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ORIGINAL EMPIRICAL RESEARCH

Trust in blockchain-enabled exchanges: Future directions in blockchain marketing

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Abstract

Prior research typically positions blockchain technology as enabling a trustless exchange environment without specifically investigating how blockchain technology provides trust and what makes the data in a blockchain "tamperproof" and "immutable." This article serves to address these research gaps by conducting semi-structured interviews with 18 informants who have had at least three years of project experience with blockchain-enabled exchanges. Our findings uncover three unique aspects of blockchain that enable trust in exchange vs. a traditional exchange: (1) trust in exchange actors: mathematics and cryptography vs. human guardians within institutions, (2) trust in exchange actions: information transparency enabling tamperproof and immutable data vs. information asymmetry, and (3) trust in exchange assets: digital vs. manual escrows for verifying ownership of valuable goods. This research is vital for marketing scholars and practitioners who seek to understand the rise of threats to trust regarding online advertising, customer trust, privacy, and digital rights.

Keywords Trust · Business relationships · NFTs · Metaverse · Online advertising · Privacy · Exchange

Introduction

Typically, a blockchain ecosystem consists of the collaborations of multinational corporations that aim at improving the efficiency and transparency of asset transfers (CB Insights, 2019). Apart from enhancing business efficiency and competitiveness, most blockchain use cases (e.g., Maersk's TradeLens for supply chain resilience, IBM's TrustChain for consumer well-being, and Walmart's Food Trust for food transparency) are developed in order to achieve common goals in the ecosystem (Bajpai, 2019). Unfortunately, due to the conflict of economic benefits and data-sharing governance, the above-mentioned use cases face challenges in onboarding more stakeholders in the ecosystem (Li et al., 2021a, b; Wight, 2018). One important note is that most blockchain-for-business use cases focus on how blockchain is integrated in the existing business operation, such as focusing on their current enterprise resource planning and inventory management systems for enhancing efficiency and removing the friction shared by ecosystem partners (Lacity & Van Hoek, 2021). In this regard, blockchain technology does not fundamentally change the nature of business since it functions as another type of technological innovation for digitalization (e.g., as a real-time data sharing infrastructure). In this paper, we underline that, for this reason, each business partner in the ecosystem tends to remain in a similar role as before and they do not change their trust in their exchange parties. For example, the suppliers of Walmart's Food Trust, a blockchain-based food traceability system, still maintain the indistinguishable set of exchange networks that they had prior to their blockchain adoption.

On the other hand, blockchain technology offers a new model of economic coordination and governance between exchange parties when it functions as an institutional technology (Tan & Salo, 2021). This means that blockchain technology enables novel forms of exchange networks that dismantle the trust component in the digital ecosystem while executing monetary transactions. For instance, in the use case of decentralized finance (DeFi; e.g., https://compound.finance/), the exchange parties—such as individuals who

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wish to borrow or lend money—in general, do not know each other's identity, and thus they have to allocate their trust in the blockchain technology since it is the only object and subject with which they are, de facto, interacting. In this sense, blockchain technology creates a new phenomenon of digital exchange as it is an authentication and verification technology that allows exchange parties to engage in digital ecosystems without the need for a trusted third party or a central institution (such as a bank in a traditional exchange) to facilitate and guarantee digital relationships, and it enables the exchange of value and transfer of ownership in an otherwise trustless environment (see Kiviat, 2015). Compared with traditional banks that act as intermediaries and agents of economic trust between exchange parties (e.g., Shapiro, 1987; Williamson, 1993), we suggest that the blockchain system similarly represents impersonal trust (i.e., trust not derived from social ties; Shapiro, 1987) in the exchange relationship. Further, blockchain technology itself represents a guardian of institutionalized impersonal trust as blockchain technology hardly needs any *social-control strategies*, such as internal social control, private surveillants, or even industry self-regulation (see Shapiro, 1987) for guarding trust in these relationships.

Shapiro (1987), however, in her seminal article on impersonal trust, asks who guards the guardians of trust. Even if she answers that trust itself does that (1987, p. 649), this intriguing question motivates the aim of this study to learn more of the trust-enabling characteristics of the revolutionary blockchain technology. To the best of our knowledge, research on blockchain-enabled exchanges and trust is relatively novel among marketing scholars. To fill this gap, we identify both the elements of blockchain that make it unique relative to traditional exchanges and how blockchain varies in its ability to facilitate trusted exchanges. We pose the following research questions: (1) What conditions provide this trust, and how? (2) What makes the data in a blockchain "tamperproof" and "immutable"?

Thus, this study is important for marketing scholars and practitioners alike who seek to understand the rise of threats to trust involved in exchanges in relation to the issues of online advertising, customer trust, privacy and digital rights, and especially to understand how blockchain technology is able to guarantee trust in the related exchange relationships. Indeed, consumers have been increasing feelings of vulnerability and their negative perceptions in regard to marketers' data use, the threat of fraudulent activities (e.g., technologically aided "synthetic advertising") or food fraud (e.g., Campbell et al., 2003; Kshetri, 2014). On the other hand, marketers' desire to connect with their customers more strongly than before, all promote the privacy policies of the companies, even as a potential differentiation tool (Martin & Murphy, 2017) and build a culture that prioritizes corporate digital responsibility (Lobschat et al., 2021; Rangaswamy et al., 2020). As such, this study provides direction for blockchain marketing for practitioners who seek to comprehend how to develop trust among their customers in a decentralized ecosystem and the blockchain-based metaverse. To aid readers, we provide a comprehensive definitional foundation of blockchain-enabled exchange terminology (see Table 1).

In the current research, we conducted a qualitative study with semi-structured interviews with 18 informants who had at least three years of project experience with blockchain technology. Our research first adds to the established literature on technology-focused research in buyer–seller relationships (Ahearne et al., 2021), second, to the literature of trust in business relationships (Fang et al., 2008; Huang & Wilkinson, 2013; Kroeger, 2012), and third, to the social exchange theory (Lioukas & Reuer, 2015). We hope that our research encourages marketing academics to develop the fundamentals of these established literatures in light of novel technologies and related transformations, and we hope that practitioners learn and adjust their decisions in regard to technology adoption and their use in blockchain marketing practice. This paper is organized as follows. First, we review the seminal and more recent literature of trust, especially trust in business relationships and from perspectives relevant for a blockchain-enabled exchange. Second, we explore the literature of blockchain and contemplate it in the light of "traditional exchange" literature, referring to buyer–seller exchange relationships and their networks. This is summarized as a comparison of current marketing exchanges and blockchain-enabled exchanges in regard to trust characteristics. The paper continues with a description of qualitative methods and a presentation of the findings based on an analysis of the interviews with our informants. Finally, the contributions are discussed, and the conclusions are drawn.

The background literature

Trust in business relationships

Trust literature in the interorganizational context can be roughly divided into two traditions (Gulati & Nickerson, 2008): the calculative tradition, represented by transaction cost economics (Williamson, 1985), and the relational tradition (Beckert, 2006; Möllering, 2001) that has its origins in social-psychology and sociology. At the heart of the calculative approach are actors' needs to reduce risks in the exchange relationships, whereas the relational approach is more adherent to the idea that sometimes risks must be accepted for the sake of wider relational and common goals (Latusek & Vlaar, 2018). The business-to-business (B2B) marketing literature has drawn from both of these streams as trust is widely acknowledged as a key relationship factor,

Table 1 Definitions of blockchain-enabled exchange terminology

Terminology	Definition	Source
Blockchain	Blockchain refers "to a fully distributed system for cryptographically capturing and storing a consistent, immutable, linear event log of transactions between networked actors" (p. 386)	Risius and Spohrer (2017)
Consensus mechanism	"A method of authenticating and validating a value or transaction on a blockchain or a distributed ledger without the need to trust or rely on a central authority" (p. 1)	Seibold and Samman (2016)
Cryptocurrencies	Virtual assets that are not issued by governments for which transactions are verified and records maintained by a decentralized system using cryptography	Sun Yin et al. (2019)
Data permanence	The condition refers to how long collected data is to be stored and used by the firms	Krafft et al. (2021)
Decentralized finance (DeFi)	"DeFi refers to an alternative financial infrastructure built on top of the Ethereum blockchain" and it "does not rely on intermediaries and centralized institutions" (p. 153)	Schär (2021)
Decentralized network	A network distributes information-processing workloads across multiple devices or nodes instead of relying on a single centralized server	Beck et al. (2018)
Digital assets	Digital representations of the values that exist in a digital format and come with the right to use	Ølnes et al. (2017)
Distributed ledger	Digital data is stored in different devices or nodes that are consensually shared and synchronized in a peer-to-peer network	Janssen et al. (2020)
Fiat currency	A government-issued and controlled currency that is legally used for monetary exchange or legal tender	Thakor (2020)
General-purpose technology	The technology that is "expected to have broad transformative application across many sectors of the economy and contribute to multifactor productivity growth" (p. 640)	Davidson et al. (2018)
Institutional technology	The technology that provides a new way of coordinating economic activity with a different group of people and is not related to the production or exchange efficiency perspectives	Davidson et al. (2018)
On-chain	This refers to cryptocurrency transactions that occur on the blockchain and remain dependent on the state of the blockchain for their validity	Frankenfield (2021)
Private key	A secret key that consists of a variable in cryptography that is used with an algorithm to encrypt and decrypt data	Loshin (2021a)
Programmable properties	The self-executing attributes of blockchain technology (e.g., the digital contract) automatically perform the terms and conditions of digital-asset transfers in a blockchain	Wang et al. (2019)
Public key	A shareable key that consists of a numerical value that is used to encrypt data	Loshin (2021b)
Smart contracts	Self-executing digital contract that automatically execute the terms and conditions of an agreement in a blockchain	Wang et al. (2019)
Tamperproof	A condition that cannot be interfered with, changed, edited, or manipulated	Dai and Vasarhelyi (2017)
Tokenization	The process of digitizing tangible and intangible assets and converting them into tokens on the blockchain	Tan et al. (2021)

implying confidence in an exchange party and willingness to rely on the partner (Moorman et al., 1993).

