



# Explaining the non-adoption of blockchain technology in global value chains: a micro-foundational perspective

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## Abstract

The business potential of blockchain technology in global value chains (GVCs) includes the creation of permanent records of information, to facilitate specifications regulation, to mitigate risk using smart contracts and through full, transparent transaction traceability at reduced costs. Blockchain as a general-purpose technology (GPT) thus has the potential to increase the effectiveness and efficiency of value creation for firm specific advantages owned and/or controlled by multinational enterprises (MNE), yet adoption of blockchain is uneven. This study adopts a micro-foundational lens to explain the non-adoption of blockchain technology in multinational enterprises' (MNE) global value chains (GVC), emphasizing the influence of the technology, organization and environment (TOE) influences on the technology acceptance (TAM) for blockchain, due to the impact on managers' perception of blockchain's usefulness and ease of use. The empirical results are based on a multiple-case study research design, that collected interview data from supply chain managers in small, medium, and large-sized manufacturing MNEs that participate in global value chains that differ in their governance patterns. The results identified fifteen different drivers of the non-adoption of blockchain technology across the technological, organizational and external environments of the MNE. The results of the study allow a parsimonious model of blockchain technology non-adoption that is aligned with the digital technology adoption literature using a TOE–TAM approach.

**Keywords** Multinational enterprises · Global value chains · General purpose technologies · Micro-foundations · Blockchain

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## 1 Introduction

Blockchain technology is receiving significant interest in both academia and practice due to its potential to disrupt the current organization of economic activity (Kane, 2017; Ozcan & Unalan, 2020). The international business potential of blockchain technology includes reduced cross border costs, improved transactional and processing time, minimized paperwork, product provenance and safety, simplified adherence to policies and regulations, and finally, a tendency towards implementations that emphasize privacy (Hooper & Holtbrügge, 2020). Examples of international business application domains include international finance, banking and insurance and global value chain (GVC) management (Hooper & Holtbrügge, 2020).

Blockchain technology's ability to enable greater transparency, immutability, and irreversibility (Rajasekaran et al., 2022) is argued to be highly suited to managing traditional supply chains, featured by multiple layers of stakeholders (Oguntegebe et al., 2022), because of its potential to enhance transparency, traceability, efficiency, and information security in supply chain management (Moosavi, Naeni, Fathollahi-Fard & Fiore, 2021). These attributes of blockchain technology make it equally attractive for GVC orchestration, by allowing the replacement of traditional contractual and relational governance mechanisms with explicit transactions (Lumineau, Wang, & Schilke, 2020). The adoption of blockchain technology for the orchestration of GVC activities is however significantly understudied (Goldsby & Hanisch, 2022).

Contrary to the common understanding that blockchain can function nearly self-reliantly, the system actually requires a significant amount of coordination between the transacting parties and additional governance mechanism over the technical aspects of its implementation. GVCs can also be difficult to govern using blockchain due to the complexity and sensitivity of partner relationships and due to the potentially strong necessity for coordination agents (Bitran et al., 2006; Sweeney, 2005). At the same time, in such transactions, which imply a considerable level of uncertainty, blockchain presents an opportunity for the minimization of conventional contractual governance and shows potential for complementary effects on the development of subsequent relational norms (i.e. building credibility and trust) (Lumineau et al., 2020).

The existing technology adoption literature has however predominantly taken a technical perspective on the implementation of blockchain and little attention is dedicated to concrete guidance for practitioners on how to effectively exercise blockchain governance (Goldsby & Hanisch, 2022). Kamble et al. (2019) argue that many MNEs currently lack the technological capacity and know-how necessary to effectively adopt blockchain. There is also a perceived distrust towards the technology due to its high cost and limited practical application evidence to this date (Kamble et al., 2019). A lack of understanding of the technology and its underlying mechanisms and capabilities leaves MNEs reluctant to adopt it. This

means that blockchain is still unproven and assumptions about its potential stem predominantly from conceptual expositions (Kamble et al., 2019).

Indeed, the role of managers in the decision to adopt blockchain technology is very poorly understood and reflects the important role of decision-maker's subjective perceptions in the well-established technology acceptance model (TAM; Davis, 1989) and technology-organization and environment (TOE) framework (Tornatzky & Fleischner, 1990) that explain technology adoption. This paper thus adopts a micro-foundational perspective to study the adoption of blockchain technology by MNEs for governing their GVCs and seeks to answer the following research question:

How can the non-adoption of blockchain technology in global value chains be explained from a micro-foundational perspective?

Several micro-foundational barriers to blockchain's adoption have been identified from the empirical evidence in this study, that clearly affect the ability of decision-makers to effectively assess technology for adoption, using the elements of an integrated TOE–TAM model for technology adoption. Blockchain is perceived as a promising disruptive technology and overall, SC managers find attractiveness in its potential. However, the microfoundational drivers of transaction costs in GVCs that blockchain is expected to address (opportunism, bounded rationality, and bounded reliability) are also found to be central to its non-adoption. A persistent trend across all cases studied shows that GVC decision-makers are boundedly rational when it comes to the integration of blockchain, as they have no knowledge and understanding of the technology. These findings reflect understandings of existing limitations of blockchain technology could additionally jeopardize the realization of the technology's full potential.

The remainder of this paper proceeds by developing a conceptual foundation that established the argument for adopting blockchain technology in MNE GVCs and explaining the current explanations for new technology adoption by firms, including how managerial decision-making can affect the adoption decision. Next, the multiple-case study research design is explained, before the findings for blockchain non-adoption are presented. Drawing on the discussion of the findings a conceptual model for blockchain non-adoption in MNE GVCs is developed, before the study concludes with implications for theory and practice.

## 2 Conceptual foundation

Information and communication technologies (ICT) have long been recognized for their important role in enabling communication and information sharing to coordinate geographically dispersed activities (Mani et al., 2014) and these digital communication technologies have played a central role in lowering coordination costs associated with the global disaggregation of value creation in GVCs (Autio et al., 2021; Mani et al., 2014). A growing body of work is now seeking to understand how 'newer' digital technologies, associated with the fourth industrial revolution, might

impact the organization and coordination of GVCs (Lee et al., 2023). For instance, Laplume et al. (2016) focused on understanding the impact of 3D printing technologies on the geographic dispersion and density of GVCs. Rehnberg and Ponte (2018) similarly sought to understand the impacts widespread adoption of 3D printing could have in terms of GVCs' restructuring, participant upgrading and the distribution of value creation. Egwuonwu et al. (2022) provide evidence that blockchain technology has a positive effect on scalability, security and traceability for retailers participating in GVCs. Despite the progress signaled in these studies, not only with the adoption of digital technologies, but also our understanding of the impact of these digital technologies on GVCs, insights from research remain at a very early stage (e.g., Chen et al., 2022; Lee et al., 2023). It is the contention of this paper that the decision-making on technology adoption is understudied in this respect.

This is also the case for the effects of digital technologies on GVCs in relation to cross-border coordination of firm activities and the adoption of effective governance mechanisms (Laplume et al., 2016). Blockchain technology is a digital technology that, because of its effect on transaction costs faced by MNEs, is seen to have the potential for significant effects on the governance of GVCs (Chen et al., 2022). Chen et al. (2022) however also notes a lack of empirical studies on blockchain adoption and studies of the impact of blockchain technology on transaction costs in GVCs. In their work, Chen et al. (2022) adopted a qualitative case study approach to study the Maersk and IBM jointly developed blockchain enabled solution TradeLens. The conceptual foundation for this study was developed to further advance this strategic value creation focused research agenda, but differs by focusing on a broader typology of GVCs and adopting a micro-foundational lens for conceptualizing the technology adoption decision for MNEs. The micro-foundational theorization reflects an emphasis on managerial (strategic) technology adoption decisions that reflects developments in international strategy theorization (Kano & Verbeke, 2015, 2019) and the emphasis on individual level factors in information and communication technology (ICT) adoption and acceptance theories (Munir & Phillips, 2005; Peter et al., 2020; Venkatesh et al., 2003, 2016).

