Indian MSME's Sustainable Adoption of Blockchain Technology for Supply Chain Management: A Socio-Technical Perspective

Vineet Paliwal[1(✉)], Shalini Chandra[2], and Suneel Sharma[1]

[1] S P Jain School of Global Management, Mumbai 400070, Maharashtra, India
vineet.dml8dba0l6@spjain.org
[2] S P Jain School of Global Management, Singapore 119579, Singapore

Abstract. This article studies the adoption of blockchain technology in Indian Micro, Small, and Medium Enterprises (MSME) in the context of innovations in supply chain management (SCM) using blockchain technology. Besides finance, SCM is one of the main areas where disruptive innovations based on blockchain technology are going to be deployed. Blockchain technology's unique proposition lies in the attributes of trust, transparency, traceability, immutability, and decentralization. MSME's form the backbone of the Indian economy. This article provides a socio-technical factors-based analysis of the adoption of blockchain technology in Indian MSME, particularly in a SCM context. Sustainability is an important variable that is expected to moderate the relationship between socio-technical factors and large-scale adoption. The relationships are tested via a survey of professionals in MSMEs in India who are both familiar with blockchain technology and sustainable SCM. This study shall offer a deeper understanding of the application of socio-technical systems theory for the adoption of blockchain technologies by MSMEs in India.

Keywords: Blockchain · Supply chain management · Adoption · Sustainability · Socio-technical theory · MSME

1 Introduction

The majority of the Indian population, comprising of 1.2 billion people, lives in rural India and the economic development of rural India requires connecting remote villages to local and global supply chains [1]. Micro, Small, and Medium Enterprises (MSME) contribute significantly to the Indian economy in terms of Gross Domestic Product (GDP), exports, and employment generation. Though MSME sector is extensively regarded as the instrument of growth in the industrial progress of India [2], it comes with its unique challenges such as the absence of adequate and timely banking finance, limited capital and knowledge, non-availability of suitable technology, low production capacity, ineffective marketing strategy, constraints on modernization & expansions, non-availability of skilled labor at affordable cost, and follow up with various government agencies to resolve problems due to lack manpower and knowledge, outdated and incompatible technologies and many more challenges [2]. This calls for the

Published by Springer Nature Switzerland AG 2020
S. K. Sharma et al. (Eds.): TDIT 2020, IFIP AICT 617, pp. 159–165, 2020.
https://doi.org/10.1007/978-3-030-64849-7_15

adoption of technologies that can facilitate the development of MSME and maximize business opportunities.

Blockchain technology, because of its unique traits and beneficial features, is suitable to overcome most of the challenges which MSME are currently facing. We believe that the extent to which the MSME will be willing to adopt this new innovative technology will depend on various socio-technical factors which revolve around *people* (such as availability of skilled labor and education), *processes* (such as enterprise strategy and market opportunities), and *technology* (such as technological infrastructure and technological capabilities). The behavioral adoption of blockchain and the drivers for its adoption in the context of Indian MSME supply chain remains sparsely investigated. Guided by theses rationales, taking socio-technical systems theory as the theoretical lens, our first research question is: #RQ1: What factors influence the adoption intention of blockchain technology by Indian MSMEs?

Sustainability of blockchain technology (technological sustainability) refers to the long-term viability of the technology in terms of social, economic, and environmental performance. Prior research has highlighted the key role of technological sustainability in influencing the socio-technical systems [3]. Moreover, technological sustainability may facilitate MSMEs to stay competitive in the market [4]. We posit that technological sustainability would play a moderating role in influencing the relationships between people, process, and technology characteristics and intention to adopt blockchains. Thus, our second research question which we aim to answer is: #RQ2: Does the sustainability of blockchain technology influence the socio-technical characteristics to enable the adoption intention by Indian MSMEs?

2 Research Model, Theory and Hypotheses

Situating our arguments in the socio-technical theory, we suggest that people (social aspects of MSME employees), process (the aspect of blockchain technology processes as practiced by the MSMEs), and technology (technological aspects of blockchain technologies) will have a direct influence on adoption intention of blockchain technologies by MSMEs. Furthermore, sustainability will play a moderating role in explaining the relationship between socio-technical aspects and adoption intention (see Fig. 1).