Trust can exist on multiple levels. From the related research, we know that an individual can trust in organizations (Morgan & Hunt, 1994) and other persons (Moorman et al., 1993). In interorganizational collaboration, trust can exist between individuals, between organizations, between teams, and also exist between other entities, even informal entities, that operate between companies (Fang et al., 2008).

In the marketing discipline, *trust* is commonly viewed as a belief or expectation about an exchange party's trustworthiness, resulting from the partner' expertise, reliability, or intentionality (Moorman et al., 1993). On the other hand, as Moorman et al. (1993) summarized, *trust* is understood as a behavior that reflects a reliance on an exchange party. Therefore, *trust* and *trustworthiness* can be distinguished based on *perceived* versus *actual* intentions, motives, and competences of the partner, leading to their co-evolution. Trust may also have an influence by *structuring* the interaction between the organizations in a network, and *mobilizing* and motivating them to share, combine, and coordinate resources for cooperation, for example (McEvily et al., 2003). The underlying assumption, stemming especially from the calculative tradition (Williamson, 1985), is that at least one of the relationship partners is vulnerable in regard to the other in an exchange relationship due to the opportunism of the other or resource-dependency between the partners. From this viewpoint, *uncertainty* is a condition present in exchange relationships, per se, and thus critical to trust even to exist (Coleman, 1990; Moorman et al., 1993).

In the field of B2B marketing, trust was first especially studied in the contexts of channel relationships where arrangements, such as having a manufacturer-distributor or manufacturer-retailer relationship, typically involve high switching costs and interdependence, creating vulnerability between exchange parties (Doney & Cannon, 1997). The seminal studies in the field (e.g., Dwyer et al., 1987; Morgan & Hunt, 1994) emphasized trust as important for both long-term business relationships and their building blocks (such as commitment between partners). This long-term, relational perspective has also defined trust as being perceived as an objective expectancy for the partner to be credible and, on the other hand, as the partner's benevolence (i.e., their genuine interest in their partner's wellbeing) (Doney & Cannon, 1997), being valuable aspects for interorganizational relationships and the network perspective to develop within B2B marketing. A relational trust perspective also emphasizes the mutuality of trust, "the perceived ability and willingness of the other party to behave in a way that consider the interests of both parties in the relationship" (Selnes & Sallis, 2003, p. 84). Studies show that ability and integrity play key roles at the beginning of a trusted relationship, whereas benevolence becomes more salient as the relationship develops (Schoorman et al., 2007).

The related literature provides a wide range of the characteristics of the exchange parties and processes that impact on trust in business relationships (Doney & Cannon, 1997). Traditionally, research has focused on certain environmental, partner-related, and behavior- or performance-related factors in explaining trust in business relationships, whereas more dynamic, process-based, and relational views have only gained attention later (Huang & Wilkinson, 2013). From the processual perspective, it is important that the development of the relationship over time enhances learning and, for example, the predictability of the behavior of the partner (Doney & Cannon, 1997; Schilke & Cook, 2013). Many characteristics of the partner impacting on the development of trust—such as reputation, expertise, similarity, or the sharing of confidential information (Doney & Cannon, 1997)—in fact presume knowledge of and learning about the partner in the longer term, enabling the development of *knowledge-based* and *identification-based trust* (McEvily et al., 2003).

Williamson (1985) divided trust into (a) personal trust, including nearly no calculativeness, (b) calculative trust, referring to commercial contexts, for example, and (c) institutional trust, referring to social and organizational contexts where, for example, contracts are used to govern and safeguard transactions. In conclusion, he stated that only personal trust, reserved for very personal relationships, is almost free from the opportunistic behavior of the counterpart. Handling risks and relationship hazards is therefore a central aspect of relationship behavior and governance. In the absence of trust, monitoring and safeguarding are used to manage uncertainty. However, these activities are generally nonproductive and create transaction costs (see also Zaheer et al., 1998).

Social exchange theory literature (Lioukas & Reuer, 2015; Luo, 2002) suggests that trust is the bedrock on which business is built. Social exchange theory explains the mechanisms and antecedents of trust production, for example. A *characteristics-based trust* mechanism is tied to cultural similarities between exchange parties, and *process-based trust* is tied to past transactions and experiences between parties (Luo, 2002; Zucker, 1986). The third mechanism suggested by Zucker (1986), *institution-based trust*, differs from the two others in that it relies on third parties as guardians of trust (see also Shapiro, 1987): individuals or firms through which trust can be guaranteed or purchased (e.g., in the form of certifications) and intermediaries, such as banks and escrow accounts. Institution-based trust is also inexpensive when compared with the other two forms of trust that need a longer time to be developed (Luo, 2002). According to Luo (2002), institution-based trust is the most likely form to solve privacy concerns in the electronic commerce context, for example. Institution-based trust, however, should be distinguished from *institutionalization-based trust*, also discussed within social exchange theory and formed when exchange parties are engaged in a relationship that desires reciprocity, through which all partners proportionally benefit from their contributions (extrinsic benefits) and desire fair rates of exchange (Khalid & Ali, 2017). Lioukas and Reuer (2015) also referred to *affect-based trust* as a central type of trust within social exchange theory and formed when exchange parties trust each other by developing an attachment-based relationship. These emotional attachments are related to intrinsic benefits rather than to any direct economic benefits; they refer to interpersonal relationships, even friendship relationships (see Kroeger, 2012), between exchange parties. These mechanisms are approached in relationship marketing research (e.g., Luo, 2002; Martin & Murphy, 2017) and are also applied to some extent in emerging exchange research in the blockchain context (e.g., L'Hermitte & Nair, 2021; Wang et al., 2021).

In organizational studies, trust in the interorganizational context has continuously achieved attention. Interorganizational trust as a distinct concept from interpersonal trust is in fact quite a recent finding in this literature (see Kroeger, 2012; Schilke & Cook, 2013). Kroeger (2012) suggested that trust exists at different levels: at the interpersonal (micro) level, the organizational (meso) level, and at the system (macro) level. Moreover, based on Berger and Luckmann's (1967) account of institutionalization, he suggested that the interplay of interpersonal and organizational trust enables the institutionalization of trust. For example, trust can be institutionalized through roles and routines for trusting in the organization that need to be enacted in the interaction of individual actors (i.e., enacted interpersonally). Thus, it is expected that without their representatives, organizations would lack the capacity for trust building as it is the individuals who can signal predictability and benevolence to external actors such as business partners (see Doney & Cannon, 1997; Kroeger, 2012). Still, business partners may also transfer this trusting behavior in order to signal the trust of the organization in question (Kroeger, 2012). This transfer of trust between different levels—in other words, this institutionalization of trust—is especially interesting for the purpose of this study as this transfer also acts in the opposite direction: interpersonal trust builds on organizational trust, and both of these build on system trust, representing a nested system of trust (see Kroeger, 2012; Shapiro, 1987). This view is based on the idea that "organizational actors are not pre-programmed robots" (Kroeger, 2012, p. 748) and that there is room for individual improvisation in trusting behavior.

Usually, clues about a business partner's trustworthiness are based on the organization's prior interactions, public information, reputation, and institutional categories, such as the industry, geographic location, and organizational age (Schilke & Cook, 2013), that is to say, they are based on "characteristic-based trust" described by Zucker (1986). Granovetter (1985, p. 491) suggested that social relations, rather than generalized morality or institutional arrangements such as contracts or authority structures "are mainly responsible" for the creation of trust in economic contexts (see also Shapiro, 1987). But what if no interpersonal or social ties exist? What if the counterparts in an exchange are unknown? This is a perspective that Shapiro (1987, pp. 625–626) takes up in her seminal article, wherein she treats trust as a social organization with the "idea of agency in which individuals or organizations act on behalf of others" and invest resources in others for some, usually uncertain, future return. For example, to facilitate exchange in impersonal markets, *agents* mediate, represent, and network or they compensate for the institutions of privacy that protect the data sources of their *principals* (Shapiro, 1987). This refers to a trusted third party acting as an intermediary whose judgment serves as a foundation for trust in an unknown party (McEvily et al., 2003).

Finally, according to Shapiro (1987), impersonal trust occurs in the situation when social control based on social ties and direct contact between the principal and agent is not possible and their performance and trustworthiness cannot be evaluated. In this situation, a question arises: who guards the agents' (e.g., banks or other institutions) trustworthiness?

In summary—and in accordance with some recent literature about trust in B2B relationships and networks, and inter-organizational studies—we suggest that a combination of transaction cost economics and social exchange theory, and structural and dynamic views of trust and its governance (e.g., De Pourq and Verleye 2021; Latusek & Vlaar, 2018; Lioukas & Reuer, 2015) provide tools with which to understand blockchain-enabled exchange and its trust components. This moves us on to discussing a blockchain-enabled exchange as an example of an organization of trust guarding in an otherwise trustless environment.

A blockchain-enabled exchange and a traditional exchange

Blockchain is said to be an institutional technology, rather than a general-purpose technology, as it offers a new model of economic coordination and governance (Tan & Salo, 2021) such as ledger entry and private keys for property rights, public keys and decentralized networks for exchange mechanisms, cryptocurrencies for fiat currencies, a code for law, and initial coin offerings for alternative finance (Davidson et al., 2018). Blockchain technology is a new form of information infrastructure that may lead to a radical change in organizations and subsequently drive them towards decentralized management (Tapscott & Tapscott, 2017). Further, blockchain technology offers a new way to enforce agreements, and achieve cooperation and coordination between business partners (Lumineau et al., 2021). In this regard, buyers and sellers may interact differently in a blockchain-enabled exchange and subsequently shift the foundational thinking on the nature of trust in the buyer–seller relationship. Based on a seminal review of contractual elements in buyer–seller relationships (Dwyer et al., 1987), trust production literature in social exchange theory (e.g., Zucker, 1986), transaction cost economics (e.g., Williamson, 1993), and blockchain literature (e.g., L'Hermitte & Nair, 2021; Wang et al., 2021), we identify seven core components of an exchange that create differences in trust in a blockchain-enabled exchange (see Table 2).

