Guest editorial: Blockchain for government organizations: past, present and the future

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1. Introduction

Blockchain allows the secure sharing of business processes (contracts, business records, business activities or other records) between companies and partners (business peer network) in an encrypted manner (Verma and Sheel, 2022). In e-voting, shared economies and other government functions, blockchain is widely used. A holistic view of the research domain requires a consolidation of fragmented findings and scattered literature (Shoker, 2018). As information or records from a business or partner is created (call it an event, transaction or element), those events are added to a growing chain of events that are all secure and encrypted. In other words, it is a global network consisting of blocks of data/transactions and distributed globally to users (Verma *et al.*, 2020). The data blocks can contain any kind of information/data based on the application of the blockchain (Walch, 2016). This digital ledger is a peer-to-peer network that works on consensus algorithms (every transaction needs most of the users to verify every transaction) and removes the reliance on external or internal sources to validate the authenticity of the records/data/information (Verma and Sheel, 2022). Thus, blockchain technology (BCT) helps in improving operational performance of firms (Verma and Sheel, 2022). The blockchain decentralizes the database (data is not stored by a single user or at a single location), leaving no central/focal points that can be hacked or breached into (Verma and Sheel, 2022). This makes BCT highly secure and is therefore rated highest when it comes to data transfers and security (Warburg, 2016).

The finance industry and the finance function in organizations have leveraged the blockchain in the best way (Macrinic *et al.*, 2016; Nuryyev *et al.*, 2020). Smart contracts, digital payments through cryptocurrency, higher levels of security and noncorruptibility and its recordkeeping abilities make the BCT useful for finance functions and the industry (Verma and Sheel, 2022). Another industry that has started to harness the power of BCT is the supply chain management sector (Warburg, 2016; Shoker, 2018). Top multinational retail chain, Walmart, is leveraging the technology to infuse efficiency into its supply chain (Warburg, 2016; Shoker, 2018). Maersk, global logistics major, is leveraging this technology in its shipping solution that infuses transparency into the international trade-related activities, including the safe transmission of supply chain documents (Verma and Sheel, 2022; Walch, 2016; Orji *et al.*, 2020). There is a need for transparency, accountability and real-time tracking to ensure that the processes are on-track and on-budget. BCT is helping supply chain management on these fronts (Malik *et al.*, 2021).

With the voluminous data that gets stored in the blockchain, it is obvious that it is easier to analyze the data and unearth deeper insights and make smarter predictions. Thus, data-driven BCT has helped firms to gain competitiveness in the market (Shi *et al.*, 2021; Li *et al.*, 2018). However, very few research papers have discussed the applications of BCT in government organizations and in improving the operational efficiency of government bodies (Shi *et al.*, 2021; Li *et al.*, 2018). It becomes also important to trace the past and present of BCT, which will help us understand the applicability in other potential areas of research and/or applicability (Shi *et al.*, 2021; Li *et al.*, 2018).

The growth of blockchain in businesses and organizations has recently gained pace (Behl, 2022; Behl et al., 2021; Nigam et al., 2022). The successful implementation and adoption of this technology have also inspired organizations to invest in it (Warburg, 2016; Shoker, 2018). However, unlike any technology, there are risks and rewards in the process of deciding to invest in BCT (Verma and Sheel, 2022; Ølnes et al., 2017). A clear understanding of key elements and applications of BCT in organizations from the lens of empirical papers, review papers and practitioners driven case studies/modeling papers is important to explore the critical factors for success and failure (Ølnes et al., 2017). The Special Issue aims at publishing papers written on the topics listed as under using one or more of the mentioned methodologies.

1.1 The role of blockchain for government organizations
BCT can be used by government agencies to establish e-government platforms due to its unique characteristics, which include trustworthy recordkeeping, shared trust in business procedures, reduced operating costs and enhanced discovery of audit trials (Palfreyman, 2015). There is one issue in adopting blockchain in government organizations: public data security (Cuomo, 2016) and authorities are looking for secure/trusted solutions for e-government services for citizens (Warkentin and Orgeron, 2020). Due to blockchain's tamper-proof security, government organizations are exploring the potential use of the technology for financial services, government-vendors, government-citizens and government-government interactions (Warkentin and Orgeron, 2020; Cuomo, 2016). By leveraging cryptocurrency, BCT can offer significant solutions to financial transactions, ushering in a new era of business transactions. Blockchain can be used effectively and efficiently in digital voting, tax collection, public health records and issuing licenses for public procurement. Using BCT, business models can be developed that are more efficient in terms of reducing risk, cost and time (Warkentin and Orgeron, 2020).

Most of the research in the field of blockchain has focused on technical aspects of blockchain, peer-to-peer processes and information exchange in the private domain (Ølnes et al., 2017; Yli-Huumo et al., 2016). Considering the exponential growth in research on BCT, reviews are warranted (Lin and Liao, 2017; Casey and Vigna, 2018; Risius and Spohrer, 2017). Only a handful of researchers have explored the benefits of blockchain in fulfilling societal needs without examining its application in government organizations (Ølnes, 2016; Ølnes et al., 2017).

