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REVIEW ARTICLE

Blockchain technology and its importance for the growth and prosperity of Indian small and medium-sized enterprises

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Abstract

Introduction: Blockchain technology (BT), since its invention, has revolutionized the business environment across the globe while the Indian small and medium-sized enterprises (SMEs) are yet to adopt this technology in a wide-spread level. In this background, the current review provides an overview of the technology and its features, successful adoption in other industries and SMEs and how Indian SMEs can gain benefits. **Problem:** Although the BT has been hailed as a boon for the future, there exist a few challenges as well such as energy consumption, environmental issues, and policy-level hindrances. The current study makes an attempt to identify the issues and provide possible solutions to overcome these challenges. **Methodology:** The current study is a narrative review that analyses the secondary data available from government reports, research articles, corporate research publications, UN and other international bodies' reports, and so on. This narrative review article conducts an in-depth analysis of various perspectives of the variables considered for the study. **Findings:** The study found that the Indian SMEs, in spite of the challenges faced, can still gain a huge advantage by leveraging the technology for which the government ecosystem, political climate, global economic conditions, steady market situations, and the mindset among the SME owners and decision-makers must work cohesively. **Recommendations:** The current study has provided a few policy-level recommendations for sustainable growth of the SMEs in the near future.

Keywords: Bitcoin, Blockchain as a service, Blockchain, Digitization, Ethereum, Infrastructure, Small and medium-sized enterprisess, Technology adoption
JEL classification: O32, O38, L25, L26, L53, L86

INTRODUCTION

Satoshi Nakamoto developed blockchain technology (BT) (also named as distributed ledger technology (Cheng et al., 2021) in 2008, as a peer-to-peer decentralized immutable public database technology and it has revolutionized the way, how businesses function. The functioning mechanism behind the BT is as follows: various transactions are executed in a decentralized database while every block collects all the information regarding a transaction and allots a hash value using complex computations. These blocks are then conjoined together in a highly-encrypted format and hence the name, blockchain is provided (Sunny et al., 2022).

Before delving deep into BT, it is of immense importance to understand that BT has unique decentralized and distributed features that ensure data integrity, anonymity (Cheng et al., 2021), securing the transactional information (Arora

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and Nagpal, 2022), decentralization (Cheng et al., 2021; Moosavi and Taherdoost, 2023), fault tolerance, transparent nature, control over the processes and audibility. (Habib et al., 2022; Moosavi and Taherdoost, 2023). Blockchain 1.0 was predominantly focused on cryptocurrency and was first applied in Bitcoin development (Wang et al., 2021; Arora and Nagpal, 2022; Moosavi and Taherdoost, 2023). In addition to Bitcoin, some other applications that use BT include Ethereum, Merkle trees, Hyperledger, multichain etc. (Dhiman et al., 2023). In literature, it was found that 38% of the blockchain types are private while 35% are public and the rest 27% belong to a consortium type, that is, a blend of both public as well as private (Moosavi and Taherdoost, 2023). Figure 1 shows some of the famous blockchain platforms that have been in use since its inception.

Blockchain 2.0 encompassed different types of financial applications of blockchain in addition to the digital currency, that is, supply chain finance, banking instruments, trading the securities etc., (Batra et al., 2019). Further, the concept of "smart contract" (Al-Sulami et al., 2024) helps in making various types of business processes to function in line with the concepts specified and rules framed. Having been known to be track-able and irreversible, the financial transactions are publicly maintained yet under secure and trustworthy environment. Blockchain 3.0 has been envisioned to penetrate in various fields such as healthcare, science, culture, and arts (Cheng et al., 2021). Thus, the application of BT has expanded across the domains since its invention, though it was first confined to cryptocurrency applications and non-fungible tokens.

BLOCKCHAIN TECHNOLOGY AND INDUSTRIES

Blockchain has been applied in different fields such as healthcare (Chen et al., 2018; Shaikh et al., 2023), UAVs (Unmanned Aerial Vehicles), mining of minerals (Onifade et al., 2024), e-commerce (Albshaier et al., 2024), satellite communications, food supply chain (Chiaraluce et al., 2024), wireless networks, logistics and freight (Irannezhad, 2020), cloud computing (Dhiman et al., 2023), energy (Borkovcová et al., 2022), big data in media industry (Peng et al., 2022), and so on. Some of the important advantages that benefit the user, when using BT, include reduction of data breach cost, high number of cross-border transactions at affordable costs (Ramageri and Arjunwadkar, 2020), elimination of inefficient supply chains, safeguarding the data, and copyright protection.