## 2.1 Blockchain technology

Blockchain is an important disruptive technology (Oguntegebe et al., 2022) based on advanced distributed ledger technology (DLT), that allows information to be recorded and stored by multiple networked entities while preserving the data's truthfulness through consensus-based validation protocols and cryptographic signatures (Benos, Garratt, & Gurrola-Perez, 2017 as cited in Schmidt & Wagner, 2019; Lumineau, et al., 2020). Blockchain technology allows sets of newly recorded transactions to be added to the blockchain in interconnected blocks, each of the blocks in the network holds a timestamp, transaction data, and the cryptographic hash of the preceding block, which makes the retroactive modification of the blocks impossible (Rajasekaran, Azees, & Al-Turjman, 2022; Wang et al., 2019).

Entities contributing and using data recorded in a blockchain are assigned specific rights over that data (Schmidt & Wagner, 2019), with blockchains typically

classified as either permissionless or permissioned (Rajasekaran et al., 2022). Furthermore, data in the blockchain can be organized in either a centralized or decentralized manner (Rajasekaran et al., 2022; Wang et al., 2019). Permissionless or public blockchains can be accessed by anyone at any time and the transaction blocks are publicly visible. Permissioned blockchains can be divided into private, consortium, and hybrid networks. Private blockchains are commonly considered more secure as only the entities (nodes) who are granted access to the network can perform and see the transactions (Rajasekaran et al., 2022). While private blockchains are often argued to be more common in smaller organizations with centralized control (Rajasekaran et al., 2022), they are also widely adopted in international business due to the restricted access to transactional information in these networks (Hooper & Holtbrügge, 2020). Consortium blockchains are semi-decentralized as several entities can manage them, but owners can choose which organizational aspects to make public and which to keep private (Rajasekaran et al., 2022). Lastly, the hybrid blockchain combines the best features of both public and private networks as it allows for transactions to be verified privately as well as publicly (Rajasekaran et al., 2022). Different consensus mechanisms are typically used depending on whether the blockchain network is public or private (Bains, 2022). For public networks, widely adopted verification mechanisms are Proof-of-Work, Proof-of-Stake, and Delegated Proof-of-Stake, while in private networks, Byzantine Fault Tolerance (pBFT), Istanbul BFT, and federated BFT are common (Bains, 2022).

## 2.2 Global value chains

MNEs pursue value chain fine-slicing by organizing their activities into smaller more coherent modules that can be separated in space and time (Linares-Navarro et al., 2014), allowing country specific advantages (CSA) to be exploited through recombination with firm specific advantages (FSA) (Rugman et al., 2011), which gives them the opportunity to build superior FSAs (Hernández & Pedersen, 2017; Rugman et al., 2011).

MNEs value chain fine-slicing takes place within GVCs, which have been argued to be ubiquitous and central to MNEs' internationalization (Mudambi & Puck, 2016). A GVC can be defined as “the full range of activities that firms and workers perform [across more than one country] to bring a product from its conception to end use and beyond” (Gereffi & Fernandez-Stark, 2016, p. 7). A GVC can be internalized into a single firm, but more commonly involves more than one firm and network-based coordination of value creating activities over more than two countries (Gereffi & Fernandez-Stark, 2016). It is in the governance of such complex GVCs (Ghosh & Fedorowicz, 2007) that blockchain technology is argued to have significant potential to reduce transaction costs, which are central to understanding international business activities (Kano & Verbeke, 2019).

Five archetypes of global value chains, that MNEs participate in, can be conceptualized drawing on the work of Gereffi et al. (2005), see Table 1. These five archetypes provide a typology of fundamental types of GVC governance; namely (1) markets, (2) modular, (3) relational, (4) captive, and (5) hierarchy (Gereffi & Lee, 2012;

**Table 1** Blockchain transaction costs for five global value chain archetypes

Global value chain	Market	Modular	Relational	Captive	Hierarchy
GVC characteristics Gerffi et al. (2005)	Low complexity of transactions	Standardization simplifies interactions	Complex, non-transferable tacit knowledge	High product complexity	Full internalization by MNE
	Suppliers are independent from buyers	Low switching costs for the MNE	Strong mutual dependence between MNEs and suppliers	Lower supplier competency	Lack of highly competent suppliers
	Trade/exchange is based on the defined price	Trade/exchange is based on significant information exchange	Trade/exchange depends strongly on trust	MNEs internalize control	Very complex products
Buyer–supplier relationship Cox (2001)	Low switching costs			MNEs dominate suppliers	Problematic tacit knowledge transfer
	MNE has low bargaining and pricing power with suppliers	MNE is able to operate relatively independently in relation to suppliers	Significant interdependence between the MNE and suppliers	The MNE dominates suppliers in terms of bargaining and pricing power	Minimal to no external supplier relationships
	Firm specific switching costs analysis for MNE	Low switching costs for MNE	High switching costs for MNE	Low switching costs for MNE	MNE is rather independent, switching costs are less relevant

Table 1 (continued)

Global value chain	Market	Modular	Relational	Captive	Hierarchy
Blockchain impact	<p>Could mitigate supplier's opportunistic behavior and consequently improve trust in the buyer-supplier relationship</p> <p>Could improve the quality of transacted information should bounded rationality occur</p> <p>Insignificant impact of bounded reliability, as the technology has little impact on purely human behavior</p>	<p>When private, Blockchain could be an excellent facilitator of standardization and an effective tool to govern specification information</p>	<p>Could significantly improve the relationship and collaboration between highly interdependent partners through increased transparency and trust</p> <p>Could inhibit opportunistic behavior through smart contracts</p> <p>Could enhance the clarity and precision of complex tacit knowledge transferred</p>	<p>Could relieve the lead firm from exercising strict monitoring and control over the supplier and could lessen the effects of bounded reliability</p> <p>Could better the collaborative performance through simplified processing and transacting of complex and valuable knowledge and specifications</p>	<p>Blockchain could lessen need for full integration by providing more security and minimizing opportunistic behavior</p> <p>The effects of bounded rationality could be mitigated through enhanced information precision and improved ability of the partners to process information</p> <p>A risk of bounded reliability remains to a certain degree</p>

Gereffi et al., 2005). The GVC types of Gereffi et al. (2005) typology can further be viewed from the perspective of a MNE integrating the work of Cox (2001), allowing an emphasis on power asymmetries (Gereffi et al., 2005) and an assessment in terms of buyer–supplier power relations (Cox, 2001).

Each of these GVC governance types represents an answer to how best the transaction costs inherent to the internationalization of economic activity should optimally be managed from a firm perspective. MNEs will participate in one or more GVCs and be subject to one or more of the governance approaches associated with each of the five GVC types. However, for the purposes of this paper, the typology needs to be further developed to more explicitly center the understandings of the governance modes around the participation of the MNE, see Table 1. This is needed as the effects of blockchain technologies are being studied from a micro-foundational perspective that is centered on the MNE as an actor. Cox (2001) clarifies that power-based buyer–supplier relationships (BSR) between the MNE and the supplier can be described as interdependent, independent, buyer-dominant, and supplier dominant. Integrating the FSA and CSA considerations and enabling technologies identified in preceding sections. Table 1 clearly illustrates blockchain technology's potential to affect the efficiencies and configurations of value chains by addressing the micro-foundational drivers of transaction costs in the different GVC types.

The aim in this paper is however not to explain how blockchain technology impacts the five different global value chains, this is done in a separate currently unpublished working paper (Anonymized, 2023), instead the alternatives are established here to show why the technology should be attractive to MNEs across all five GVC archetypes. Thereby allowing this study to focus on the decision to adopt blockchain technology across different types of MNE GVCs.