2.1 Socio-Technical Theory for Adoption of Blockchain Technology

This research is contextualized specifically to the adoption of blockchain technologies for supply chain management by the Indian MSMEs. MSMEs in India don't have a high level of technology orientation or technology budgets. Large software enterprises were previously not focusing on MSME's, and therefore, good solutions were costly. But these days, software as a service (SaaS) based solutions is made for MSME. This calls to look at the socio-technical aspects for adoption. Therefore, it is necessary to draw on the social and technical perspectives and its interaction with the sustainability to understand the adoption of blockchain by MSMEs.

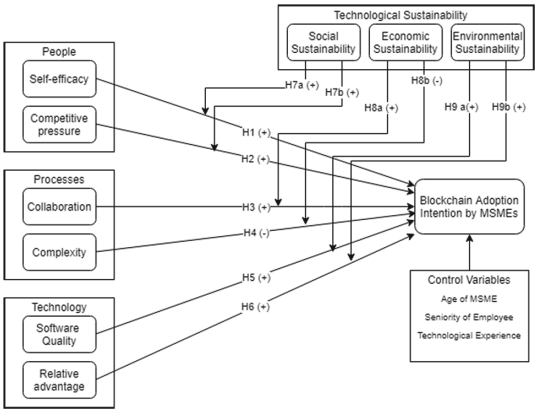

Fig. 1. Blockchain adoption model by MSMEs

Ehrenberg and King [5] advocates the use of socio-technical theory (STT) to analyze blockchain technologies. STT notes the interaction between people and technology in any organizational development. It takes an ecological view and emphasizes the interaction between society's complex infrastructure and human behavior. STT thus underscores technology implementations as an ongoing social process, thereby reiterating the technological interaction system and social system [6]. STT is based on the key principles of human values, continuous improvement, social behaviors in addition to technical aspects of storage and control of information by people [7]. Thus, socio-technical refers to the accordance between the social and technical aspects of any organization. Prior research has employed STT for distinct studies such as the broad study of Information and Communications Technologies (ICT) [8], and the study of standard tool models vis-à-vis socio-technical models [8]. Guided by these research directions, we base our conceptualization on socio-technical theory to conduct an empirical analysis of the adoption of blockchain technology by MSMEs. STT revolves around its three key dimensions of people, process, and technology, which we discuss in the following sections.

People is the first key dimension of STT. The two variables considered under this dimension are the self-efficacy and competitive pressure of the people (society in general) dealing with the blockchain technology.

Self-efficacy is defined as beliefs in one's capabilities to meet given situational demands. Self-efficacy predicts several important work-related outcomes like proficiency, attitude, and performance at the job. Compeau and Higgins [9] note that although information systems can increase organizational effectiveness, this does not always translate into utilization. They highlighted the key role of the self-efficacy of the people for the successful implementation of technology in any organization. Prior studies [9] have examined the role of self-efficacy of people for technology use. If the users learn and master the revolutionary technology such as blockchain, they can adopt it with ease. Hence, we hypothesize,

H1: In the blockchain context, self-efficacy is positively associated with adoption intention by the MSMEs.

Competitive pressure is defined in terms of its effect on a firm's incentives to initiate any technological process innovation. Because blockchains are immutable and tamper-proof, its secure and reliable features provide an edge over others to compete. MSMEs striving to compete with other enterprises may be influenced to adopt blockchain technologies because firms like to stay ahead in the competition [10]. Hence, we hypothesize,

H2: In the blockchain context, competitive pressure is positively associated with adoption intention by the MSMEs.

Process is the second key dimension of STT. It represents the strong glue that holds together the "People" and "Technology" variables in socio-technical analysis. Any digital transformation or business process re-engineering initiative that brings in new technology like "blockchain" will definitely bring in new technical features and change the interactional as well as collaborative behavior of people with technology. These new processes introduced may simplify previous processes. On the contrary, it may introduce more complex but powerful features for more people or stakeholders involved. These may inhibit people from adopting new technology. Guided by these rationales, we posit collaboration and complexity as two key factors within the dimension of the process.