Blockchain applications have its own challenges to overcome, to be used in a wide range of applications, such as high energy consumption (Ramageri and Arjunwadkar, 2020) and scalability issues (Habib et al., 2022). Further, as mentioned earlier, the existing cryptocurrencies are volatile in nature and the risk factors associated with the asset are high (Cheng et al., 2021).

ROLE OF SMALL AND MEDIUM-SIZED ENTERPRISES (SMEs) IN A NATION'S DEVELOPMENT

The role played by SMEs in a country's economic growth, skilled manpower development, poverty alleviation (Telukdarie et al., 2023), employment generation, and women empowerment, is inevitable. When compared with established organizations, it is easy for the SMEs to bring and implement the change easily. However, data security issues, limited access to resources, lack of multi-faceted talent to deal with technology for smooth conductance of day-to-day operations (Pelletier and Cloutier, 2019), outdated technologies, entrepreneur's orientation towards

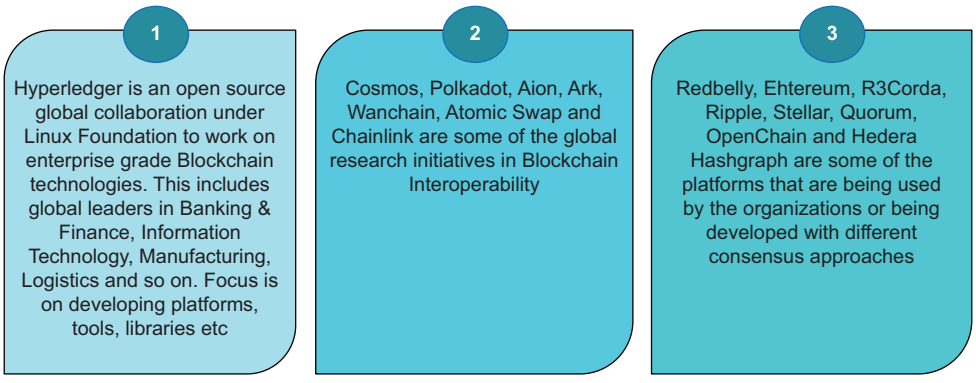

Figure 1: Some of the famous blockchain platforms
Source: MeitY (2021)

the adoption of novel technologies (Alshareef and Tunio, 2022; Ramayah et al., 2022), economic uncertainties, competition and environmental restrictions hinder the growth and development of the SMEs (Syed et al., 2021). The SMEs can reap a number of advantages by implementing the digital technologies in their day-to-day operations such as timely and efficiency procurement and delivery of goods and services, exposure to global consumers, cost-effective production and marketing, resource-savvy environment, etc. (Telukdarie et al., 2023).

According to (Kumari, 2024), the contribution of SMEs toward India's gross domestic product (GDP) stands at 30%. The contribution of 75 million micro, SMEs (MSMEs) towards GDP, growth and development, income generation, innovation, women empowerment, and employment opportunities will be crucial for India to achieve the goal of becoming the world's third largest economy by 2027. According to Deloitte report authored by (Majumdar, 2024), the MSMEs have undergone a paradigm shift towards digital payments during and after the pandemic, while the adoption of technologies such as cloud computing, automation, robotics, artificial intelligence (AI), and machine learning (ML) have steadily increased in the aftermath of COVID-19. (Ahmad and Pandey, 2024) found that despite the challenges, the SMEs acknowledge the benefits that can be reaped from the adoption of digital technologies into their operations, marketing, HR, and administration.

Digitalization of the processes can heavily influence the growth of SMEs while time, skills, and finances are the primary reasons that pull back the entrepreneurs from moving ahead in technology adoption (Telukdarie et al., 2023; Kaur et al., 2024). In literature, the authors identified a total of eleven categories such as technological, environmental, management, organizational, knowledge, people, financial, resources, strategic, regulations, and infrastructure, which tend to influence the adoption of technology among the SMEs (Zamani, 2022). Although the BT is still at nascent stage for implementation in SMEs, the industry experts predict that the blockchain is going to be the preferred technology in the upcoming years (OECD, 2020a).