### 2.3 Opportunities and challenges of GVC orchestration using blockchain technology

Blockchain presents opportunities for GVC orchestration through the replacement of traditional contractual and relational governance mechanisms in explicit transactions (Lumineau, Wang, & Schilke, 2020). Zhu et al. (2022) confirm that there is a growing body of work taking a transaction cost approach to understanding blockchain adoption in GVCs, but not necessarily from an international perspective. In tacit transactions which imply a considerable level of uncertainty, blockchain especially represents an opportunity for the minimization of conventional contractual governance and shows potential for complementary effects on the development of subsequent relational norms (i.e., building credibility and trust) (Lumineau et al., 2020). While the potential benefits of employing blockchain technology as a tool for digital governance have been explored by a vast body of recent literature, the challenges of the adoption of the technology for the orchestration of GVC activities are significantly understudied (Goldsby & Hanisch, 2022).

Contrary to the implied understanding that blockchain could function nearly self-reliantly, the system requires a significant amount of coordination between transacting parties and additional governance mechanism over the technical foundation.

GVCs could be difficult to configure using blockchain due to the complexity and sensitivity of partner relationships and due to the potentially strong necessity for coordination agents (Bitran et al., 2006; Sweeney, 2005). In addition, the existing technology adoption literature takes a prevalently technical perspective on the implementation of blockchain and little attention is dedicated to concrete guidance for practitioners on how to effectively exercise blockchain governance (Goldsby & Hanisch, 2022).

Moreover, existing limitations of blockchain could additionally jeopardize the realization of the technology's full potential. Kamble et al. (2019) argue that many MNEs are currently lacking the technological capacity and knowledge necessary to effectively adopt blockchain. There is also a perceived distrust towards the technology due to its high cost and limited practical application evidence to this date (Kamble et al., 2019). The lack of technology knowledge and its underlying mechanisms and capabilities leaves MNEs reluctant to adopt blockchain. This means that blockchain is still unproven and assumptions about its potential stem predominantly from conceptual expositions (Kamble et al., 2019), rather than actual adoption. There is a need to better understand the non-adoption of the technology.

## 2.4 Technology adoption decision-making

The decision to adopt blockchain technologies in a MNE GVC is clearly a case of decision-making within the boundaries of an organization that requires interfirm coordination, that addresses an application domain that has almost completely overlooked the individual employee (Venkatesh 2006). This paper seeks to address this gap in our understanding by focusing on two themes suggested as fertile for this purpose, namely technology adoption decision-making/-makers in business organizations (Venkatesh, 2006) and the adoption of technologies for supply-chains (Venkatesh, 2006).

Technology adoption has been explained by several theories and models at the individual, group and organizational levels of analysis (Gangwar et al., 2014). The technology acceptance model (TAM; Davis, 1989; Davis & Venkatesh, 1996) and technology-organization and environment (TOE) framework (Tornatzky & Fleischer, 1990) are most suited and widely adopted for explaining technology adoption by organizations, which is the focus of this paper. The TAM and TOE are also increasingly integrated in studies of technology adoption due to their complementarities (Chatterjee et al., 2021; Gangwar et al., 2014, 2015), see integration in Table 2. This combination is highly suited to the purposes of this paper as the TAM can be applied at both the individual and organizational levels (Gangwar et al., 2014), while the TOE is clearly focused on the nature of the technology, the organization and its external environment contexts (Gangwar et al., 2014), with the organization and its environmental contexts argued to represent key antecedents to the perceived usefulness and ease of use of the technology (Chatterjee et al., 2021; Gangwar et al., 2015).

The TAM model (TAM-1), see Fig. 1 and Table 2, focuses on the influence of perceived usefulness (PU) and perceived ease of use (PEOU) of a technology on the

**Table 2** TOE–TAM model with microfoundations

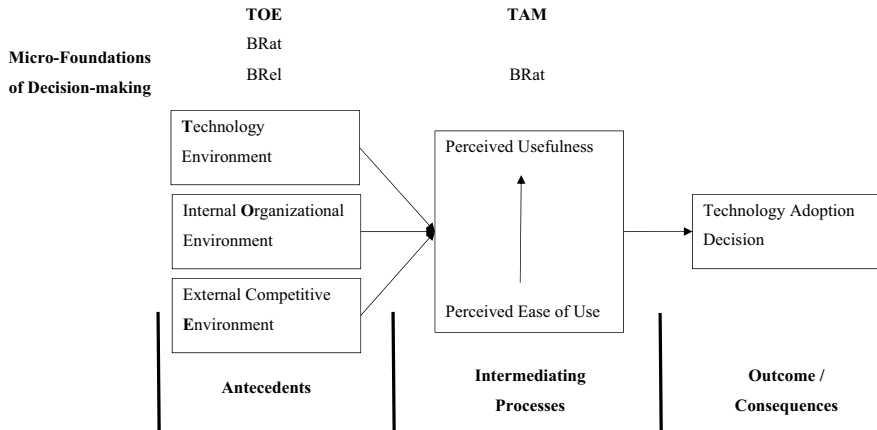
Technology adoption model/framework		Microfoundations of managerial technology adoption decision-making
TAM model	TOE framework	Kano and Verbeke (2019)
Davis (1989)	Tornatzky and Fleischner (1990)	Kano and Verbeke (2015, 2019)
Davis and Venkatesh (1996)	Chatterjee et al. (2021)	
Chatterjee et al. (2021)	Gangwar et al. (2014, 2015)	
Gangwar et al. (2014, 2015)	Lin (2014)	
Level of analysis	Individual/organization	Individual
Dependent variables	User acceptance/adoption	Decision-making
	Behavioral intention	
	Actual behavior	
Antecedents	External variables (TOE)	Information availability
	Beyond the scope of this paper, these would be the determinants of the TOE framework elements	
Independent variables	Organization context	Time
Technology related variables	Environment context	Experience/knowledge
	Perceived usefulness/perceived ease of use	Bounded rationality
	Perceived usefulness	Bounded rationality
		Bounded rationality
		Bounded rationality
		Bounded rationality
		Bounded rationality
		Bounded rationality
		Bounded reliability

Table 2 (continued)

Technology adoption model/framework		Microfoundations of managerial technology adoption decision-making
TAM model	TOE framework	
Davis (1989)	Tornatzky and Fleischner (1990)	Kano and Verbeke (2019)
Davis and Venkatesh (1996)	Chatterjee et al. (2021)	Kano and Verbeke (2015, 2019)
Chatterjee et al. (2021)	Gangwar et al. (2014, 2015)	
Gangwar et al. (2014, 2015)	Lin (2014)	
	Organizational culture	Bounded rationality
	Organizational slack	Bounded reliability
Perceived ease of use	Organizational readiness (IS infrastructure incl.) (perceived barriers)	Bounded reliability
	Technology competence (skilled and competent (IS) staff (staff training)	Bounded rationality
	Organization size	Bounded reliability
	Competitive pressures (market scope/nature)	Bounded rationality
External environmental context variables	(improved production/operations) (improved products/services)	Bounded reliability
	Information intensity	Bounded rationality

Table 2 (continued)

Technology adoption model/framework	Microfoundations of managerial technology adoption decision-making
TAM model	Kano and Verbeke (2019)
TOE framework	Kano and Verbeke (2019)
Davis (1989)	Tornatzky and Fleischner (1990)
Davis and Venkatesh (1996)	Chatterjee et al. (2021)
Chatterjee et al. (2021)	Gangwar et al. (2014, 2015)
Gangwar et al. (2014, 2015)	Lin (2014)
Perceived ease of use	Bounded rationality
Partner Organizations in Ext. Network (Partner pressure/trust/dependency/relational commitment/Effect on relational power)	Bounded reliability
Partner organizations in Ext. Network (vendor support)	Bounded rationality
(IS support in external networks)	Bounded reliability
(quality of consulting support)	Bounded rationality
Government pressure	Bounded reliability
(regulatory support)	Bounded reliability
Industry/sectorial dynamics	Bounded rationality



**Fig. 1** TAM–TOE technology adoption model integrating microfoundations of managerial decision-making. *Source:* Adapted from Chatterjee et al. (2021), drawing on Kano and Verbeke (2015, 2019)

behavioural intention (BI) and observed actual behaviour (AB) related to adopting a technology (Gangwar et al., 2014). The PU can be defined as the subjective assessment of the probability that adopting a specific technology will improve performance (Gangwar et al., 2014). While PEOU can be defined as the degree to which the use of the technology being considered for adoption will be free of effort (Gangwar et al., 2014). Furthermore, previous empirical research has confirmed that PEOU influences PU, as well as showing that these two influences explain the intention and subsequent actual adoption of a technology (Gangwar et al., 2014). The TAM was however initially developed to explain user acceptance of new technologies, and as a result the model must be extended (TAM-2/TAM-3) to study firm-wide technology adoption (Gangwar et al., 2014). These models retain the core causal paths between PU, PEOU and BI, but extend the model by adding external antecedents that affect PU and PEOU. The extended TAM models are often operationalized with variables that reflect the specific technology being studied (Gangwar et al., 2014).