Therefore, this special issue is addressing the following key questions through a series of selected papers as follows.

2. Contribution of the special issue articles
The first paper titled "Blockchain technology: a trouble-shooter for blood cold chains" by Dinith Asokan, Justin Sunny and V. Madhusudanan Pillai and Hiran V. Nath explores the scope of blockchain in blood cold chain (BCC)s through a demonstration. BCC represents a system for preserving the blood during its journey from the donor to the ultimate transfusion site. Existing BCCs have many drawbacks related to information transparency and information security. Secured and real-time information sharing in BCC can bring several benefits. The purpose of this paper is to summarize the issues in typical BCCs and to explore the scope of blockchain in the management of BCCs. Findings indicated that BCCs are concerned with several issues both from technical and non-technical perspectives. BCT is capable of troubleshooting the issues in the existing BCCs. Combining blockchain and IoT technology enables real-time information sharing among the entities. The demonstration

presented in this work depicts how the blockchain-based smart contract can support operations in a typical BCC.

The second paper titled "Applications of blockchain for vaccine passport and challenges" by Vinaytosh Mishra investigate the applications of blockchain in vaccine passport solution. The world is facing an unprecedented situation because of the COVID-19 pandemic. Many countries have witnessed sporadic lockdown and travel restrictions, and it has marred trade and tourism. As the mass vaccination has started the life is slowly and steadily returning to true normal. Various countries are issuing vaccination passports to manage the immunization information and validate it. To realize vaccine-passport's true potential, security and privacy concerns should be taken care of. There is a need for studies to evaluate the emerging technology for the vaccine passport. This study uses a mix of qualitative and quantitative methods to achieve its objective. This study uses a systematic literature review (SLR) to analyze the potential of blockchain for vaccine passports. The case study of three different types of organizations implementing blockchain for vaccine passports was analyzed and results were presented. Last but not least, focus group discussion and search of secondary literature was to do to identify scientific, ethical and legal challenges associated with the use of vaccine passports. The method used for calculating the importance score of these challenges was analytical hierarchy process. This study concludes that blockchain-based solutions are very suitable for vaccine passports and addresses the concern related to interoperability, privacy and security. The case study approach was used to elaborate the use of blockchain in three different options available for the vaccine. Last but not least, this study identifies the challenges faced by vaccine passport programs and suggests measures to overcome them. This study concludes that the ethical challenges associated with vaccine passports are more important and should be preferentially treated.

The third paper titled "IIoT implementation challenges: analysis and mitigation by blockchain" by Ravinder Kumar, Rahul Sindhwani and Punj Lata Singh categorize the challenges into cause and effect group. The modern scenario of customization, personalization and multi-restrictive working because of pandemics has affected the operations of manufacturing small and medium enterprises (SMEs). In the new normal, the digitalization of manufacturing SMEs can be the path breaker. Modern digitalization includes a mix of technologies such as the industrial internet of things (IIoT), the internet of things, cyber-physical system and big data analytics. This digitalization can help in achieving new design changes, efficient production scheduling, smart manufacturing and unrestricted on-time delivery of quality products. This research paper aims to recognize and analyze the challenges faced while implementing IIoT technologies in manufacturing SMEs and tries to find the possibility of mitigating challenges by BCT.

The fourth paper titled "How blockchain technology can be a sustainable infrastructure for the agri-food supply chain in developing countries" by Anup Kumar, Santosh Kumar Srivastava and Sarbjit Singh aims to formulate a conceptual sustainable framework for developing a trusted, reliable, scalable, transparent, traceable and sustainable agri-food supply chain in a developing country so that it minimizes wastage and increases the efficiency levels of agri-produce and its usage. This study uses a rigorous review of extant literature, case studies and the interview method for theory building, using BCT as a subject. Further, the study builds a framework to relate blockchain solutions to the challenges faced by the agri-supply chain. Notably, the use of BT in the agri-food supply chain is a relatively new area of study. Limitations of using BT 3.0 in a diverse supply chain like the food sector, especially in a developing country such as India, may be overcome by adopting BT 4.0 and could change the country's face by controlling inefficiencies and ensuring transparency, helping in good governance, improving the humanitarian supply chain and integrating the bottom of the

pyramid to the main economy. Based on the findings, this study proposes BT 4.0 for the agri-supply chain in India to deal with the current issues of demand-supply gap, wastages of agri-produce, unequal distribution of profit among agriproduct producers and logistics suppliers and ensuring sustainability. Results in this study have been derived from a specific demographic condition in India. Future research with other demographic conditions may be replicated. BT is a new technology product, and its effectiveness is yet to be established. The outcome of this study provides the application of BT 4.0 in the area of the agri-food supply chain. The BT 4.0 framework has been developed on studying a few cases that either implemented BT or were in the testing phase. The benefits of the agri-food supply chain *vis-à-vis* its overall social well-being may be achieved on the successful implementation of the framework, despite existing complexities in the food supply chain. Further research on this subject may help the other dimensions of the complexity of adopting BT 4.0. Both practitioners and policymakers from developing countries can, therefore, use the findings of this study to analyze BT 4.0 and address the concerns of the agri-food supply chain.