In this background, the current study deals with the application of BT among the SMEs in India. The current study makes an attempt to explore the challenges faced by SMEs in adopting BT in terms of policy regulations of the government, funding environment, technology setbacks, and the opportunities available for easy adoption of BT for sustained growth of the SMEs. The current review is a first-of-its-kind in Indian setting with special focus on SMEs though the application of BT has been focused in various countries and other types of businesses. The study not only details about the opportunities, but also provides suggestions to the policy makers so as to establish the sustained growth of SMEs, aided by BT.

ADOPTION OF BLOCKCHAIN TECHNOLOGY ACROSS THE GLOBE

Having been considered as a disruptive innovation, only next to internet (Wang et al., 2021), BT eliminates the supervision of a central authority over any sort of transactions that occur among the members of a society (Cheng et al., 2021) and is considered to be a cost-effective solution. Bitcoin, the most popular application of BT, was introduced at first as a potential substitute for the traditional banking solution. Instead of a central banking authority, the crypto money is transacted from one peer to another, in the name of Bitcoin (Habib et al., 2022).

The conventional industries have digitized themselves as a competitive edge in the market while this phenomenon has led to significant contribution toward digital economy development. The development of decentralized blockchain infrastructures and the increased usage of cryptocurrencies empowered the creation of new decentralized business models, financial systems and governance structures. Although this new phenomenon provides immense opportunities, there is a wide range of problems arise as well, in terms of socio-economic and environmental aspects (Cai and Hong, 2024).

The projections for the adoption of BT in global supply chain financial market are promising with estimates being 6.85 Billion USD for the year 2028 i.e., a whopping 51.62% growth from 2021 to 2028 (Alsmadi et al., 2023). In 2023, the market size for the global BT applications was 12.3 Billion USD whereas it is expected to grow at a compound annual growth rate of 57% by 2030 (GlobalData, 2024). Apart from the financial sector, the global adoption of BT in different types of industries such as transportation and logistics, cross-sectors, retail, healthcare, and government is expected. The Asia-pacific region is expected to achieve the highest growth during the period spanning 2023 and 2030.

BLOCKCHAIN TECHNOLOGY IN INDIA

As far as Indian scenario is concerned, the government of India has developed a national-level strategy for BT.

The Ministry of Electronics and Information Technology (MeitY) has framed the strategy for blockchain in India in which the government has vowed for research and development of BT, creation of a trusted digital platform by involving multiple stakeholders, promote capacity building, and so on (MeitY, 2021). According to the report authored by (Tripathi, 2023) in ORF-India, various state governments such as Tamil Nadu, Karnataka, and Uttar Pradesh have framed policies for BT development and has adopted BT in their e-governance systems. Further, Deloitte (Deloitte, 2018) reported that the states such as Andhra Pradesh, Telangana, Maharashtra, and Gujarat have taken numerous initiatives toward blockchain implementation in their e-governance systems.

ADOPTION OF BLOCKCHAIN TECHNOLOGY IN MULTIPLE INDUSTRIES

The application of BT has been widened in various industries such as supply chain, finance, media, gaming, and human research management (Alebaba et al., 2022). Figure 2 infers that the adoption of BT has become viral in all the industries and is expected to play a significant role in industry 5.0, in addition to other disruptive technologies.

Al-Sulami et al. (2024) conducted a systematic review pertaining to the studies conducted in BT in different industries and found that most of the studies were focused on supply chain, finance, and banking and general applications, while the emerging industries include education, healthcare, SMEs, and agriculture. According to the World Economic Forum (World Economic Forum, 2024), BT, in addition to AI, is a boon for the higher educational institutions since it increases the efficiency of

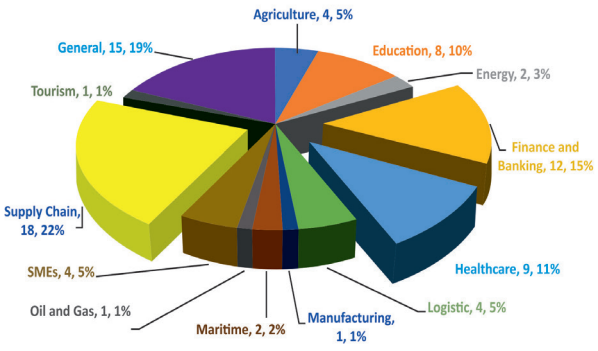

Figure 2: Application of blockchain technology in different industries
Source: Al-Sulami et al. (2024)

scientific research, security, credibility, accessibility for learners, and the institutions, democratizes the industry by breaking the institutional barriers. Some of the leading institutions that have already adopted blockchain in their teaching-learning initiatives include MIT, University of Utah, etc., The adoption of BT in supply chain (Duan et al., 2023) is driven by internal (asset management, quality control improvement, demand forecast and inventory management, cost reduction, security and commitment from the leadership), and external factors (sustainability issues, cooperation and collaboration, technology evolution, efficient logistics, and competition).