The TOE framework articulates three contexts that can be used to organize antecedents for PU and PEOU of the TAM model (Chatterjee et al., 2021; Gangwar et al., 2014, 2015), see Fig. 1 and Table 2. The five original factors of the innovation diffusion model (IDM; Rogers, 1995) are central elements of the technological environment within which a technology adoption decision is made (Gangwar et al., 2014). Table III of Gangwar et al. (2014) reveals a complex pattern of importance of the significance of the relative advantage, complexity, compatibility, observability and trialability in explaining the adoption of technologies, including EDI (Electronic Data Interchange), ERP (Enterprise Resource Planning), e-business, e-commerce, RFID (Radio-Frequency Identification), and knowledge management.

In terms of the organizational context, for the same technologies, Gangwar et al. (2014) show that (top) management support, organizational slack, organizational readiness, organizational culture, skilled and competent staff, IS staff and

infrastructure, technology competence, training, organizational size and perceived barriers have all received extensive attention.

The external (competitive) environment is the final context of the TOE (Gangwar, 2014) and integrates the influences of competitive pressures (including concerns like market scope/nature, improved production/operations, improved products/services), the information intensity of the business activity, the relationships with partner organizations in the external network of an organization (including with respect to partner pressure/trust/dependency/relational commitment/effects on relational power), as well as the quality of partner organizations (including in relation to vendor support, access to IS support in external networks, and the quality of consulting support), but also government pressure and (regulatory) support, and finally industry/sectorial dynamics (Gangwar et al., 2014).

While the diverse influences across the three contexts of the TOE model each need to be specified in a given study in terms of their effects on PU and POEU for a given technology, Table 2 broadly organizes them into most intuitive causal paths in relation to the TAM model, specifically the PU and PEOU. Table 2 however also (in the final column) seeks to make clear that each of these contextual influences on PU and PEOU are potentially subject to the microfoundational influences on managerial decision-making, specifically with respect to the bounded rationality of decision-makers and the risks of bounded reliability between partners (Kano & Verbeke, 2015, 2019).

## 2.5 Micro-foundations of managerial technology adoption decision-making

The adoption of novel digital technologies, like blockchain technology, is closely tied to the influence of key employees with decision-making responsibilities related to technology adoption (Loonam et al., 2018) and institutional entrepreneurs that legitimize technologies within an organization by moving across the organizational boundary within the strategic action field (SAF) for a given digital technology (Peter et al., 2020). Hernandez et al. (2008) integrated decision-makers as respondents on behalf of the firm in their study of the adoption of management software using TAM, providing empirical support for actively considering decision-makers.

This paper argues that it is possible to integrate behavioral aspects of managerial decision-making that would affect decision-makers assessment of the TOE–TAM integrated model dimensions. The developing microfoundational approach to strategic decision making suggests that all decision-making is subject to either bounded rationality (BRat) and/or bounded reliability (BRel) (Kano & Verbeke, 2015, 2019). In strategic analysis, the aim is to reduce these sources of transaction costs, but in this paper the two aspects of managerial decision-making are integrated to show why the TOE–TAM model may lead to suboptimal technology adoption decisions. How they may affect the decision to adopt blockchain technology, when understood through the lens of an integrated, as presented in Fig. 1 and Table 2.

Simon (1957, p. xxiv) defined bounded rationality as human behavior which is “intendedly rational but only limitedly so”. In other words, bounded rationality is the individual’s restricted capacity to make optimal choices, stemming from the natural

human limitation for processing information and from the inevitable imperfect availability of information (Kano & Verbeke, 2019). Bounded rationality is also associated with the risk of losing control over valuable resources as future contingencies cannot be costlessly anticipated, thus contracts between partners are incomplete and coordination costs may arise, especially in complex, value-adding activities.

Verbeke and Greidanus (2009) introduce the envelope concept of bounded reliability, suggesting that economic actors are reliable but only boundedly so. Kano and Verbeke (2015, p. 98) further clarify that bounded reliability as human behavior that reflects an “imperfect effort to make good on open-ended commitments”. There are three main reasons for economic actors to display BRel: opportunism, benevolent preference reversal or identity-based discordance (Kano & Verbeke, 2015).

Opportunism is defined as “self-interest seeking with guile; calculated efforts to mislead, distort ... or otherwise confuse” (Williamson, 1981, p. 500). Economic actors displaying opportunistic behavior are less likely to share information in its entirety (a prerequisite for bounded rationality) and are expected to behave uncooperatively during economic transactions (Annals, 2019). Benevolent preference reversal, argued to be due to a reprioritization, overcommitment, and regression, is defined as “consisting of reprioritization and scaling back on overcommitment” leading to good-faith commitment non-fulfillment (Kano & Verbeke, 2015, p. 103). Identity-based discordance “refers to commitment non-fulfillment due to conflict between “what one promises” (in good faith) and “what one represents” or “values” in terms of one’s identity (Kano & Verbeke, 2015, p. 108). A manager taking a technology adoption decision may find making the ‘right’ decision is in conflict with internal psychological conflicts or as a result of intra-group conflict leading to preferences for ‘local goals’. Alternatively, it may be as a result of divided attention (Kano & Verbeke, 2015).

The integrated TOE–TAM approach to explaining technology adoption is subject to systemic microfoundational influences on the assessment of both the technological, organizational and external environmental contexts. While the TOE contexts are presented as being rationally assessable, it is clear that this is based on assumptions of accurate assessment. Accepting the argument that managers making technology adoption decisions are boundedly rational reflects the assumption that the usefulness of a technology is a subject perception of a manager, which from a bounded rationality perspective reflects assumptions of incomplete information and limited information processing when assessing the TOE contexts of a technology adoption decision. Additionally, decision-makers may perceive differing degrees of bounded reliability on the part of external partners in the firm network and internal functions related to a technology adoption decision, which again will affect the interpretation of the TOE contexts for the usefulness and ease of use once adopted. Thus, technology adoption is likely to be more effectively understood if these managerial microfoundational drivers are considered.

### 3 Research design

The aim of this study is to find an explanation for the non-adoption of blockchain technology into the GVCs of MNEs. Due to the nature of the research question and a focus on contemporary events, the most appropriate design for this research is a multiple-case study (Baxter & Jack, 2008; Yin, 2018). The study follows a deductive approach, drawing on established theorization of technology adoption decision-making. To achieve an in-depth understanding of the complex focal phenomenon, qualitative empirical data is collected through semi-structured interviews (Yin, 2018) and thematical coding (Saldaña, 2015).