Collaboration in supply chains works across multiple organizations. In order to create more value addition for the consumer and bring in more productivity, collaboration is of the utmost importance. Prior research has highlighted the key role of collaboration among partners with different goals and priorities for effective supply chain integration [11]. Because blockchains are essentially decentralized, its adoption is likely to be influenced by the collaboration among its partners. Hence, we hypothesize,

H3: In the blockchain context, collaboration is positively associated with adoption intention by the MSMEs.

Complexity refers to the complexity of technology implementation in the business processes of an organization. A high degree of complexity confuses users and causes them to have difficulty in implementing new business processes, which in turn adversely impacts its adoption decision. Since complexity can be a deterrent to successful implementation, followed by the use of innovation, it is usually negatively associated with adoption [12]. Blockchains, designed as a complex interplay of characteristics such as immutability and decentralization, may impede its adoption. Hence, we hypothesize,

H4: In the blockchain context, complexity is negatively associated with adoption intention by the MSMEs.

Technology is the third dimension of STT. New technologies are often disruptive. We have used two variables, "Software Quality" and "Relative Advantage," to describe the key idea behind the use of technology. New technology must bring some relative advantage for it to justify its adoption. Also, the new technology should adhere to certain software quality standards.

Software quality refers to the ISO 9126-1 software quality model. The model identifies six main quality characteristics, namely: Functionality, Reliability, Usability, Efficiency, Maintainability, Portability [13]. For the technology to be adopted and

deployed across organizations and across various stakeholders of the supply chain, it is required that the blockchain technology-based software has long passed the Proof of Concept phase and has a high software quality based on the ISO 9126 metrics.

H5: In the blockchain context, software quality is positively associated with adoption intention by the MSMEs.

Relative advantage is the degree to which an innovation is beneficial to the competition. The perceived benefits of blockchain will provide an incentive for technology adoption. Past research indicates a positive relationship between the perceived advantage of using the technology over competition (relative advantage) and the adoption of IS innovations. Blockchain technology brings unique benefits of traceability and trust. With these benefits, blockchain is likely to affect key supply chains management objectives such as cost, quality, and sustainability [14]. This leads us to our next hypothesis:

H6: In the blockchain context, the relative advantage is positively associated with adoption intention by the MSMEs.

2.2 Sustainability

Sustainability stands on the three pillars of social, economic, and environmental performance.

Social sustainability offered by blockchains like trust, transparency, equal opportunities to participate in the supply chain, and improved job opportunities raise the self-confidence of the stakeholders [15]. Therefore, self-efficacy acts with boosted confidence at the individual level, which causes a greater effect on the adoption intention. Also, social sustainability implies that even though one remains aware of the competitive pressure, it does not turn into stress [15]. Hence, stakeholders can take informed action according to the changing business environment. Therefore, social sustainability afforded by blockchains increases the chance of "competitive pressure," turning into a "great opportunity". Hence, we hypothesize,

H7a: In the blockchain context, social sustainability positively moderates the relationship between self-efficacy of the MSMEs and their adoption intention such that the relationship becomes stronger for higher levels of social sustainability.

H7b: In the blockchain context, social sustainability positively moderates the relationship between the competitive pressure of the MSMEs and their adoption intention such that the relationship becomes stronger for higher levels of social sustainability.

Economic sustainability implies that the initiative should be profitable so that it can continue without being a burden on an organization, company, or the government. Profitability is important for sustained operations of the initiative. Effective collaboration is an important means of raising the productivity. However, a complex process that may come with new technology implementation in the organization can create hiccups. When most IT implementations partially or completely fail, complexity is often the key reason behind failure. Therefore, economic sustainability offered by blockchains is expected to moderate the relationship between "process" (collaboration and complexity) and adoption intention.

H8a: In the blockchain context, economic sustainability positively moderates the relationship between the collaboration of the MSMEs and their adoption intention such that the relationship becomes stronger for higher levels of economic sustainability.

H8b: In the blockchain context, economic sustainability negatively moderates the relationship between complexity and the adoption intention by MSMEs such that the relationship becomes weaker for higher levels of economic sustainability.

Environmental sustainability in the context of blockchains implies that the technology should be environment friendly. For example, if an initiative is creating pollution in disproportionate amounts, then scaling that initiative into something huge and global will neither be possible nor desirable. Such an initiative is likely to soon come under the governmental regulatory bodies scanner and be banned. Therefore, the quality of software and relative advantage afforded by blockchains will translate into adoption only when the roadmap of widescale adoption is clear in terms of environmental friendliness.

