity and automation. For managing the finance function of business, the technology is used in payments settlement, cryptocurrencies, cross-border payment services, peer to peer lending and robo advisory as part of financial investments. With low cost, error free and faster transaction benefits, the blockchain technology is used in banking business. The share ledger and dis intermediation is helping financial institutions, tax authorities, regulators and individuals in monitoring financial activities in a system.

R2. What are the challenges associated with blockchain application in business?

There are various challenges and concerns that deter the adoption of the same in the global business environment. There are various data and privacy concerns of blockchain system that impact the public image of the blockchain system which in turn have led to various regulatory constraints of mass scale of adoption of the same in various firms and business organizations (Lin & Liao, 2017; Zheng, Xie, Dai, Chen, & Wang, 2018). 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 (Dorri, Kanhere, & Jurdak, 2016; Khan & Salah, 2018). The business using public blockchain can face serious issues if the data is not meant for public entirely. Another challenge with the technology is security. The adoption of blockchain by business has suffered due to its close association and identification with bitcoin in the eyes of the government bodies and policy makers. Blockchain are infamously tied to various Bitcoin frauds and scandals that have taken place in the cryptocurrency market. These bitcoin scandals and frauds have severely dented the credibility and reliability of blockchain among regulators and societies across the globe. Although blockhain systems are inherently designed in a manner to make it tamper resistance and fraud-proof, certain business process and systems can still be susceptible to attacks and attempts of fraud by collusion of large number of network members. These security concerns can prove to be detrimental in wide scale adoption in different functions of business and supply chain process (Monrat, Schelén, & Andersson, 2019).

Another issue with the adoption is scalability concern of blockchain systems, as transaction speed and storage issues are prime concerns with regard to large volume of data of different business functions including sales, marketing, personnel, operations, supply chain and accounting systems (Upadhyay, 2020). The adoption of blockchain system extensively will involve a very high cost due to training, design and implementation of the same. The blockchain applications in industries is evolving and more and more blockchain experts and required to train the people and implement the blockchain technology in different functions of business. Furthermore, some regulators & governments around the world are not in favour of the process and technology supporting blockchain due to the integrity concern. This shall act as a barrier for businesses who are keen to apply blockchain in their business processes. Therefore, still a long way to go before blockchain systems can be properly integrated with the business world (Deshpande, Stewart, Lepetit, & Gunashekar, 2017; Mohanta, Jena, Panda, & Sobhanayak, 2019).

R3. What is the future of blockchain in business management?

Although the blockchain is being understood and applied by managers in order to enhance the the value of all business processes, still lot to be done for effective business management. The distributed ledger technology and its complex features are still in experimentation and application phase where developers and experts are introducing and experimenting the use of blockchain in day to day business activities. The researchers and academicians around the globe are making the cost benefit analysis of firms using blockchain technology in their business operations. Whether it is about recruiting and placing personnel, planning and controlling activities in finance and accounting, deploying marketing strategies or improving the production or cash cycle, blockchain technology will play a key role in the future. The blockchain community is training executives and personnel about the implementation of technology in day to day operations. Using blockchain, in the years to come the benefit of low cost would be enjoyed by start-ups and small scale business. Easy traceability of records which are immutable and permanent is going to help businesses to manage all important data of business operations. This can be shared using permissioned or private blockchain with important stakeholders including suppliers, customers, investors and employees. The authentic transactions added to the network based on cryptography function will make the data more reliable and secure for all the parties. The elimination of intermediaries will improve the lead time and reduce the operating and cash cycle for businesses. The enhanced transparency of business internal and external dealings will improve trust among the business community.

5. Main contribution and practical implications of the study

The study contributes to the existing literature where the blockchain has been applied in business. The study identifies the major functions of business and the role of blockchain in managing these business functions. The study explores the applications of blockchain in managing marketing, human resource, supply chain, manufacturing and operations and finance. All these activities and process in these functions if planned and controlled well leads to sound business management. Distributed ledger technology facilities disintermediation and market decentralization. The smart contract as a feature of blockchain technology can be applied to all transactions involving movement of resources namely finance, material and people. This will lead to effective tracking, visibility,

security enhancement and cost reduction in the overall business process. The study further highlights the challenges associated with the implementation of blockchain technology in different areas of business.

The study will be useful to the practitioners as well as to the scholars around the globe. Based on the uses of blockchain platform in different functions of business will help them to formulate policy addressing the integration of different business process. The permanent record maintained and shared using permissioned or private blockchain could be used for future contracts or evidences needed for legal cases if any. Moreover, reduced cost of operations shall help them to maximize the wealth of the firm. For researchers, the study will guide them to integrate different business fields and conduct interdisciplinary research quantitatively measuring the cost and benefits of using blockchain in managing businesses.

6. Conclusion and future direction of research

There is no doubt that the blockchain technology can significantly change the global business environment and lead to a paradigm shift in the functioning of the business world. However, to unlock the tremendous potential there are various challenges in adoption and viability of the blockchain technology that needs to be addressed before we can see the legal, economical and technical viability of this technology on the operation of various business applications.

In this study, the authors have explained the blockchain technology and its application in marketing, human resource, supply chain, manufacturing and operations and finance functions of business. Further, it reviews the studies highlighting the challenges for blockchain technology implementation and the potential ahead to leverage the advantage of technology implementation. The study found that the blockchain have been applied widely in the area of finance along with supply chain and operations. There is the dearth of studies covering the blockchain in human resource management. This study qualitatively reviews the studies related to the blockchain application in business and its allied functions. The study being qualitative in nature based on review of literature is not free from publication and sample selection bias. Furthermore, it does not integrate and present the blockchain framework for the entire business process. The researchers could take further studies covering monetary measurement of cost, revenue, profit and investment related to different areas of blockchain and business. This shall further help them to understand the role of blockchain technology in business management.

Credit author statement

Abhinav Pal: Investigation;Methodology.
Dr. Chandan Kumar Tiwari: Conceptualization; Data Curation; Formal Analysis; Visualization.
Dr. Nivedita Haldar: Supervision; Validation.

Declaration of Competing Interest

None.

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