The fifth paper titled "Blockchain for government organizations: past, present and future" by Sanjeev Verma and Ashutosh Sheel comprehensively reviews the blockchain applications for government organizations and presents the past, present and future trends of blockchain applications for government organizations. Systematic review protocol instrumentalized the systematic review of research articles published from 2013 to 2021. Science mapping discerns scientific actors' trends and performance analysis like most influential authors, documents and sources. Content analysis of selected data set unfolds the past, present and future of blockchain applications for government organizations. Findings indicated that BCT offers enormous potential for the transformation of government organizations and public services. The primary areas are cryptocurrency, e-voting, shared economy, smart contracts, financial and health services, tourism, logistics and water sustainability.

The sixth paper titled "Categorizing transaction costs outcomes under uncertainty: a blockchain perspective for government organizations" by David M. Herold, Sara Saberi, Mahtab Kouhizadeh and Simon Wilde provide theoretical frameworks about the organizational uncertainty behind what and when to adopt BCT and their implications on transaction costs. The immature nature and the absence of standards in BCT lead to uncertainty in government organizations concerning the adoption ("what to adopt") and the identification of the right time ("when to start"). Using transaction cost theory and path dependency theory, this paper proposes two frameworks: to assess transaction cost risks and opportunities costs; and to depict four different types of transaction costs outcomes regarding blockchain adoption. This paper identifies various theoretical concepts that influence blockchain adoption and combine the two critical constructs of "bounded rationality" and the "lock-in effect" to categorize the multiple transaction costs outcomes for blockchain adoption.

The seventh paper titled "Applications of blockchain in government education sector: a comprehensive review and future research potentials" by Manoj Kumar Dash, Gayatri Panda, Anil Kumar and Sunil Luthra endow with a systematic review of literature on blockchain in context to the government education sector in terms of its usage, benefits, obstacles and practical implementation in future areas in education. The study adopted a bibliometric visualization tool to classify data in yearly publications, highly cited journals, prominent authors, leading publications in countries and institutions and highly cited papers – the data was extracted from the SCOPUS database by using relevant keywords. Thus, the following research questions were developed: how has BCT been used in the government educational sector? What are the benefits examined in the field of education? What were the problems/obstacles faced using the technology in a government education

structure? The findings identify and provide a comprehensive review of the technique regarding the present research stream in terms of highest publication, author, journal, subject-wise and relevance of the technology in government education structure. Thus, the future research potential of the technology in the education sector is much more as it is in the initiation stage. A lot of opportunities and benefits need to be extracted at large.

The eighth paper titled "Blockchain technology adoption in government organizations: a systematic literature review" by Himanshu Falwadiya and Sanjay Dhingra identify the factors that affect the adoption of BCT and provides a conceptual framework to adopt BCT in government organizations. To answer the research questions, this study has used SLR. For achieving the quality and transparent process, this study has applied the PRISMA framework in the SLR. With the help of SLR, this study has identified 72 factors that influence the adoption of BCT. After critically examining the factors, this study has developed the conceptual framework for the adoption of BCT in government organizations with four factors of the unified theory of acceptance and use of the technology model and four additional factors, i.e. facilitating conditions, social influence, effort expectancy, performance expectancy, trust, transparency, cost and security. To perform SLR, this study has used two databases: Web of Science and Google Scholar; future studies can consider other databases. This study has provided the framework but has not validated it; future studies can use structural equation modeling and artificial neural network to validate the framework. This study helps to provide insights about BCT and helps government and policymakers to take decisions for the adoption of BCT and in determining the future action plan.

3. Conclusion

A future study should examine the potential barriers that may stand in the way of the adoption and implementation of BCT in a variety of fields. It is necessary to investigate further the use of BCT in different sectors that can help policymakers, academics and stakeholders to understand how BCT can be used to solve various challenges that organizations and governments face (Verma and Sheel, 2022; Walch, 2016; Orji *et al.*, 2020). The implementation and use of BCT raise legal and regulatory issues. Blockchain should be regulated in several sectors and applications by a proper legal framework (Warburg, 2016; Li *et al.*, 2018).In the literature, there are no studies on the phased adoption of BCT. Organizations must determine the different phases of adoption and implementation of BCT (Warburg, 2016; Li *et al.*, 2018). Few longitudinal studies exist. In future studies, longitudinal studies should be considered to identify factors contributing to blockchain adoption (Warburg, 2016; Shoker, 2018).

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Further reading

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