Exchange governance In the traditional governance of exchange, a significant focus has been given to the lawful enforceable promises, including the rights and obligations of the exchange parties, where each partner is expected to conform to a set of social norms and patterns of behavior for the development of trust (Lumineau et al., 2021). In contrast, a blockchain-enabled exchange is based on self-contained and autonomous systems of rule which depend on blockchain protocol and code-based rules (Beck et al., 2018). Thus, blockchain has changed accountability (from

Table 2 A comparison of a traditional exchange and a blockchain-enabled exchange

Component of exchange	Traditional exchange	Blockchain-enabled exchange	How blockchain create differences in trust
Exchange governance	There is a significant focus on lawfully enforceable promises and each partner is expected to confirm to a set of social norms and patterns of behavior for trust forming	There is a significant focus on self-contained and autonomous systems of rules, which depend on blockchain protocol and code-based rules	Trust is formed by the blockchain technology's capability to maintain consensually agreed norms that guide behavior, facilitate social interactions among exchange parties, and enhance transactional efficiency for economic benefits
Market power	Significant depend on dominant market players	The influences of the dominant market players are reduced	Trust is formed by shifting the dependency on the multiple actors that could maximize their economic benefits in the ecosystem
Overall exchange network	Centralized	Decentralized	Trust is digitally constructed toward the blockchain technology itself, especially among exchange parties who hold a strong emotional attachment to the decentralization of power and democracy
Exchange performance measurement	Significant attention is paid to measuring, specifying, and quantifying all aspects of performance, including psychic and future benefits	Significant attention is paid to the stability and scalability of digital-asset transfers	Trust is developed when programmable properties (e.g., smart contracts and digital assets) are self-executed over time without friction or risk of error
Transaction structure	Silo data that needs for reconciliation and verification	Distributed data that enhances visibility and transparency	Trust is formed as blockchain technology reduces perceived risk by increasing information transparency
Data permanence	Data is editable and removable	Data is time-stamped and immutable	Trust is built as the dataset is transparent to exchange parties on a real-time basis and they feel secure about storing data in a blockchain
Ownership of exchanged assets	Data sharing: data as a tool for relationship management	Data tokenization: data as a digital asset	Trust is formed as the blockchain technology provides economic benefits to the data owner, promoting the democratization of the sharing and monetization of digital assets

legal institutions to a technical approach), the alignment of incentives (from intermediaries to developers / users / token holders), and trustworthiness (from inter-organizational trust to trustworthy technology) in the exchange relationship (Tan & Salo, 2021). In this regard, the regulatory principles of blockchain governance are prone to a consensus mechanism for trust building. In line with social exchange theory, a consensus mechanism serves to assess the role of the rules and norms that govern the exchange process and regulate the interactions and actions of the exchange parties (Cropanzano & Mitchell, 2005; Lambe et al., 2001). Thus, trust is developed by the blockchain technology's capability to maintain consensually agreed norms that guide behavior, facilitate social interactions among exchange parties, and enhance transactional efficiency for economic benefits (L'Hermitte & Nair, 2021).

Market power In a traditional exchange, especially in the domain of digital marketing, players are forced to increase their dependency on tech giants such as Amazon, Apple, Google, Facebook, and Microsoft (Tweh & Riley, 2021). The tech giants have maintained their monopoly position through their digital business platforms (Rangaswamy et al., 2020), and this allows them to abuse their market power by charging excessive fees, imposing tough contract terms, and using the vast amounts of data they have gathered on consumers and other businesses to muscle out rivals, gain an advantage in new product markets, and reduce innovation by others (Gordon, 2020). On the other hand, blockchain technology has been proven to maintain the data permanence that guarantees trust in monetary transactions (e.g., Bitcoin transactions) and exchanges of information (e.g., an Ethereum smart contract for DeFi), and it directly lowers both the cost of verification and the cost of networking, which are traditionally covered by intermediaries in order to retain trust in economic transactions (Catalini & Gans, 2020). Thus, multiple actors have to agree on the rules and standards set in a collaborative and trusted governance model in the blockchain network, and such an arrangement eventually enhances trust by reducing the power of dominant market players in the ecosystem because each actor is treated equally, regardless of their market power. As such, each actor plays a notable role in the exchange network without relying on a dominant actor.

Overall exchange network In contrast to a traditional exchange, such as the exchange in supply chains with multiple relationships that mostly have a centralized network (Hughes et al., 2019), blockchain technology can provide a trust mechanism for exchange parties in the blockchain ecosystem due to its decentralized networks (Chang et al., 2019). *Decentralization* refers to governing an exchange network in a distributed fashion. In this sense, every single actor has the right to exert power in the exchange network as the data is copied and spread across a distributed network of computers for each agreement to be executed (Beck et al., 2018). Thus, blockchain enables an exchange environment that moves from a centralized social relationship-based trust system to a trustworthy ecosystem, where trust is digitally constructed by the blockchain technology itself, especially between exchange parties who hold a strong emotional attachment to the decentralization of power and democracy (Dierksmeier & Seele, 2020).

Exchange performance measurement In the blockchain ecosystem, the stability and scalability of programmable properties are critical for marketing exchange and refer to the self-executing attribute of blockchain technology (e.g., a smart contract) that automatically carries out the terms and conditions of digital-asset transfers (Wang et al., 2019). Researchers have indicated four properties that facilitate more efficient digital-asset transfers: self-verification, self-executing contracts, a shared distributed ledger/database, and automated client account clearing and reconciliations (Dai & Vasarhelyi, 2017; Fanning & Centers, 2016; Kiviat, 2015; Mainelli & Smith, 2016; Narayanan et al., 2016; Ølnes et al., 2017). Thus, before deploying smart contracts, the exchange parties must engage in designing a set of ideal smart contracts that eliminate all possible disputes (Davidson et al., 2018), wherein significant attention must be paid to measuring, specifying, and quantifying all aspects of smart contract performance. In this sense, as long as the exchange parties are compliant with the terms and conditions, the smart contracts will be automatically executed over time without friction or risk of error, and the transactional efficiency increases and trust is gradually developed (Hawlitschek et al., 2018). In this sense, blockchain diminishes the need to signal and control trust.

Transaction structure Due to the nature of siloed databases in traditional exchanges, partners perform transaction reconciliations to correct any discrepancies and are part of the verification process for reducing perceived risk. In the context of the blockchain-enabled exchange, Montecchi et al. (2019) have argued that the transaction structure of blockchain (i.e., traceability, certifiability, trackability, and verifiability) serves to reduce perceived risks of consumers, including financial, psychological, social, performance, and physical risks. For instance, integrating blockchain technology with national emission trading schemes and corporate carbon asset management could strengthen the corporate accounting system used for the measurement of carbon footprints (Tang & Tang, 2019). Additionally, blockchain is expected to re-engineer current auditing procedures into a more precise and timely automatic assurance system (Dai & Vasarhelyi, 2017). Thus, blockchain technology acts as an infrastructure that places the visibility and transparency of the transaction among the exchange parties' sustainability goals; it serves as a means of reducing the perceived risk by increasing information transparency in the blockchain ecosystems (Boukis, 2019).

Data permanence In contrast to a traditional exchange, which underlines a relational database system, a blockchain is a time-stamped series of immutable and unalterable data records (Beck et al., 2018). Each block is secured and bound to the other by using cryptographic principles or the chain. Thus, blockchain applications could enhance consumers' provenance knowledge, including providing assurances of origin, authenticity, custody, and integrity (Montecchi et al., 2019). For example, exchange parties in an ecosystem could have a transparent and unalterable dataset of how food is produced, packaged, stored, and delivered. Furthermore, blockchain is a system that records information in a way that makes it difficult or impossible to change, hack, or cheat the system (Yli-Huumo et al., 2016). In this sense, the data permanence is strong, which directly increases trust in inter-organizational relationships and, therefore, at a system level, as the dataset is transparent to exchange parties on a real-time basis, this enables each partner to build an emotional attachment to the blockchain—a feeling of confidence regarding the data stored in the blockchain.

Ownership of exchange assets Due to the aforementioned decentralized network and data permanence in the blockchain-enabled exchange, blockchain enhances the ownership and control of firms' digital data contributions (i.e., their exchange assets) in regard to competitive advantage. Thus, exchange parties could monitor the usage and output of their digital assets (i.e., data) efficiently, especially outputs distributed in a digital form (George et al., 2019). For instance, by having a dynamic data management policy, the data owners could provide low data access to others for a specific purpose within a particular period, which would enhance the granularity of data sharing between the exchange parties in the network. In this regard, trust is developed as blockchain provides economic benefits to the data owner, which encourages democratization of the sharing and monetization of digital assets by moving towards data tokenization (Sandner, 2021).

Methods

Research design and the sample

As limited understanding exists regarding blockchain-enabled exchange and trust, we conducted a qualitative study in order to comprehend this emergent and contextual phenomenon (Patton, 2002). We used abductive reasoning, through which a theoretical understanding was developed while analyzing and interpreting our empirical data (Dubois & Gadde, 2002). Since current knowledge of blockchain ecosystems is lacking, it was useful to study the phenomenon in a selected and information-rich setting (see Patton, 2002). As such, we interviewed informants who had at least three years of project experience with the blockchain-enabled exchange. Through the interview process, the informants disclosed they had played significant roles in institutionalizing a blockchain architecture between exchange parties, improving user/customer experience, or enhancing value creation for consumers, firms, and society. Accordingly, their experiences were related to the three key foundations of marketing: institutions, processes, and value creation (Eckhardt et al., 2019).