BLOCKCHAIN TECHNOLOGY AND THE SMEs

One of the crucial barriers for the growth of SMEs is the availability of funds. In Israel, it has been predicted that the high-technology start-ups that involve BT attracts more and confident investments from Venture Capitalists, in addition to public investments (OECD, 2020a). The blockchain companies based in Italy primarily cite the following reasons such as decentralization, immutability, transparency, traceability, and security for wide-spread usage of blockchain among the MSMEs. Italian SMEs in food, agriculture, textile, manufacturing and 3D printing have benefitted a lot from leveraging the BT (OECD, 2020b).

According to (Mahjoub et al., 2022), blockchain presents three primary advantages such as integrity, confidentiality, and availability to the SMEs so that the SMEs can prevent themselves from data theft, loss of data, erred data creation, etc., On the other hand, the SMEs can save costs by adopting blockchain since it automates the primary roles, gets rid of the transaction authentication costs, and removes the intermediaries. In addition to this, the SMEs can have each unique ID for each of their assets which make it unable to counterfeit, establishment of the ownership over assets, and digital permanence. The continuous in-flow of funds can be ensured without any disruption in blockchain, which acts as a lifeline for the SMEs to avoid delayed payments. Early stages of development, demand for adoption across the network for traceability, absence of interoperability among the blockchain ecosystems, lack of regulatory frameworks, scans, and market manipulation are some of the serious concerns faced by SMEs in adopting BT.

Khan et al. (2023) discussed about the collaborate role played by BT, AI, and industrial internet of things since this collaboration transforms the conventional working modules of the SME manufacturing processes, streamline the

process hierarchy so as to realize the integrity, provenance, traceability, and trustworthiness. This study proposed an unique architecture comprising blockchain, Internet of Things, ML, and AI. The proposed B-SMEs model was simulated, and the outcomes were found to be promising for real-time applications.

The business performance of a few African countries' (Nigeria, Ghana and Kenya) SMEs driven by BT was assessed earlier (Rakshit et al., 2024), and the research confirmed that the technological and organizational blockchain contexts had an impact on the organizational commitment. On the other hand, the support from the top management had an influence upon the transparency and these two factors, that is, organizational commitment and transparency had an impact on the performance of the SMEs.

INDIAN SMES AND THE BLOCKCHAIN ADVANTAGE

The following five states have key MSME clusters in India such as Maharashtra (20%), Tamil Nadu (11%), Gujarat (8%), Uttar Pradesh (8%), and Rajasthan (8%). Figure 3 shows the number of businesses that have embraced digitization of SMEs in India. Before COVID-19, the digitization of SMEs was considered to be a cost-consuming affair and was not prevalent. However, the need for contact-less transactions during the COVID-19 helped the SMEs to enjoy the benefits of digitization of their transactions at a low transformation cost, high efficiency, increased revenue, and improved communication (RedSeer, 2023).

The entry of digital payments has reinvented the business transactions between the SME owners and their consumers in India. For instance, India transacted over 2,071 crores during the financial year 2017–18 through digital payments whereas it increased up to 11,660 crores until 11th Dec during the financial year 2023–2024 (Ministry of finance India, 2023).

In literature, a blockchain-driven SME global operations model was proposed by (Rakshit et al., 2022). The proposed framework was verified for its applicability among SMEs for which the data was collected from 43 high-tech SMEs. The study found that the internationalization prospects of the SMEs and their marketing capabilities increase, when they engage with behaviour change technique and Amazon. The authors also recommended the future researchers to consider the regulatory consequences of scalability of the SMEs and long-term importance of global supply chains.