H9a: In the blockchain context, environmental sustainability positively moderates the relationship between software quality and the adoption intention by MSMEs such that the relationship becomes stronger for higher levels of environmental sustainability.

H9b: In the blockchain context, environmental sustainability positively moderates the relationship between relative advantage and the adoption intention by MSMEs such that the relationship becomes stronger for higher levels of environmental sustainability.

3 Proposed Methodology and Future Work

We are using a survey methodology for data collection from MSMEs across India. We have used measures and scales based on past validated scales from existing literature. We adapted the scales to our research context. The questionnaires created the use of a 5-point Likert scale. The questionnaires have been circulated online in Indian MSMEs and addressed to senior managers in those organizations. An online survey has been conducted, and the respondents were informed about the research ethics, which we are taking care of in this survey. The data collected initially was examined and found to have satisfactory factor structure and psychometric properties. We shall be doing a detailed analysis to test our proposed hypotheses so that the final results will be ready to share at IFIP WG8.6 Working Conference 2020.

4 Expected Contribution

In this research, we have explored factors for the adoption of blockchain technologies in supply chain management by MSMEs in India based on the foundations of STT. This research-in-progress paper is expected to make several theoretical and practical contributions. Theoretically, to the best of our knowledge, this is one of the first empirical studies on blockchain technology adoption, which is guided by STT. In addition, this study highlights the key moderating role of sustainability with

socio-technical features and for the adoption of blockchain technology. Future research can add new factors thereby extending the research model. From the viewpoint of the practitioners, the results of the study will be useful for MSMEs who need to focus on the right set of factors to create their technology roadmap and corporate strategy. A well-focused and implemented technology roadmap plan can lead to successful blockchain technology adoption to gain sustainable competitive advantage.

References

1. Schuetz, S., Venkatesh, V.: Blockchain, adoption, and financial inclusion in India: research opportunities. Int. J. Inf. Manage. **52**(101936), 8 (2020)
2. Challenges to MSME. https://www.indiansmechamber.com/challenges_to_msme.php (2020). Accessed 30 July 2020
3. Savaget, P., et al.: The theoretical foundations of sociotechnical systems change for sustainability: a systematic literature review. J. Clean. Prod. **206**, 15 (2019)
4. Queiroz, M.M., Wamba, S.F.: Blockchain adoption challenges in supply chain: an empirical investigation of the main drivers in India and the USA. Int. J. Inf. Manage. **46**, 13 (2019)
5. Ehrenberg, A.J., King, J.L.: Blockchain in context. Inf. Syst. Front. **22**, 7 (2020)
6. Lee, A.: Editor's comments. MIS Q. **25**(1), 4 (2001)
7. Cherns, A.: The principles of sociotechnical design. Hum. Relat. **29**(8), 10 (1976)
8. Kling, R., Lamb, R.: IT and organizational change in digital economies: a socio-technical approach. Comput. Soci. **29**, 9 (1999)
9. Compeau, D.R., Higgins, C.A.: Computer self-efficacy: development of a measure and initial test. MIS Q. **19**(2), 23 (1995)
10. Chandra, S., Nanda Kumar, K.: Exploring factors influencing organizational adoption of augmented reality in e-commerce: empirical analysis using technology-organization-environment model. J. Electron. Commer. Res. **19**(3), 237-265 (2018)
11. Kouhizadeh, M., Saberi, S., Sarkis, J.: Blockchain technology and the sustainable supply chain: theoretically exploring adoption barriers. Int. J. Prod. Econ. **231**(107831), 21 (2021)
12. Bhattacharya, M., Wamba, S.F.: A conceptual framework of RFID adoption in retail using TOE framework. Int. J. Technol. Diffus. **6**(1), 32 (2015)
13. ISO 9216 Software Quality Characteristics. http://www.sqa.net/iso9126.html (2020). Accessed 4 Aug 2020
14. Kshetri, N.: Blockchain's roles in meeting key supply chain management objectives. Int. J. Inf. Manage. **39**, 10 (2018)
15. Singh, S.K., et al.: Self-efficacy and workplace well-being: moderating role of sustainability practices. Benchmarking Int. J. **26**(6), 17 (2019)