Interviews

We conducted semi-structured video conferencing interviews with 18 informants from Europe, the US, and Asia between May and September 2021. Given the complex nature of the phenomenon studied, this is a suitable way to increase the credibility of our findings. In collecting the interview data, we started with a set of grand tour questions, such as "What is your current position?", "What kind of professional background do you have?", "What kind of experiences do you have from blockchain?", and "How would your business work without blockchain?" Then, we narrowed down to more specific questions that relate to blockchain-enabled exchanges, such as "What, if any, blockchain brings in your business when compared with the traditional way of conducting this business?", "Could you please go into detail about how blockchain changes the way a firm develops buyer–seller relationships?", and "What do you see the buyer–seller relationship to be based on in a blockchain-enabled exchange?"

The interviews lasted between 32 and 81 min, with an average length of 54.7 min. We purposively selected information-rich participants (Patton, 2002) by using the authors' networks and snowball sampling. The interviewees willingly participated in the study and granted permission for the interviews to be recorded in a video format. The number of participants was not determined beforehand, but we followed the principles of saturation and stopped collecting data when no new information was added (Gummesson, 2005). All the interviewees have a strong understanding of blockchain, having more than three years of experience of blockchain-enabled exchanges. Further, they are equipped with a combination of both business and marketing perspectives on blockchain. We present a brief description of each informant's blockchain use cases in Table 3.

Table 3 Informants

Informant	Current informant's position	Blockchain area	Blockchain tasks/responsibilities	Years of blockchain experience	Duration in min
A	Co-founder & co-director	Decentralized finance	Consults, designs, and co-develops blockchain-based projects for startups	5	43
B	Co-founder & director	Decentralized finance	Designs and deploys a blockchain-based decentralized trade fund platform	4	32
C	Managing director	Decentralized finance	Develops and manages a blockchain-based payment system	3	56
D	Business analyst for blockchain	Public service payments	Develops and deploys a smart money system for public service payment	3	48
E	Crypto lead	Venture capital for blockchain projects	Evaluates and approves funding for blockchain startups	4	50
F	Chief information officer & co-founder	Asset tokenization	Co-develops and deploys a blockchain physical asset (i.e., gold) tracking system	5	29
G	Co-founder	Virtual assets	Provides virtual assets services, including crypto exchange and security tokens offering	4	68
H	Senior manager	Insurance: blockchain division	Responsible for the deployment of a blockchain-based trip delay insurance	6	52
I	Managing director	Supply chain	Consults and manages blockchain-based supply chain	5	42
J	Founder & managing principal	Food supply chain	Designs, consults, and manages blockchain-based food ecosystem	8	74
K	Blockchain consultant & developer	Finance & gaming	Designs, consults, develops, and deploys blockchain-based projects, decentralized finance, non-fungible token, and gaming projects	5	59
L	Chief executive officer	Supply chain finance	Provides blockchain-based infrastructure and supply chain finance for the chemicals industry	7	63
M	Chief technology officer	Oil & gas	Designs and deploys a blockchain-based supply chain for an oil and gas use case	4	48
N	Chief technology officer	Supply chains	Provides blockchain service for B2B supply chain document exchange	6	65
O	Partner	Marketing & education	Develops and deploys non-fungible token and blockchain marketing	4	47
P	Head of innovation center	Digital identity management	Designs and develops a secure network of verifiable identity data	5	65
Q	Head & principal investigator	Smart contract	Specializes in planning and deploying smart contract projects, such as decentralized finance, identity, and media projects	10	81
R	Business director	Food supply chain	Develops and manages blockchain-based food ecosystem	7	63

Data analysis

With regard to the analysis of the interview data, the construction of the interview protocol was directed by seven core components of an exchange that create differences in trust in a blockchain-enabled exchange and a traditional exchange. To establish trustworthiness during each phase of thematic analysis, we followed the six-phased method as proposed by Nowell et al. (2017). In phase 1, the authors familiarized themselves with the interview data by watching the recordings with transcripts multiple times, followed by documenting the authors' thoughts, interpretations, and questions. All interview data were transcribed into texts by using Google automatic transcription software. To improve the accuracy of the machine transcriber, both authors reviewed and corrected the transcripts while re-watching all the videos twice, on different days. The texts file of each video was saved in a secured shared network managed by the authors' university.

In phase 2, the authors generated initial codes by using computer-based qualitative analysis software (QSR NVivo 12 Plus). Such a process allowed the authors to simplify and focus on specific characteristics of the data related to blockchain-enabled exchanges. The authors organized frequent follow-up meetings in order to work systematically through the entire interview data set and gave full and equal attention to each data item. In phase 3, the authors searched for themes that were highly associated with the data, and the themes were not related to the questions asked during the interviews, referring to a data-driven thematic analysis approach (Braun & Clarke, 2006). In phase 4, the authors reviewed and refined the themes to ensure they reached a coherent pattern. Specifically, the authors revisited the interview videos and transcripts to ensure each individual theme accurately reflected the meanings evident in the data set as a whole. In phase 5, the authors defined and named the themes (see Chalmers Thomas et al., 2013) to ensure they fit into the overall phenomenon of blockchain-enabled exchanges and trust. Several rounds of refining versions were developed until both authors reached a consensus. In this process, the first author sought external advice from the blockchain community and both authors scrutinized all the codes at least twice, followed by expressing their personal insights into the research findings to make certain that all aspects of the interview data were thoroughly considered and analyzed. Numerous rounds of revisions were made to ensure that the final version of the thematic categories was free from overlapping meanings and precisely interpreted the empirical findings, as well as establishing the linkages between the identified themes and existing literature (see Epp & Price, 2011). Such iterative analysis was essential in order to enhance the reliability of the authors' subsequent results, which are illustrated and supported by a rich set of quotations from the data (see Healy & Perry, 2000). In phase 6, the authors produced a report by summarizing the findings and demonstrating how the current research findings have contributed to the extant literature.

Findings

In this section, we present the findings of our analysis that focused on how blockchain enables trust differently than a traditional exchange in business relationships. To answer our research questions, our findings show what conditions provide trust in a blockchain-enabled exchange and how (sub-Sections 4.1 and 4.3), and what makes the data in a blockchain tamperproof and immutable (sub-Section 4.2). Therefore, we classify our findings into three trust mechanisms (cf. e.g., Lioukas & Reuer, 2015; Luo, 2002; Zucker, 1986) that explain how blockchain enables trust differently than traditional exchange (see Table 4). The first mechanism, *trust in exchange actors*, considers how exchange actors producing trust are different for traditional and blockchain-enabled exchanges, showing that in a blockchain-enabled exchange, trust is cryptography-driven, whereas in a traditional exchange trust is based on human actors. This is also visible in the market power and the overall network structure. The second mechanism, *trust in exchange actions* considers actions providing controls of trust, including exchange performance measurement, transaction structure, and data permanence in a blockchain-enabled exchange that is based on an immutable, real-time, and transparent-based audit trail, which is different from a traditional exchange that relies on actions of a few authorities in their reconciliation and verification processes. The third mechanism, *trust in exchange assets*, considers differences in the ownership of exchange assets in a traditional exchange as compared to a blockchain-enabled exchange that is based on proof of existence, proof of ownership, and digitally escrow of asset ownership. Next, we represent our findings in terms of these three trust mechanisms in detail. The mechanisms are based on exchange components in buyer–seller relationships (Dwyer et al., 1987) and related trust characteristics (i.e., antecedents of trust) of blockchain-enabled exchange illustrated in italics in the following sections.

Trust in exchange actors: Mathematics and cryptography vs. human guardians within institutions

Our findings indicate how in a blockchain exchange the production of trust is no longer based on traditional mechanisms of trust such as personal characteristics of the exchange actors, the identification of the actors (e.g., Luo, 2002; Zucker, 1986), or trusted third parties within institutions as guardians of trust (e.g., Shapiro, 1987). This influences the

Table 4 The findings exemplified by informants for differences in trust between a blockchain-enabled exchange and a traditional exchange

Mechanism for enabling trust	Quotation	Explanation on how blockchain enables trust differently than traditional exchange
Trust in exchange actors: Mathematics and cryptography vs. human guardians within institutions	" Blockchain is a technology between things, between companies, between buyers, and sellers; it intermediates in its own way, and it provides you with a trusted network […] **I don't need the courts or the regulators to protect me** from the fear that you will steal my assets and not give me other assets in return because we're going to settle on-chain […] **what we are interested in is building out a crypto-economic design**." *(Informant A, Co-Founder & Co-Director, DeFi, 5 years)* "We just get rid of all of the cost factors and moral hazard factors **by replacing them with mathematical and cryptography-driven governance**, for example, with smart contract blockchain systems." *(Informant Q, Head & Principal Investigator, Smart contract, 10 years)* "**The blockchain also has cryptography behind it**. You really no longer need to trust someone on the other side of your purchase if you trust the blockchain. You know that **you don't need to trust the counterparties** anymore and that usually that's why you need to have a middleman." *(Informant B, Co-Founder & Director, DeFi, 4 years)*	Highlights that blockchain enables trust in exchange actors that focuses on mathematical and cryptography-driven exchange governance and overall exchange network, rather than based on human guardians within institutions
Trust in exchange actions: Information transparency enabling tamperproof and immutable data vs. information asymmetry	"In a blockchain, where you can trust that something has been signed by the person who claims to have signed it, you can trust that an asset is the same asset that you saw on the Internet the other day; **you can verify where something came from all the way back to its genesis**." *(Informant P, Head of Innovation Center, Digital Identity Management, 5 years)* "**It's totally based on transparency**, so anyone can see the code, and then it's about self-execution, so you can't modify the smart contract […] you can trust the consensus that things are not changed along the way." *(Informant R, Business Director, Food Supply Chain, 7 years)* "All the Ethereum nodes [the computers running software operated by unknown third parties which serve to verify, store, and create blocks in the Ethereum blockchain network] run the same code in order to check that they get the same answer, and then **they're all recording that same answer in their ledgers so that you have a reliable record of a financial transaction**. Of course, this is the funny thing about blockchain […] **the accounting books are all completely public**, and as a result, there are hundreds of thousands of bookkeepers all double-checking that the books are valid, and that's what stops fraud from happening." *(Informant K, Blockchain Consultant & Developer, Finance & Gaming, 5 years)*	Presents that blockchain enables trust in exchange actions that are based on self-executing smart contracts and all exchanges must be checked and verified by multiple third parties; the information is transparent throughout the exchange on an immutable, audit trail, and real-time basis, whereas not all exchange parties have a similar set of information about current and past transactions in a traditional exchange