In the study conducted earlier (Kumar Bhardwaj et al., 2021), the researchers attempted to analyze the factors that influence the SME owners toward the adoption of BT in their firm. The authors found the following reasons that favor the adoption of BT by the SMEs; relative advantage, technology compatibility, technology readiness, top management support, perceived usefulness, and vendor support. On the other hand, in another study, the authors (Mishra et al., 2023) found that ease of local and international legislation followed by regulation and user data privacy remain the critical success factors toward the adoption of BT in Indian SMEs,

POLICY SUGGESTIONS

The unwavering commitment shown by the Republic of China to adopt BT in their SMEs, especially their financial operations, is commendable. China embraced digital innovation through dynamic government policies, strong

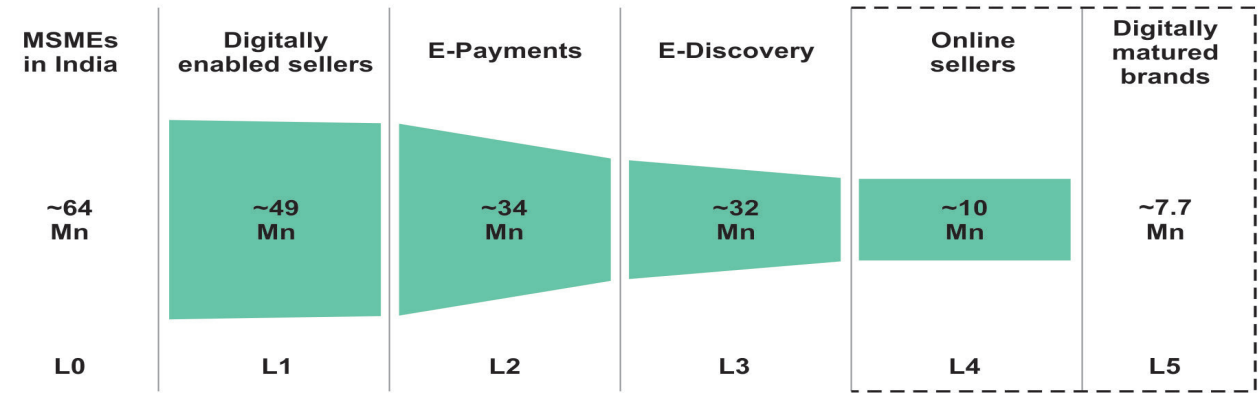

Figure 3: Micro, small, and medium enterprises segmentation funnel - FY2022
Source: RedSeer (2023)

technological infrastructure, collaboration among the academia, research, and industry helps them in applying the technology in a wide-range of industries (Kumar et al., 2023). Although the government of India has already framed a strategy for BT, the development is still at a nascent stage while prime importance should be given for this disruptive technology. The governments (states and the union) must take initiatives to empanel the experts from the academia, research, and the industry so that the knowledge transfer can happen and skill development becomes possible.

On the other development, the existence of information asymmetry between the SMEs and banks/investors and huge collateral requirements is some of the crucial issues that can be overcome with the help of BT. When the assets of these SMEs are transformed into crypto, then the banks/investors gain verified information to assess the credibility of the SMEs since the data are accurate, cannot be counterfeited and transparent (Chen, 2023). The same reason was cited in the context of SMEs in Saudi Arabia as well (Alshareef and Tunio, 2022). The government of India must strategize their technical resources to quickly develop a nationalized platform, synchronize it with the rest of the digital platforms so as to achieve interoperability as well as data security.

The National Informatics Centre has already adopted BT for education (Certificate chain), employment (document chain), crime and judiciary (Judiciary chain), logistics chain (medical products transport), and property chain (property) (MeitY, 2024), while there is a lack of unique blockchain for the SMEs to gain access to funding, speed payment receipts, cross-border transactions, technology upgradation, and so on. It is important for the SMEs to be guided by the GOI through legal frameworks so as to achieve a sustainable growth. Although India leads in terms of development of modern supply chain solutions, compared to China and the US, according to (Khanna et al., 2022), the country is lagging behind China and the US in terms of integrating blockchain and cloud computing technologies, implementation of blockchain-cloud in agriculture, Blockchain-as-a-Service (BaaS), etc. Hence, new policies should be framed to incorporate the BT across a wide range of industries while those firms/individual who take initiatives must be incentivized.

CONCLUSION

The current review focused on multiple aspects of BT, the benefits gained by the adoption of BT in different types of industries, challenges associated with technology adoption in terms of socio-economic-political-environmental concerns, and the growth of BT in all these years. Further, the study also briefed about the contributions from governments in promoting the latest technology for a sustainable future. This review article detailed about the role played by BT in enhancing the performance of SMEs in both India and across the globe. Having been tested and tried, the policy implications suggested in this article would be highly beneficial, if implemented, since these recommendations have been suggested by international researchers in their respective countries.

AUTHORS' CONTRIBUTIONS

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CONFLICTS OF INTEREST

I declare no conflicts of interest relevant to the research presented in this work.

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