#### 3.1 Multiple-case study design

Deductive qualitative multiple case study designs rely on theoretical sampling of cases (Yin, 2018) to fit categories. As such, the current study had the potential to include up to five cases, reflecting the five GVC archetypes of Gereffi et al. (2005). The challenge for the data collection was that it was impossible to define the MNEs GVC archetype before the interview was conducted. While the aim at the start of data collection was to ideally gain interviews with managers experienced with each of the five conceptually identified GVC types as per Table 1, this was not possible in practice. As shown in Table 3, the fieldwork for this study allowed three of the potential five conceptually identified GVCs (market, modular, and relational GVCs) to be studied and for a fourth hybrid GVC type to be inductively identified and included. It was not possible to interview managers that could provide insights for captive and hierarchical GVC types. The allocation of a given interviewee (unit of data collection) to a given GVC type (our cases) was made possible by coding the GVC attributes as conceptualized in Table 1 and described in our codebook (see Table 4). The same attributes were consistently coded to allocate interviewees to a specific case.

Three embedded units of analysis (EUAs) are derived from the conceptual foundation (Yin, 2018), reflect the key concepts of blockchain's potential to impact on GVCs, the main attributes of GVCs as well as the drivers of transaction costs explored in this study. This multiple-case study has a theoretical replication logic (Yin, 2018) as it is expected that the way in which blockchain will affect transaction costs will vary across cases in terms of the relevant mechanisms driving technology adoption decisions and as a result managerial perceptions of the PU and PEOU of blockchain technology (see Table 2).

#### 3.2 Data collection and analysis

Data was collected from supply chain managers, the units of data collection (UDCs) for each case (Yin, 2018), representing a mix of small, medium, and large-sized manufacturing MNEs (Table 3), following the European Commission's (2020) definition of small (<50 employees), medium-sized (51–250), and large (>251)

**Table 3** Overview of the Units of Data Collection for the Study

Case #	Organization	Description	MNE size	Role of respondent	Date	Duration of interview (h)	Medium	Permission to record	Permission to transcribe
Market GVC	MNE B	American Industrial Manufacturer	Large	VP of supply chain	16.02.2021	1	Zoom	Yes	Yes
	MNE C	American Industrial Manufacturer	Large	Global supply chain director	17.02.2021	1	Zoom	Yes	Yes
Modular GVC	MNE D	Swiss Industrial Manufacturer	Medium	Head of procurement	17.03.2021	1	Zoom	Yes	Yes
Relational GVC	MNE E	Israeli Consumer Goods Manufacturer	Large	Supply chain planning supervisor	05.02.2021	1	Zoom	Yes	Yes
	MNE F	Spanish Cosmetics Manufacturer	Medium	Supply chain manager	01.03.2021	1	Zoom	Yes	Yes
	MNE G	Danish Mechanical Engineering Manufacturer	Large	Global supply chain manager	17.02.2021	1	MS Teams	Yes	Yes
	MNE H	American Consumer Goods Manufacturer	Large	Supply chain manager	16.02.2021	1	Zoom	Yes	Yes
	MNE I	French Apparel and Textile Manufacturer	Medium	Sourcing specialist	12.03.2021	1	Zoom	Yes	Yes
Hybrid GVC	MNE J	Swiss Consumer Goods Manufacturer	Small	Head of procurement and global supply chain	03.02.2021	1	Google Meet	No	No
	MNE K	Swiss Industrial Automation Manufacturer	Large	Supply chain manager	15.02.2021	1	Zoom	Yes	Yes
	MNE L	Swiss Machine Manufacturer	Small	Head of global supply chain development	04.03.2021	1	Zoom	Yes	Yes
	MNE M	Swiss Machine Manufacturer	Large	Director global supply chain	22.03.2021	1	Zoom	Yes	Yes

**Table 4** Initial deductive codebook

Code group	Code	Abb.	Definition	References	
GVC attributes from MNE perspective	Buyer–supplier relationship	SS	Suppliers take advantage of MNE for favourable transactional terms	Cox (2001)	
	Superior MNE	SMNE	MNE takes advantage of suppliers for favourable transactional terms		
Performance objectives	High Dependability	HD	High reliability in terms of supplier keeping promises regarding products and services delivery	Kshetri (2018)	
	Low Dependability	LD	Low reliability in terms of supplier keeping promises regarding products and services delivery		
	High Speed	HS	High speed of products and services delivery		
	Low Speed	LS	Low speed of products and services delivery		
	High Cost	HC	High cost of products and services delivery		
	Low Cost	LC	Low cost of products and services delivery		
	Importance of FSA transferability	Low FSA Importance	LFSAI	The degree to which it is important for the MNE to be able to transfer FSAs from home to host market	Rugman (1980)
		High FSA Importance	HFSAI		
	Importance of CSA access	Market-based CSA	MCSA	It is important for the MNE to have access to market-based CSAs in the host country	Rugman (1980)
		Resource-based CSA	RCSA	It is important for the MNE to have access to resource-based CSAs in the host country	
Institutional CSA		ICSA	It is important for the MNE to have access to institutional CSAs in the host country		

Table 4 (continued)

Code group		Code	Abb.	Definition	References
Enabling technology	Advanced GPT	AGPT		Advanced GPTs are necessary for the execution of complex transactions	Qiu and Cantwell (2015, 2018)
	Basic ICT	BICT		Basic ICTs are sufficient for the execution of transactions	
	Advances ICT	AICT		Advanced ICTs are necessary for the execution of complex transactions	
Transaction cost drivers	Expected transaction costs	O		MNE is expected to face opportunistic behaviour when transacting with suppliers	Williamson (1981)
		Bounded rationality	Brat	MNE is expected to face bounded rationality when transacting with suppliers	Simon (1957)
Blockchain attributes	Bounded reliability	BRel		MNE is expected to face bounded reliability when transacting with suppliers	Simon (1957)
	Traceability of data and assets	TDA		Data and assets transacted can be easily traced	Schmidt and Wagner (2019)
	Transparency of transactions	TTr		Full historical record of transactions is visible	Sultan et al. (2018)
	Immutability of transactions	ITr		Transactions within the Blockchain network cannot be modified	Conte de Leon et al. (2017)
	Consensus and trust	CT		Blockchain uses consensus algorithms as trust-forming tools	Sultan et al. (2018)

enterprises. As access to potential interview partners during the Covid-19 crisis was challenging, no criteria related to the specific nature of the manufacturing activities of the firms at which interviewees were employed were set. As the case selection was theoretically determined and allocation of interviewees was completed based on the GVC type, the specific industry membership was not the determining factor for the analysis in this study.

While ideally data saturation would have determined the end of the fieldwork phase of the study (Guest et al., 2006), this was instead determined by balancing the costs and effort of gaining further participants. Nevertheless, the 12 interviews conducted represent a sound foundation for the study. In their study of data saturation or ‘data adequacy’ for such purposive or non-probabilistic samples, Guest et al. (2006) found that data saturation was achieved within the first twelve interviews and basic elements of the meta themes were present as early as the sixth interview. Additionally, our study benefits from the strengths of the cross-case design and associated theoretical replication logic (Yin, 2018).

Qualitative data was collected via semi-structured interviews with the individuals directly responsible for the management and coordination of the MNEs’ (or their subsidiaries in host markets) supply chain activities. As mentioned earlier, since the MNEs could only be allocated within the cases during the process of data analysis, it has been established that only three of the pre-determined cases are represented in the data, and an additional fifth case has emerged from the evidence collected. This also resulted in an uneven distribution of interviewees across the GVC cases. To ensure the quality and coherence of the interviews, interview protocols were developed using an interview protocol refinement model suggested by Castillo-Montoya (2016) (see Table 5 in “Appendix”). The framework describes four phases that aid the researchers in creating interview protocols consistent with the aims of the study.

To assess the feasibility of the selected data collection strategy, the researchers executed a pilot study (Kim, 2011; Yin, 2018). The pilot test took place in the form of a semi-structured interview with a respondent from the above-outlined target group. As the pilot study represents phase 4 of the protocol refinement model suggested by Castillo-Montoya (2016), the final interview questions were altered based on the analysis of the trial interview (see “Appendix” for the final interview protocol).