Table 4 (continued)

Mechanism for enabling trust	Quotation	Explanation on how blockchain enables trust differently than traditional exchange
Trust in exchange assets: Digital vs. manual escrows for verifying ownership of valuable goods	"You always have to define very explicitly who generates the data, who owns it, who administers it. You can't operate a blockchain network without answering these questions, so **the ownership and the value of data become more visible**." *(Informant N, CTO, Supply Chains, 6 years)* "**The network itself can escrow assets between buyers and sellers** and only release those assets when the buyer gets what they specified in advance and the seller themself gets what they specified in advance, so **the network acts as a trusted escrow agent**." *(Informant A, Co-Founder & Co-Director, DeFi, 5 years)*	Describes that blockchain enables trust in exchange assets by digitally ensuring proof of existence, issuing proof of ownership, and escrowing the ownership of valuable goods, rather than based on manual escrow

exchange governance, and subsequently, each actor has a notable role in the ecosystem reducing the power of dominant market players. Thus, in a blockchain ecosystem, trust is developed towards different exchange actors than traditionally as human actors are replaced by technology, mathematics, and cryptography that provide trust, as described in the following paragraphs:

> Blockchain is a technology between things, between companies, between buyers, and sellers; it intermediates in its own way, and it provides you with a trusted network […] I don't need the courts or the regulators to protect me from the fear that you will steal my assets and not give me other assets in return because we're going to settle on-chain […] what we are interested in is building out a crypto-economic design.
> *(Informant A, Co-Founder & Co-Director, DeFi, 5 years)*

Although blockchain governance could be negotiated and agreed between the exchange actors in the ecosystem, a specific set of institutional arrangements is needed to ensure the trustworthiness of the blockchain-enabled exchange. Informant A expressed that a blockchain application is a separate entity (i.e., an object) and it is not owned and controlled by any of the exchange actors. In this sense, blockchain does not function as a data infrastructure per se, it is a virtual form of intermediary that provides a trusted network for the marketplace that only performs mutually agreed transactions in real time. As such, every single exchange involves a *consensus-based economic transaction between the buyers and sellers*. A consensus is reached when the exchange actors mutually agree on a course and economic value is provided by one economic unit to another in the blockchain application. Further, the quote from informant A suggests that the informant uses blockchain to replace traditional third-party guardians of trust, such as courts and regulators. Therefore, a key aspect is to establish a crypto-economic design that encourages the participation of many public auditors.

Importantly, there is an implicit worldview of blockchain users in their greater *trust in mathematics and cryptography* and the dilution of the need to rely on a few choices of human guardians, as confirmed by informant Q:

> We just get rid of all of the cost factors and moral hazard factors by replacing them with mathematical and cryptography-driven governance, for example, with smart contract blockchain systems.
> *(Informant Q, Head & Principal Investigator, Smart contract, 10 years)*

Accordingly, a blockchain-enabled exchange serves to replace human-driven promises with a mathematical and cryptography-driven algorithm, which assists in tackling unethical and dishonestly issues that are possibly caused by corrupted human-driven institutions with different layers of traditional trusted guardians (e.g., bankers, lawyers, politicians, giant tech firms, and dominant players in the ecosystem).

Importantly, in our interviews the informants noted that exchange actors *perform economic transactions without relying on the trustworthiness of counterparties*. The reason given is that buyers and sellers, in general, do not know each other's identity, which would be needed in order to reach a consensus agreement. Instead, the exchange actors place their trust in the blockchain applications by *executing smart contracts on-chain, without enforcement authorities*. In contrast to a traditional exchange, which highly assigns trust to the exchange actors' reputation and authorities' enforcement capabilities (e.g., banks, governments, lawyers, and giant tech firms), actors in a blockchain-enabled exchange can autonomously check their transaction on a real-time and audit-trail basis, as quotes of informants B and C depict:

> The blockchain also has cryptography behind it. You really no longer need to trust someone on the other side of your purchase if you trust the blockchain. You know that you don't need to trust the counterparties anymore and that usually that's why you need to have a middleman.
> *(Informant B, Co-Founder & Director, DeFi, 4 years)*
> Smart contracts are the most obvious example that you can use to enforce an agreement—not necessarily a legal agreement—but enforce an agreement between two counterparties without needing to refer to the enforcement authorities.
> *(Informant C, Managing Director, DeFi, 3 years)*

As informants B and C reported with regards to the DeFi application, blockchain technology allows customers to earn interest on various digital assets without knowing the counterparties and they do not depend on enforcement authorities; the DeFi application allows investors to supply their digital assets to others by algorithmically setting the interest rates based on supply and demand of the digital assets in smart contracts. On the other hand, borrowers can instantly receive loans by depositing their digital assets as collateral.

To achieve consensus in a decentralized manner and to maintain the integrity of the network, informant D expressed that the blockchain-enabled exchange requires unique verification and validation processes in the ecosystem: *a reward and punishment system from unknown third parties*:

> If you work or act in a blockchain, you help the ecosystem to run and you get some benefits—for example, you get these mining rewards—and if you harmfully work against the blockchain ecosystem, you can get some kinds of punishment, for example, you lose some amount of cryptocurrency.
> *(Informant D, Business Analyst for Blockchain, Public Service Payments, 3 years)*

Accordingly, each node (i.e., each unknown third party) must agree on the state of all the cryptographic information recorded in the blockchain network, and this prevents certain kinds of economic attacks. Thus, the nodes must consistently act with integrity in order to have a chance to earn fees and block rewards as they have committed their resources and time to maintaining the longest chain in the network.

Similarly, it is the cryptography that enables reciprocity also in regards economic benefits among exchange actors. Informant E emphasized that the overall blockchain-enabled exchange network structure serves to *democratize the economic benefits* thus influencing the market power between exchange actors. An important note is that exchange actors significantly evaluate economic benefits rather than network benefits in the blockchain ecosystem, as depicted in the following quote:

> We can play with cryptography to improve the financial flows and payments so this is why we really believe that blockchain can bring value to business networks and provide a bigger cake for everybody.
> *(Informant E, Crypto Lead, Venture Capital for Blockchain Projects, 4 years)*

> It [blockchain] can improve the trust, but sometimes it doesn't, for instance the TradeLens project is a perfect example […] Everyone has to have a benefit, or they won't join. Why would they? It's like when we're kids right—we all want to have a chance to win.
> *(Informant I, Managing Director, Supply Chain, 5 years)*

As illustrated by informant I in a supply chain use case, most shipping parties were reluctant to participate in a blockchain-based supply chain network as they were not given the authority to control and own the network shipping data, where the network shipping data belonged to two giant corporations. As such, the project encountered difficulties recruiting other shipping parties as it did not democratize the economic benefits for all the other actors in the ecosystem, which limited the trust in exchange actors in the blockchain-enabled exchange as the project utilized a traditional exchange ideology that focused on the human guardians within two giant corporations, rather than creating trust via cryptography and mathematics-driven characteristics.

> We can actually replace most aspects with decentralized trust, but not everything […] we would expect it to de-hierarchize things, and we would expect to move away from these large and centralized firms to more distributed networks of firms that share a digital infrastructure that provides trust across that ecosystem.

(Informant A, Co-Founder & Co-Director, DeFi, 5 years)

Finally, as illustrated in the above quotation, informant A mentioned that blockchain technology has inspired new way of thinking of the overall exchange network as it governs the coordination between exchange actors in *a flat structure with a distributed network of exchange actors*. In a traditional exchange, the actors generally assign their trust to trusted agencies such as the court, accounting and auditing firms, management companies, and lawyers (Lumineau et al., 2021). However, in a blockchain-enabled exchange, the mathematical and cryptography-driven exchange network could be used to replace some of the trusted agencies at a lower cost, and subsequently, this allows flat and agile business collaboration with less hierarchical and less bureaucratic middle management layers, as well as allowing the move from centralized firms to more distributed networks between the exchange actors in a crypto economy.

Trust in exchange actions: Information transparency enabling tamperproof and immutable data vs. information asymmetry

According to our findings, blockchain-enabled exchange actions are trustworthy as they provide data which are time-stamped, immutable, and transparent. This is in contrast with trust mechanisms in a traditional exchange, where significant attention is paid to measuring, specifying, and quantifying all aspects of performance, including psychic and future benefits of an exchange action (Dwyer et al., 1987). In the traditional exchange, verification processes are needed as not all exchange parties have a similar set of information about current and past transactions, and the history of exchanges is often controlled by gatekeepers, resulting in uncertainty between exchange actors thereby. In contrast, in blockchain-enabled exchange, exchange actions are transparent on an immutable, audit trail, and real-time basis:

> In a blockchain, where you can trust that something has been signed by the person who claims to have signed it, you can trust that an asset is the same asset that you saw on the Internet the other day; you can verify where something came from all the way back to its genesis.
> *(Informant P, Head of Innovation Center, Digital Identity Management, 5 years)*
> I was talking about crypto VCs [venture capitalists] because people are checking the on-chain activity and governance proposal […] people can see what the VCs are doing and proposing to the DAO [decentralized autonomous organization] […] people also say "It's not fair" or "It's not enough. Why should VCs have a discount for the tokens?" […] this level of extra transparency for me.
> *(Informant E, Crypto Lead, Venture Capital for Blockchain Projects, 4 years)*

With regards exchange performance measurement, parties may gain more trust as a result of *transparency with on-chain governance* in a blockchain-enabled exchange. Informant P explained that blockchain provides full transparency of exchanges stored in the network, which allows parties to acquire information of each transacted exchange, and such historical access to on-chain governance is important in establishing trust in exchange actions. Further, on-chain governance allows parties to view all the governance processes in the blockchain network, such as the rules, voting, choices, and contributions of venture capital reducing uncertainty between exchange parties. As noted by informant E, exchange parties, venture capitalists, and other users consistently check on the blockchain scanner (e.g., Etherscan.io and Bscscan.com), and in one funded project, they had to terminate collaboration with a business partner because they discovered from the on-chain governance that this business partner had secretly short-sold tokens out of self-interest. In this sense, the informant expressed that on-chain governance adds an extra level of transparency and security since it allows the public to audit the exchange network in real time.

> We created an asset tracking system that sort of digitally notarizes the data to the blockchain […] we have scanners that we deploy in the vaults and we put RFID [radio-frequency identification] tags on the gold bars; the vault personnel scan the bars photographs, upload them, and then that data is hashed and time stamped in the blockchain. Of course, we could change or manipulate the data, but if we did that, it would be publicly exposed because of the hashing. If you visit explored.xxx.net you can see how that works, you can see the history of each and every bar, any changes that have been made to its data, and so on.
> *(Informant F, CIO & Co-Founder, Asset Tokenization, 5 years)*
> Blockchain changes, it's more like big digitalization, so it means that we can work in real time and there is also a point where we can audit the transaction on-chain.
> *(Informant G, Co-Founder, Virtual Assets, 4 years)*

One key element for a blockchain-enabled exchange is related to a *real-time and transparent-based audit trail.* As reported by Informants F and G in the asset tokenization use case, transactions are publicly available so that other actors, such as investors, can check the status of their asset investment on a real-time basis. In addition, a trustable blockchain application must be designed to *reduce the likelihood* *of contract manipulation during the exchange actions*. For instance, informant F explained that any manipulation would be publicly explored, and this would hurt his firm's trustworthiness, whereas informant H provided a flight delay insurance use case that integrated with the Oracle system. In this case a decentralized worldwide data feed service provides real-time flight data into the blockchain automatically, as depicted in the quote of a senior manager of an insurance company:

> In the case of flight delay insurance […] let's say the flight is delayed for one hour; you land in Munich, then Munich airport documents it on their home page or in another system. This information is then sent to the blockchain […] the Oracle system will give the information to the blockchain and that will trigger the payout […] there are fewer chances for any manipulation of our insurance contract.
> *(Informant H, Senior Manager, Insurance: Blockchain Division, 6 years)*

Informants K and R expressed their view that a well-designed blockchain application should be able to implement *open-source and self-executing programmable contracts* during exchange actions. Informant R stated that the contracts in a blockchain-enabled exchange should be open source to confirm and check that the accuracy of the code. They also explained that such an ecosystem ensures information transparency:

> The smart contract is that different parties now can transact in a way that's open-source, transparent, deterministic, and immutable.
> *(Informant K, Blockchain Consultant & Developer, Finance & Gaming, 5 years)*
> It's totally based on transparency, so anyone can see the code, and then it's about self-execution, so you can't modify the smart contract […] you can trust the consensus that things are not changed along the way.
> *(Informant R, Business Director, Food Supply Chain, 7 years)*

In terms of the transaction structure, informants emphasized two elements of blockchain-enabled exchanges: *A set of truths* and *fraud prevention*. Informants I and J noted that a blockchain provides *a set of truths* about the events or exchange in actions that have been recorded on-chain:

> For supply chain partners, blockchain is really there to provide truth about events that have taken place.
> *(Informant I, Managing Director, Supply Chain, 5 years)*
> Blockchain provides one single source for the truth of the data: that is where you can optimize the value chain or supply chain.
> *(Informant J, Founder & Managing principal, Food Supply Chain, 8 years)*

Thus, exchange parties always have a complete record of historical transactions that they can access in the future in case they need to do so for investigation purposes. In order to maintain the blockchain transaction structure, blockchain-enabled exchanges must be available to the public, and all exchanges must be checked and verified by unknown third parties (commonly known as *nodes*) via a zero-knowledge proof. Such an exchange action is critical for *fraud prevention*, the peer-to-peer approach is an essential prevention strategy for matching data points with exchange activities and detecting abnormal transactions, as described by informants K and Q:

> All the Ethereum nodes [the computers running software operated by unknown third parties which serve to verify, store, and create blocks in the Ethereum blockchain network] run the same code in order to check that they get the same answer, and then they're all recording that same answer in their ledgers so that you have a reliable record of a financial transaction. Of course, this is the funny thing about blockchain […] the accounting books are all completely public, and as a result, there are hundreds of thousands of bookkeepers all double-checking that the books are valid, and that's what stops fraud from happening.
> *(Informant K, Blockchain Consultant & Developer, Finance & Gaming, 5 years)*
> The current accounting information system is completely ineffective at fraud detection and […] smart contract blockchain systems would be the right thing. It would make a lot of sense in the free market […] and create so much more efficiency, effectiveness, and accountability.
> *(Informant Q, Head & Principal Investigator, Smart contract, 10 years)*

Importantly, informant K explained that each transaction is verified in real-time by many "public auditors" (commonly known as nodes) within the network. In contrast, in the traditional exchange, transactions are verified by central institutions and auditors periodically, and many exchanges are not audited due to the audit sampling procedure (Dai & Vasarhelyi, 2017). For this reason, blockchain is more effective than the traditional accounting information systems at preventing fraudulent activities as it enables exchanges in real-time and visibility of all transactions of all parties in a blockchain network.

With regards to data permanence, all the informants agreed that in a blockchain-enabled exchange, the control of trust is related to exchange actions, and they emphasized two trust characteristics of blockchain: *a sense of certainty* and *a sense of reliability*. Transaction visibility serves as an important factor that leads to a sense of certainty between exchange actors:

> For everyone involved—the trading partner, financing partner, and the service provider—trust is replaced by certainty: I can count the transactions, I see the material, I see the inventory, I see the consumption.
> *(Informant L, CEO, Supply Chain Finance, 7 years)*
> Let's call it a digital backbone in which trust is inherent […] there is no dispute about the charging of the prices on your bill because everyone has exactly the same information […] stakeholders are much more related to each other because you really create one joint system.
> *(Informant M, CTO, Oil & Gas, 4 years)*
> Because we can provide this real-time data to multiple participants and we can trust that the information that we receive from the blockchain is reliable.
> *(Informant D, Business Analyst for Blockchain, Public Service Payments, 3 years)*

Informant L claimed that trust is replaced by certainty as he could view the transaction details on-chain, such as the materials, inventory, and consumption levels, whereas informant M viewed blockchain technology as trust building because it creates a joint system in which stakeholders feel certain about the information involved. As reported by informant D, patients have a clear number of free visits to public psychotherapy services throughout the year and they can turn up without an appointment: this reduces the hassle of making a phone call to the psychotherapy center. Thus, a blockchain-enabled exchange enhances a sense of reliability, and thereby trust, between the exchange actors because the information is in symmetry for all of them—all the relevant information is known to all the parties involved during the exchange actions.

Trust in exchange assets: Digital vs. manual escrows for verifying ownership of valuable goods

Based on our findings, blockchain enables trust in exchange assets by digitally ensuring proof of existence, issuing proof of ownership, and escrowing digital assets between exchange actors. In a traditional exchange, the asset ownership is manually escrowed and protected by authorized parties, such as government agencies that provide institution-based trust (e.g., Zucker, 1986).

To illustrate, in a supply chain finance use case, blockchain technology empowers a consumption-based and automated financing solution between the exchange parties. Specifically, this is focused on real-time inventory management by tokenizing all the events in the supply chain, including issuing the *proof of delivery* and *proof of existence*, as expressed by informant L:

> We tokenize all the events in the supply chain by replenishing and providing material between the trading partners so that we have a proof of delivery, we have a proof of existence, and we can tokenize these assets or events for them to be used in the blockchain.
> *(Informant L, CEO, Supply Chain Finance, 7 years)*

Thus, exchange parties can grant permission to financial institutions to access the transacted data on a blockchain distributed network. This provision ensures the integrity of information in a trusted business environment and thus enables the execution of a reverse factoring smart contract upon setting up a mutual agreement between the parties involved for their exchange of assets. In this regard, suppliers take advantage of early payments (i.e., they have increased liquidity) by receiving a discounted payment from the financial institutions, the customers make the payment on the invoice due date, whereas financial institutions earn interest revenue from the supply chain finance services.

The proof of ownership is considered one of the main discussions in the context of a blockchain-based supply chain, including the data owner, data administrator, and who can own and access to the data, as described by informant N:

> You always have to define very explicitly who generates the data, who owns it, who administers it. You can't operate a blockchain network without answering these questions, so the ownership and the value of data become more visible.
> *(Informant N, CTO, Supply Chains, 6 years)*

From the perspective of digital art, informant O stated that blockchain technology enables digital asset ownership by utilizing a non-fungible token:

> Digital art has been rising in the crypto space, there is a super big hype surrounding NFTs [non-fungible tokens] and celebrities are also putting out their artwork and brand using non-functional tokens.
> *(Informant O, Partner, Marketing & Education, 4 years)*

A non-fungible token is recommended to artists in order to preserve the value and originality of their digital art as the underlying blockchain technology is characterized by immutable and audit trail features.