The analytical logic of explanation building (Yin, 2018) was adopted and the technique of multi-cycle thematic coding (Saldaña, 2015) was applied to develop rich analytical patterns. Atlas.ti (2021) was used to apply an initial deductive codebook to generate the first round of analytical patterns for the within-case analyses (the codebook is available as a supplementary materials file). The approach was integrated into the multiple case study analytical logic of first completing standalone within-case analyses, followed by systematically comparing these findings across cases (Yin, 2018).

### 3.3 Quality criteria

The technique of inviting the interview subjects to review the drafts of the case analyses (Yin, 2018) was adopted to improve construct validity, already enhanced by the use of multiple sources of data per case (Yin, 2018). To ensure strong internal validity, the explanation-building analytical technique was adopted, an advanced form of pattern matching (Yin, 2018), which aims to build a general explanation relevant to each of the five cases by examining the relationships between the type of global GVCs each of the interviewed MNEs features and the integration of blockchain technology in the execution of value-adding activities along the MNEs' GVCs. To strengthen the external validity of the study, the researchers sought to actively generalize theory in the discussion of the findings of the study, which is strongly supported by the extensive theoretical foundation of the study (Yin, 2018). The reliability of the study was ensured by consistently documenting the study and recording unambiguous specifics about the fieldwork procedures, thus providing a case study database. In addition, the integration of the interview protocol in the process is another recommended tactic applied to prevent documentation issues and to avoid compromised reliability of the case study.

### 3.4 Ethical considerations

There are multiple steps a researcher could take to guarantee the privacy and confidentiality of the respondents, reflecting the researcher's duty to protect the personal information that research participants have shared with them (Kyngäs et al., 2020). In this project, the investigator ensured the confidentiality of the interviewees by providing them with a consent form that allowed them to state their desired level of discretion.

## 4 Determinants of blockchain non-adoption

As a result of challenges experienced during fieldwork, data could be collected for three of the five types of GVC and a hybrid GVC type and also only from managers in MNEs that had not yet adopted blockchain technology. Thus, Fig. 2 provides the empirically supported explanation for the non-adoption of blockchain technology by GVC type. Critically, the explanation for the non-adoption of blockchain technology has four categories of influences, namely (1) managerial micro-foundations, (2) attributes of blockchain technology, (3) attributes of the organizations (MNEs), and (4) attributed of the supply chains of the firms.

The findings suggest that the low technological maturity of blockchain, a lack of exemplary use cases, the low degree of supply chain management complexity and low managerial understanding of blockchain technology, all explaining the non-adoption of the technology from a micro-foundational perspective.

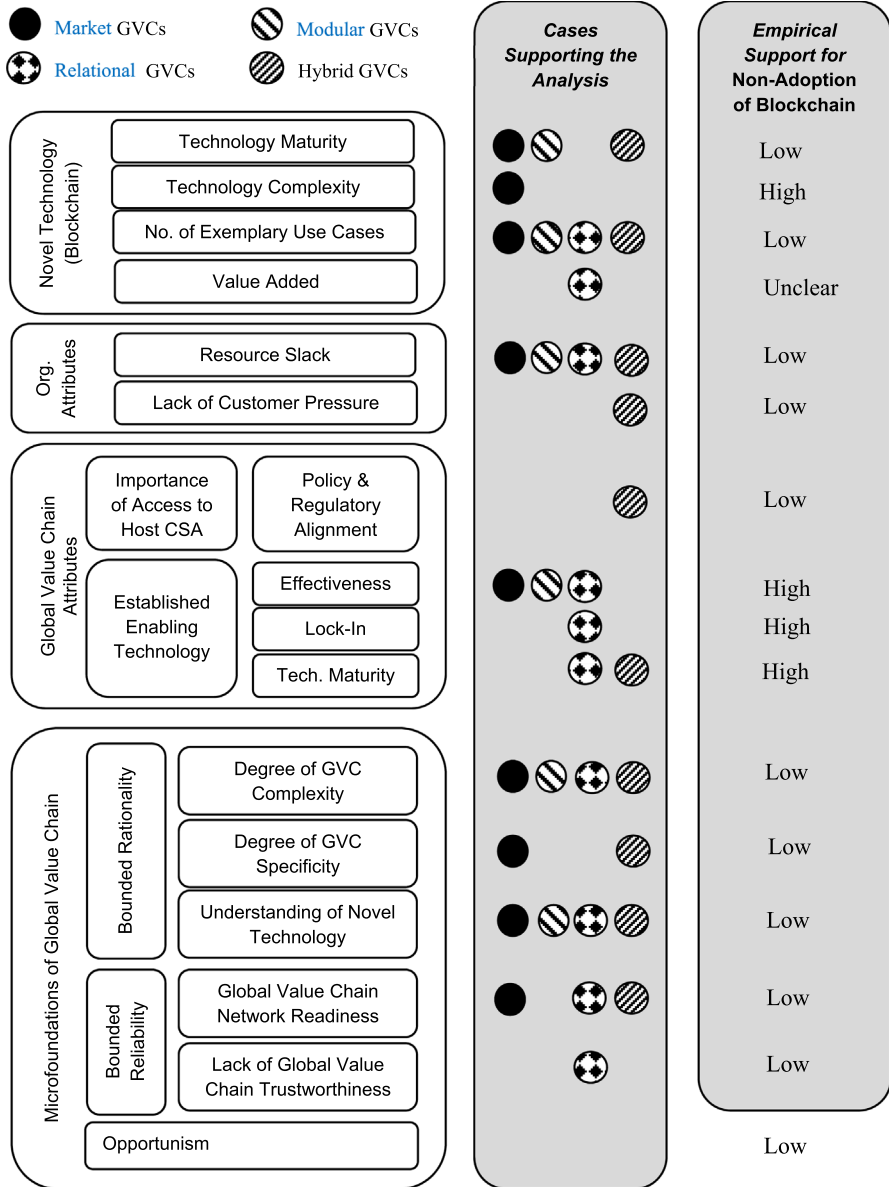


Fig. 2 Determinants of blockchain non-adoption

The low technological maturity of blockchain creates bounded rationality for managers considering its adoption, as there is a limited understanding of the risk in adopting blockchain technology. At the same time, low managerial understanding of blockchain technology can independently vary in the degree and the potential for a manager to understand its potential for supply chain management. When managers

are boundedly rational in their understanding of a technology, greater numbers of exemplary use cases allow this lack of understanding to be reduced. Consequently, the degree of supply chain management complexity is more challenging as a driver of the non-adoption of blockchain technology. As on the one hand lower complexity makes understanding how blockchain might be adopted easier, while on the other hand the main opportunities for blockchain are to be found in the management of complex transactions.

The high level of technology maturity of current supply chains and low degree of supply chain management specificity were found to be relevant in two cases. The maturity of established technologies used to manage GVCs limits the potential for transaction costs related to their effective implementation. The low degree of supply chain specificity is related to limited bounded rationality in GVC coordination, as the relationship between participants are well understood and therefore not complex to manage. Both these factors limit the potential for blockchain technology to reduce bounded rationality or reliability in the supply chain of an MNE.

There are a number of important non-microfoundational factors found across the majority of the cases, argued to be better explained as “technical” or “risk management” factors. In all cases, the lack of slack resources for undertaking the innovation that would be needed to implement blockchain technology was regarded as important. The financial constraints of firms to make investments in an unproven technology like blockchain is a challenge, as there are insufficient slack resources for undertaking risky innovations in many firms. Relatedly, the effectiveness of the current technological basis for supply chains is seen as a barrier to change, as they are proven and MNEs may be reliant on proprietary technology solutions. Finally, the low level of supply chain network readiness for blockchain adoption is a further condition that might explain non-adoption, as it would require systematic adoptions along the supply chain for blockchain technology to be effective.