Artists can *monitor and conduct provenance tracking of their digital assets* efficiently, especially outputs distributed in a digital form across different digital platforms. Informant Q also highlights the importance of blockchain technology in *enabling automated royalty payments*:

> It goes on-chain, yeah, and so you have provenance tracking of your assets, which is very powerful of course, certainly in relation to media […] so you can then really track that this is the person who produced the script, this is the person who did the cutting, here we have the actors who are in this and that scene, this is the producer. Yeah, so you have key events that you can really record in an immutably traceable way.
> If you introduce blockchain-based systems with deposits and this is all backed by smart contracts, then the payment doesn't even go to the producer of some media content—you have installed smart contracts and the payment preferably does not even come from Netflix because it is disintermediated, it comes from the media consumers and it is based on the smart contracts and it is fairly distributed based on the agreement on your assets.
> *(Informant Q, Head & Principal Investigator, Smart contract, 10 years)*

In this sense, the artists could clearly identify their full and fractional asset ownership rights, and once an exchange occurs in the blockchain, a monetary reward is automatically credited to the artists involved. For example, in the media industry, a scriptwriter or an actor could immediately receive his or her royalty payments (5% for the scriptwriter, 10% for the actor) from the end user for every pay-per-view transaction that occurred in the blockchain-enabled exchange. In this regard, artists no longer have to rely on the producer or media agencies distributing royalty payments to them.

Further, a blockchain-enabled exchange is a network that has the capability to *escrow digital assets between exchange actors*. The blockchain network only releases the transacted digital assets to other parties when each party has fulfilled the specifications stated in the smart contract, as informed by noted by A:

> The network itself can escrow assets between buyers and sellers and only release those assets when the buyer gets what they specified in advance and the seller themself gets what they specified in advance, so the network acts as a trusted escrow agent.
> *(Informant A, Co-Founder & Co-Director, DeFi, 5 years)*

In this context, blockchain acts as an autonomous trusted escrow agent, managing the buyer–seller relationship so that the involved parties can trust in their exchange assets by gaining the economic benefits expected from the transaction. As such, blockchain also functions in terms of asset protection to safeguard the exchange actors' digital assets from creditor claims. For this reason, the informant felt that the blockchain's capability to escrow digital assets is a trust enabling process generally managed by a third-party guardian (e.g., lawyers and bankers) but is assumed in the blockchain technology itself.

The following Table 5 illustrates mechanisms for enabling trust in a blockchain-based exchange, based on exchange components in buyer–seller relationships (Dwyer et al., 1987) and related trust characteristics, different from those in traditional exchange. These trust mechanisms in blockchain-enabled exchanges are linked to the theoretical contributions of this study: impersonal-relational trust (cf. Shapiro, 1987) and institution-based trust (cf. Luo, 2002; Williamson, 1985; Zucker, 1986) that a blockchain-enabled exchange produces as aggregated trust mechanisms. These are discussed in detail in the next section.

Concluding discussion

Blockchain technology is said to be an Internet of trust with promising characteristics that suggest it may become a revolutionary technology in regard to trust in exchange relationships. Recent literature, mainly within the fields of information systems and information management (see Hughes et al., 2019), has predicted the boosting of blockchain technology in business, but it is still waiting for successful use cases that would gain the interest of wider audiences. The existing literature on blockchains mostly implicitly refers to the characteristics of the technology that impact trust development in exchange relationships. Further, as Ahearne et al. (2021) showed, technology-facilitated buyer–seller interactions are another important area on the future research agenda, and this includes blockchain-enabled exchanges. Thus, there is more than enough momentum to address the characteristics of blockchain exchanges from the perspective of the established literature of trust in B2B relationships to understand how marketers can successfully adopt blockchain in their businesses. To the best of our knowledge, this is the first study that explicitly addresses the identified black box of the "Internet of trust" in the context of blockchain literature and business practice. Specifically, the current research serves to examine what characteristics and components of a blockchain-enabled exchange provide trust and how. We answer the following research questions: (1) What conditions provide trust in the blockchain ecosystems, and how? (2) What makes the data in a blockchain "tamperproof" and "immutable"?

Because of the novel context of this study, we addressed the trust concept from a broad angle to marketing and organizational studies (see Table 5) of buyer–seller relationships (e.g., Dwyer et al., 1987; Moorman et al., 1993; Morgan & Hunt, 1994) and drawing from both the contextual literature and rich empirical data gained from use cases and blockchain professionals to ground the framework. The qualitative approach allowed us to understand that analyzing characteristics of blockchain-enabled exchanges calls for an interplay between calculative and relational perspectives on trust to understand the dynamics in business relationships (see Huang & Wilkinson, 2013).

The existing trust literature discusses traditional exchange relationships wherein trust is developed towards someone (on an interpersonal level), between organizations (on an inter-organizational level), or even at the system level. Furthermore, the literature assumes that social relationships are needed for trust to be developed (e.g., Shapiro, 1987). In the blockchain ecosystem, these conditions are fundamentally changing. Based on the empirically grounded framework, this study identifies seven components of exchanges that enable trust in blockchain-facilitated business relationships. First, exchange governance, market power, and the overall exchange network can be seen as *social components of exchange* and also as the social antecedents of trust in blockchain-enabled exchanges as they most clearly include emotional attachment or affect-based trust, which refer to relational trust and stem from social-exchange theory (Lioukas & Reuer, 2015). However, the nature of this "social exchange" is different from those traditional exchanges as here *impersonal-relational trust* is primarily developed towards a non-human actor (i.e., mathematical and cryptography-driven blockchain governance), and is then possibly transferred into interorganizational trust, reducing possible risks in the exchange.

Second, we can identify that the *structural components of exchange* that stem from transaction cost economics and represent calculative trust (e.g., Williamson, 1993) are emphasized in the mechanisms of trust that relate to information transparency and digitally escrowed ownership as recurring transactions (via exchange performance measurement, transaction structure, data permanence, and ownership of exchange assets). Overall, within these exchange components, we are able to see trust characteristics of blockchain that refer to *institution-based trust* (Zucker, 1986). However, blockchain-enabled exchanges do not seemingly contain process-based trust (as suggested by Zucker) stemming from long-term relationships. Neither does it contain characteristic-based trust based on similarities between the exchange parties and presumes their (i.e., the parties) knowledge of each other (see Luo, 2002; Zucker, 1986). Instead, blockchain *replaces* these mechanisms of trust by enabling tamperproof and immutable data (i.e., information transparency), as well as executing a digital escrow to verify the ownership of valuable assets. Therefore, it is possible to argue for the notion of blockchain as an Internet of trust. This is especially so as trust can be institutionalized, but this traditionally needs recurring interactions in the exchange relationships (e.g., Kroeger, 2012). This is exactly what happens in the blockchain ecosystem as recurring transactions (even if in a situation when the exchange parties are unknown as is the case in a decentralized system) are controlled by the blockchain in a trustworthy way.

Theoretical implications

The history of research on trust in B2B relationships and networks spans more than 50 years (e.g., Huang & Wilkinson, 2013; Lewicki et al., 1998; Moorman et al., 1993). Cooperation between people and companies is highly reliant on trust to succeed (e.g., Huang & Wilkinson, 2013). Thus, the rich contributions stemming both from the calculative perspective (Williamson, 1993) and the relational perspective (e.g., Moorman et al., 1993) on trust are mostly about the history of people trusting people or organizations at different levels (e.g., Fang et al., 2008). However, as Ahearne et al. (2021) recently showed, buyer–seller interactions facilitated by technology are fundamentally transforming the landscape of exchange relationships. Therefore, revolutionary technologies such as blockchain will presumably also change exchange relationships and, accordingly, also the development of trust, which is a key component in business relationships. This study focused on blockchain technology regarding trust in exchanges and by doing so contributes to technology-focused research in buyer–seller relationships and literature of trust in business relationships and social-exchange theory in an important way.

First, this study adds to the established literature on technology-focused research in buyer–seller relationships (e.g., Ahearne et al., 2021) and increases an understanding of the change adherent to related exchanges. Building on the established literature of buyer–seller relationships (e.g., Dwyer et al., 1987; Moorman et al., 1993; Morgan & Hunt, 1994), this study suggests that in blockchain-enabled exchanges the relational exchange between business partners changes as they become discrete transactions (see Dwyer et al., 1987) enabled by technology. This creates efficiency for businesses as there is a diminishing need for control and certain transactions happen automatically. However, this is not necessarily the whole landscape of the business relationship as efficiency in routine-like activities and transactions (e.g., those of a back office) may create room for value creation in other areas of exchanges and the relationship if the counterparts are known business partners. Our study suggests that blockchain is at its best in an otherwise trustless environment with recurring transactions and exchanges.