Several factors were identified only in one case. Interviewees at MNEs with supply chains aligned with a market GVC identified the high level of technological complexity associated with blockchain technology as a barrier to adoption. Data for interviewees at firms with supply chains integrated into relational GVCs argued that the value-add of blockchain technology was unclear and that they experienced a “lock-in” with current technologies in their supply chains. At the same time, the potential for bounded reliability in the supply chain was perceived as low, as non-trusted partners were not ongoingly cooperated with. Interviewees at firms that operate in hybrid GVCs identified a lack of customer pressure for change, and a lack of policy and regulatory alignment related to blockchain technology as further drivers for non-adoption of the technology.

It is notable that these findings are well aligned with previous research on digital technology adoption (Gangwar, 2014) and also specifically barriers to digital technology adoption (Senna et al., 2022). To allow the findings for this study to be most effectively compared to previous research, only the strongest findings (for three or more cases) are integrated into a model of blockchain non-adoption (Fig. 3) and discussed in the next section.

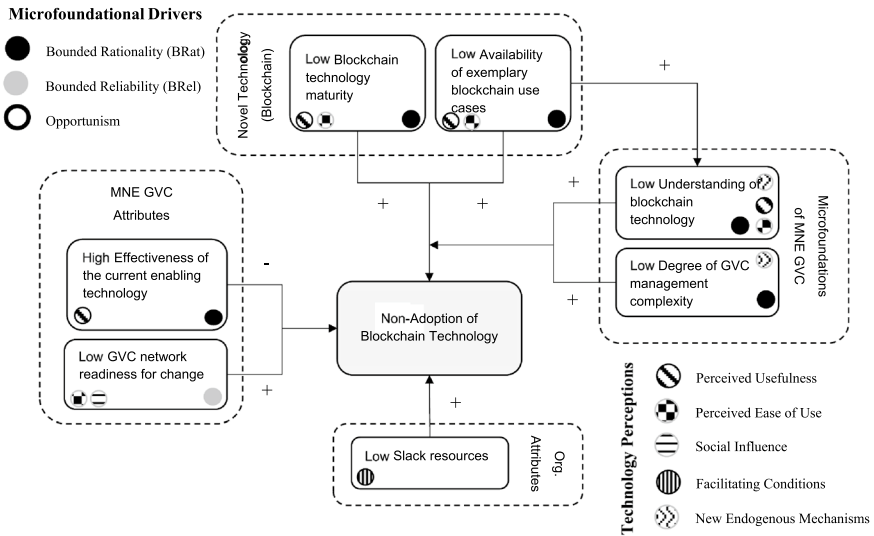


Fig. 3 Model of blockchain adoption in MNE global value chains

### 5 Discussion of findings

The results show significant micro-foundational influences in the technology adoption assessment, see Fig. 3, driven by BRat and BRel, but there is no relevance of opportunism, supporting the arguments for moving beyond traditional approaches to the drivers of transaction costs in international business theory (Kano & Verbeke, 2015, 2019). Critically, the findings for the study are also strongly aligned with an integrated TOE–TAM model of technology adoption (Tornatzky & Fleischner, 1990; Davis, 1989), thus providing clear support for integrating micro-foundational influences into the integrated TOE–TAM model more explicitly for organization level analyses. This also reflects a need to understand technology non-adoption decisions within a given socio-technical system (Senna et al., 2022).

The findings clearly confirm the argument that many MNEs currently lack the technological capacity and knowledge necessary to effectively adopt blockchain (Kamble et al., 2019), especially as the technology is poorly understood (BRat in the Technology context), and that blockchains’ lack of standardization is a recognized barrier to the technology’s adoption (Senna et al., 2022). This reflects the findings of Gangwar et al. (2014) that a technology adoption decision is affected by employees’ knowledge, for both PEOU (in studies of RFID using TAM and ERP, e-business, e-commerce using TOE) and organizational readiness (in studies of ERP, e-business, and knowledge management using TOE). These findings also echo a recent study by Senna et al. (2022) on Industry 4.0.

The findings support the argument that there is distrust towards the technology, due to its high cost, novelty, and limited practical application evidence, reflecting Kamble et al. (2019; BRat in the Technology context of TOE) and Senna et al.

(2022). A study of RFID adoption using TAM also shows trust as a significant factor affecting PEOU and PU, while in a study adopting the TOE, trust was identified as significant in adoption of EDI (Gangwar et al., 2014). However, the findings do not reflect the arguments in Chen et al. (2022) that there is a general push to reconfigure GVCs to address e.g., overpayment of vendors or visibility gaps that reduce traceability and improve information. The interviewees for this study see no need for that type of change, and multiple impediments to blockchain adoption.

The findings for this study make a case for a default assumption of non-adoption due to managers' low bounded rationality (BRAt) in relation to currently adopted technologies, which starkly contrasts with their limited understanding of blockchain technology, and due to the perceived effectiveness of current technologies at enabling the management of participation in GVCs.

These findings speak to the subjective perception of technology usefulness and ease of use from the TAM (Davis, 1989), but interestingly suggest the assessment of usefulness and ease of use may not be made in isolation, but rather both independently and compared to currently adopted technologies. This finding speaks to the relative advantage, observability, and trialability of a technology from the technology context of the TOE (Gangwar et al., 2014; Senna et al. 2022). Low supply chain readiness reflects considerations of the effort that will be required and the influence of social drivers within the GVC when a new technology requires successful adoption across multiple actors. Senna et al. (2022) similarly show high investments, the need for adaptive retrofitting, and a lack of seamless integration and interoperability to be an important barrier to technology adoption in their literature review and results.

The bounded reliability (BRel) found in this study is argued to reflect the perception of interviewees that adopting blockchain technologies along the GVC is likely to be complex and not easy to achieve. These findings clearly align with the perception of ease of use in the TAM (Davis, 1989), supported in a study of RFID adoption, showing trust in service providers and partners were significant influences on technology adoption (Gangwar et al., 2014). Bounded reliability of GVC participants is also likely to be driven by subjective norms and reference group influence, reflecting constructs associated with the organizational and external (network) environments of the MNE. Studies adopting the TOE framework (Tornatzky & Fleischner, 1990) showed top management support (organization context) to be a consistently significant influence (for studies of EDI, ERP, e-business, knowledge management, and e-commerce) (Gangwar et al., 2014), while a study of ERP adoption using TAM provided evidence that the work environment was significant for the PEOU of the technology (Gangwar et al., 2014).

The lack of organizational slack resources promotes the non-adoption of blockchain, reflecting a more resource-based explanation (Zhu et al., 2022), under resource constraints and uncertainty about outcomes (TAM: perceived usefulness and ease of use (Davis, 1989; Davis & Venkatesh, 1996), there is less possibility for undertaking new activities and less room for accommodating higher risk projects. Resource/organizational slack was found to be significant in explaining the adoption of EDI and e-commerce using TOE (organizational context) (Gangwar et al., 2014).

While high levels of investment was an important technology adoption barrier in Senna et al. (2022).

The characteristics of blockchain technology and the micro-foundations of the supply chain are connected and the four subdimensions are all associated with bounded rationality as a central driver. The bounded rationality of decision makers, due to the perceived low maturity and low availability of use cases for blockchain technology, affects performance and effort expectations, which clearly align with the subjective perceptions of technology attractiveness and ease of use in the TAM model (Davis, 1989). The low availability of exemplary use cases also affects the understanding of blockchain technology from a supply chain management perspective, clearly reflecting the observability and trialability dimensions of the technology context of the TOE (Tornatzky & Fleischner, 1990), see Table 3, leading to low performance and high effort expectations, as would be expected based on an integrated TOE–TAM model, see Fig. 1. This clearly speaks to a bounded rationality on the part of interviewees related to the technology context of the decision-making and as a result in terms of their perceptions of usefulness and ease of use (TAM; Davis, 1989). Overall, the findings for this study are well aligned with an integrated TOE–TAM model of technology and support the thesis of this paper that to fully understand the adoption decision, it is needed to integrate the microfoundational influences of BRat and BRel.

## 6 Conclusion

The findings of the study suggest that wide-scale adoption of blockchain technology in MNE GVCs is unlikely to happen in the near future, despite the arguments for doing so, thereby addressing the lack of empirical studies of blockchain adoption (Chen et al., 2022). The research question can be answered as follows: Blockchain technology is not widely adopted in MNE GVCs because the external environment (the GVC) is featured by concerns about boundedly reliable partners in the external network of the GVC, while the perceived usefulness and ease of use of blockchain technology is affected by bounded rationality of decision-makers related to the technology (comparison to effectiveness of current technology, blockchain maturity and availability of use cases) and organizational context (degree of management complexity and understanding of blockchain), see Fig. 3. Organizational slack resources are also important for explaining the non-adoption of blockchain technology, but are not impacted by microfoundational influences.

### 6.1 Contributions to conceptualizing blockchain technology adoption in MNE GVCs

The findings support the need to not only consider the technology, but also the organizational and environmental (GVC) contexts of technology adoption decisions (Davis, 1989; Tornatzky & Fleischner, 1990). The differences in non-adoption across the four types of GVC speak to the importance of the

immediate external environment (Tornatzky & Fleischner, 1990) of the MNE, their GVC, and the organizational environment (Tornatzky & Fleischner, 1990) for the blockchain technology adoption decision. In market GVCs, blockchain is not integrated since there is no external pressure to do so (yet), reflecting the importance of the external context (Tornatzky & Fleischner, 1990). Only when forced by its external partners would the MNE consider adopting the technology, suggesting that at this time the GVCs are featured by an acceptable degree of bounded reliability in buyer–supplier relationships. In modular GVCs, there is no interest in the adoption of blockchain (yet) as the current technologies are perceived as sufficient, this speaks to the lack of standardization of blockchain as a barrier (Senna et al., 2022). In relational GVCs, the identified drivers of blockchain’s non-adoption include internal bounded rationality, bounded reliability in the form of the technology’s non-integration along the MNEs upstream network, insufficient trust in blockchain’s capabilities as well as economic considerations such as limited resource slack for investing into blockchain’s adoption. As would be expected, the closer the degree to which the GVC comes to being internalized, the more important the organizational context (Tornatzky & Fleischner, 1990) of the technology adoption decision becomes. A common feature of the Hybrid GVCs is the combination of fully internalized GVC activities with externalized ones. Hybrid GVCs are either satisfied with their existing technological solutions, or if in the position to adopt blockchain technologies, perceive the technology as too young and unproven given the financial commitments involved.

Managerial decision-making is affected by both bounded rationality regarding blockchain technology and external and internal bounded reliability related to making the case for adoption. We argue that our findings suggest a more explicit assessment of the micro-foundations of the technology decision in to the integrated TOE–TAM model (Davis, 1989; Tornatzky & Fleischner, 1990) would allow a more critical assessment of technologies.

## 6.2 Implications for practice

While blockchain is considered highly secure and reliable, more proof of blockchain’s capabilities is required for MNEs to be willing to invest. Especially in relational GVCs, captive GVCs, and hierarchical GVCs, blockchain could improve relationships and collaboration, mitigate the risk of opportunistic behavior through the use of smart contracts, and improve security overall. Thus blockchain experts should do more to develop exemplary use cases to communicate the potential of blockchain technology to potential adopters.

## Appendix

See Table 5.

**Table 5** Interview protocol

## Interview protocol

**Pre-interview preparation**

Studying information about the company and interviewee

Ensure functioning recording device/program

Prepare pen and paper

Provide interviewee with consent form

**Introduction of researcher**

My name is \_\_\_\_\_, and I am a student in the MSc in International Management program at the University of \_\_\_\_\_. I am currently working on my Master Thesis, the topic for which was inspired by my interest in the impact of technological innovations on essential processes of international business collaborations

**Introduction of study**

The Master Thesis implies a qualitative multiple-case study following a deductive approach and designed with the aim to answer the following research question:

*How can the integration of Blockchain technology into multinational firms' supply chains be explained?*

In addition, the MT strives to provide answer to the following sub-questions:

*How does Blockchain technology change multinational companies' internalization decisions in terms of their supply chains?*

*How are multinational enterprises prevented from integrating Blockchain technology into their supply chains?*

**Objective of the study**

The purpose of the study is to discover to what extent medium-sized MNEs have adapted Blockchain Technology into their Global Supply Chains and how does the implementation of this disruptive GPT impact the transaction costs those MNEs face in their collaboration with suppliers in host markets

**Relevance of the study**

Due to the limited evidence of integration of Blockchain Technology in GSCs and its consequences to the present moment, the study could have relevance to managerial practice and decision-making in respect to choice of GSC governance mechanisms, control, and coordination

**Respondent selection criteria**

The interview participants selected are Supply Chain Managers representing small, middle-sized, and large multinational enterprises, which carry out transactions with suppliers in the host markets they have expanded operation in

**Confidentiality**

The confidentiality of each interviewee is ensured and confirmed via a Consent Form, whereby each participant has the opportunity to indicate whether they give consent for the recording of the interview and the degree of anonymity they prefer

## Interview questions

**Question 1:** Could you tell me something about yourself and your work as --- at MNE X?

*Professional experience in general*

*Experience with the current firm*

*General experience with SCM*

**Question 2:** Tell me about how the international activities the firm's Supply Chain are organized?

*Degree of internalization/externalization of procurement activities*

**Table 5** (continued)

## Interview questions

*What is the % breakdown of Tier 1, 2, and 3 suppliers?*

**Question 3:** To what extent are your host market suppliers strategic and to what are they are transactional?

*Or have you segmented them into strategic and transactional based on their Tier and the nature of the components they supply for you?*

*To what degree does X hold bargaining power in the collaboration respectively with its strategic and transactional suppliers in foreign markets?*

**Question 4:** To what degree are you able to reallocate the assets in your supply chain to alternative uses?

**Question 5:** What resources has X transferred to its suppliers to be able to operate the Supply Chain?

*E.g. IP, knowledge/information*

*Electronic communications—e.g. electronic data interface (EDI)*

**Question 6:** In terms of the information you exchange or transfer to your suppliers, what is the complexity and sensitivity of information you exchange respectively with your strategic and transactional suppliers?

**Question 7:** What are the potential risks and issues you are most concerned about avoiding and which you need to manage in you Supply Chain?

*What are the potential outcomes in the management of relationships with suppliers that you actively seek to avoid? Based on your personal experience*

*How do you manage those risks and issues?*

**Question 8:** How crucial is it for your company to benefit from specific endowments and institutional policies when transacting with suppliers in your host markets?

**Question 9:** Are you and your company familiar with Blockchain Technology and its potential implications for international business operations?

*Are the technologies currently in use advanced or basic?*

*Have you integrated it?*

*Why do you think companies are interested in integrating/or have decided to integrate Blockchain?*

**Question 10:** What motivated your decision to (*not*) integrate Blockchain in your Global Supply Chain (*respectively if the answer to Q9 is positive or negative*)?

**Question 11:** How has the integration of Blockchain in your GSC altered the way you transact with your suppliers in foreign markets? (*If blockchain has been integrated*)?

What do you believe could be the impact Blockchain Integration into the Supply Chain in regards to transactions with your suppliers in foreign markets? (*if blockchain has not been integrated*)

*Would they be interested to adopt?/Under what conditions?*

**Question 12:** To what degree do you recognize the level of integration/externalization of your GSC activities to be a result of the integration of Blockchain? (*If blockchain has been integrated*)

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**Data availability** The interview data collected for this study is held by the authoring team in accordance with data privacy regulations of the European Union and Switzerland. The data is subject to confidentiality agreements signed with interviewees during the data collection process and as a result no original data has been made available or shared.

## Declarations

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest.

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