Second, this study contributes to the literature of trust in business relationships (Fang et al., 2008; Huang & Wilkinson, 2013; Kroeger, 2012). The study suggests that in blockchain-enabled exchanges technology (as a non-human actor) becomes not only an object of trust but also a subject of trust. Thus, the study shows that impersonal, agentic trust (e.g., Shapiro, 1987) can also be relational when technology is involved as a

Table 5 An overview of types of trust, exchange components, and mechanisms enabling trust of a blockchain-enabled exchange

Types of trust	*Trust definition in blockchain-enabled exchanges*: Trust is based on *impersonal-relational trust* and *institution-based trust* at system level. In impersonal-relational trust, relational trust (e.g., Doney & Cannon, 1997) is developed primarily towards a non-human actor—mathematical and cryptography-driven blockchain governance, which is then possibly transferred to an inter-organizational trust, for reducing possible risks in the exchange. Thus, the nature of social exchange is different from traditional exchanges. Accordingly, the institutionalized trust (e.g., Kroeger, 2012; Shapiro, 1987) develops through technology, not humans, whereas in the traditional exchange literature (e.g., Luo, 2002; Williamson, 1985; Zucker, 1986), the assumption is that representatives of organizations through e.g., their habits and culture institutionalize the trust at the organizational level. Consequently, in blockchain-enabled exchanges, process-based and characteristic-based trust tied to humans (e.g., Luo, 2002; Zucker, 1986) are replaced by the blockchain trust characteristics, but the institution-based trust (e.g., Luo, 2002; Zucker, 1986) with technology as a guardian of trust stays. The structural components of exchange are emphasized in blockchain characteristics						
	Impersonal-relational trust			Institution-based trust			
Exchange components	Exchange governance	Market power	Overall exchange network	Exchange performance measurement	Transaction structure	Data permanence	Ownership of exchange assets
	• Consensus-based economic transaction • Trust in mathematics and cryptography over human guardians • Without relying on the trustworthiness of counterparties • On-chain smart contract execution without enforcement authorities • A reward and punishment system from unknown third parties' verification and validation	• Democratize the economic benefits	• A flat structure with a distributed network of exchange actors	• Transparency with on-chain governance • Real-time and transparent-based audit trail • Reduce the likelihood of contract manipulation during the exchange actions • Open-source and self-executing programmable contracts	• A set of truths • Fraud prevention	• A sense of certainty • A sense of reliability	• Proof of existence • Proof of ownership • Enabled provenance tracking of digital assets • Enabled automated royalty payments • Escrow digital assets between exchange actors
Mechanisms enabling trust in blockchain exchange	Trust in exchange actors: Mathematics and cryptography			Trust in exchange actions: Information transparency enabling tamperproof and immutable data			Trust in exchange assets: Digital escrow for verifying ownership of valuable goods

subject of trust development, adding especially to the literature on institutional trust. In addition, this study advances an understanding of trust at different levels of inter-organizational exchange. The study shows that in blockchain-enabled exchanges trust is primarily developed at the system level, in this case referring to the blockchain ecosystem of collaborating and/or competing firms. Adding to the contributions by Fang et al. (2008), Kroeger (2012), and Shapiro (1987), we suggest that the blockchain ecosystem forms a nested system of trust wherein system-level trust is transferred as inter-organizational trust, initiated by blockchain-enabled exchange components. However, this transfer of trust between different levels—in other words, the institutionalization of trust (see Kroeger, 2012)—differs in this context, as in the earlier literature it is said that trust needs the representatives of organizations (e.g., Fang et al., 2008) to act in a trustworthy manner for inter-organizational trust to be developed and for trust to be institutionalized (see Kroeger, 2012; Shapiro, 1987). In blockchain-enabled exchanges the direction of trust transfer is the opposite moving from the system level to the inter-organizational level, without an inter-personal level, a human factor. This is a key characteristic of blockchain-enabled trust in business relationships, leading to numerous trust-related managerial implications ranging from solving privacy issues to preventing the opportunistic behavior of exchange actors. Finally, blockchain technology replaces the need for a trusted third-party, which the existing literature (e.g., Shapiro, 1987) suggests for trustless conditions as a guardian of trust between exchange parties and to increase certainty between them.

Third, the current research contributes to the social exchange theory (Lioukas & Reuer, 2015) by suggesting that structural exchange components are emphasized in a blockchain-enabled exchange, whereas social and relational components of trust (Zucker, 1986) have a smaller role and process-based trust develops over time or is even non-existent if one follows its current definition in the extant literature. Thus, this research suggests the blockchain-enabled trust mechanisms; trust in exchange actors creating impersonal-relational trust and trust in exchange actions and assets that primarily create institution-based trust. However, relational trust elements, such as a sense of reliability and certainty, are also relevant controls of trust. The controls of trust (i.e., exchange performance measurement, transaction structure, data permanence, and ownership of exchange assets) reduce the need for resources, providing a more inexpensive guardian of trust in exchange actions and exchange assets. Thus, we suggest that blockchain can solve the problem of the irony that we frequently protect trust and respond to its failures by bestowing even more trust. As Shapiro (1987, p. 652) has said: "The more we control the institution of trust, the more dissatisfied we will be with its offerings."

Applying the framework to marketing domains

Online advertising

Up-to-date, online advertising is highly operated by centralized advert exchanges (Johnson et al., 2020), such as Google AdX and OpenX. The key role of an advert exchange is to provide a real-time auction marketplace that enables the advertisers (e.g., brands) and publishers (e.g., TIME Magazine, CNN, blogs, and mobile applications) to buy and sell their advertising space in order to acquire new customers or promote their products. For this reason, advertisers have to compete with other competitors to win limited advertising space from the publishers. Unfortunately, the centralized advert exchanges do not provide advertisers or brands with a transparent media supply chain, which has resulted in little detail (e.g., detail about to whom, when, and where their ads are displayed) and unreliable measurements (e.g., the viewable impression and conversion rate) of their massive online advert spending (Handley, 2017). Further, due to the complex fee charged by the centralized advert exchanges, most of the dollars that advertisers spend are not being transferred to the publishers (Blustein, 2020).

However, in the context of blockchain-enabled exchanges, online advertising is governed by a decentralized advert exchange ecosystem (e.g., the Adshares and Alkimi use cases) that serves to increase the transparency and immutability of the media supply chain (Chorley et al., 2021). That is, producers and advertisers perform exchanges in a decentralized real-time auction marketplace whereas consumers have a choice to decide whether or not to be exposed to the advert in advance. Each advert is publicly published under a pseudonym on the distributed and immutable database; the ad performance activities—such as pay per click, cost per click, impressions, the click-through rate, the conversion rate, and the bounce rate—are verified by validators on the network via zero-knowledge proof. In this sense, validators are incentivized with verification fees to maintain their integrity in every exchange (i.e., in their advert performance activities). Advertisers are motivated to deliver authentic advertisements as consumers could report misleading ads on the transparent and immutable network. Producers are rewarded with advert revenue and advert relevancy. Consumers benefit from decreased advert density and gain rewards from browsing ads. In this regard, the blockchain-enabled exchange serves to coordinate a new way of organizing online advertising activities and managing trust between exchange actors, the decentralized advert exchange is viewed as an autonomous network that provides a set of truths with a tamperproof and immutable media supply chain, rather than being viewed as a privately owned entity that aims for profit maximization and market monopoly.

Consumer trust and privacy

From the marketing perspective, Krafft et al. (2021) stated that understanding the customer–firm data exchange is essential for managing a valuable customer relationship. Due to customers' high acceptance rate and dependency on digital platforms, marketers could nowadays collect and analyze customer data from different digital touchpoints (e.g., from social media sites, mobile apps, and smart home IoT devices) and subsequently translate it into competitive advantages (Krafft et al., 2021). Previous studies found that customer trust serves as an essential predictor of their willingness to share biographic and biometric information (Ioannou et al., 2021), identifiers (Veltri & Ivchenko, 2017), and behavioral data (Urbonavicius et al., 2021). In this regard, customers' trust is manifested in customers releasing personal information in digital spaces, whereas firms concretize the privacy enhancement for data management as a strategy for building customer trust (Martin & Murphy, 2017). While customers authorize marketers to deliver them data-driven values, such as personalized offerings, customers are also increasingly concerned about privacy invasions and undesired marketing communications in digital spaces (Martin & Murphy, 2017). To alleviate customers' concerns over data privacy issues, Luo (2002) proposed three trust mechanisms—including characteristic-based mechanisms (e.g., cooperative marketing programs), process-based mechanisms (e.g., reputation and brand names), and institutional-based mechanisms (e.g., third parties' certificates)—that underline relationship marketing theory and social exchange theory.

Krafft et al. (2021) argued that customers evaluate four distinct dimensions of data exchange expectation—including data ownership, data intimacy, data permanence, and the data value—which moves towards a self-sovereign identity approach that focuses on how customers control their identity and privacy rather than relying on firms' data management (Berg et al., 2018). Intriguingly, such conditions may not apply to blockchain-enabled exchanges as consumers do not need to rely on third parties' assistance to perform a transaction. For instance, in a digital asset marketplace platform (e.g., the OpenSea use case), the signup or login process only requires a crypto hot wallet web browser extension, such as MetaMask, that only requires consumers to remember their login password and secret backup/recovery phrase. Thus, consumers do not need to disclose any identifiable personal information (e.g., their real name, address, telephone number, and credit card information) to the platform while making a digital asset purchase. In this regard, the ownership of the digital asset is attached to the unique address generated by a crypto wallet regardless of the identity of the purchaser. Importantly, the ownership transaction is added to the chain in real time without relying on enforcement authorities and exchange actors' trustworthiness.

In terms of physical exchange, we foresee a solution for retailers and marketplace platforms by verifying the consumers' identity using a decentralized identity network. For instance, in the near future, Finnish retailers could verify consumers' legal age limit for alcohol consumption by connecting with Findy—a national verifiable identity data network in Finland. In this regard, private retailers and online platforms could verify consumers' personally identifiable information via real-time integration with national-based identity networks, which directly enables trust in exchange actions. For this reason, in the blockchain-enabled exchange, consumers shift their trust towards a decentralized identity network (e.g., Soulbound tokens) and perceive fewer privacy concerns during their exchange with retailers.

Digital identity and digital rights

As for digital identity management, such as Estonia's digital ID use case, blockchain technology enables individuals to prove their digital identities not only in their home country but also in other European countries without worrying about a verification process that heavily relies on physical documents and confirmations from different sources of authority. A trusted identity is vital (for example, for international migrants or refugees), potentially enhancing the process of accessing health, social, finance, and education services in another country as one's credentials and records have been verified and stored in the blockchain database (Berg et al., 2018). Further, as explained in the previous sub-section, a decentralized identity network enables consumers to "have control over their identity and related attributes, rather than relying on the state authorities or monopolistic commercial actors" (Berg et al., 2018, p. 14). Apart from selectively only disclosing the information that is related to the authentication process, consumers are moving towards being in control of the credentials that represent their identity—self-sovereign identity—in order to avoid their online identity being misused by private retailers and centralized advert exchanges, which contributes to their well-being.

In terms of digital rights, to date blockchain is the only technology that can provide the ownership of exchange assets in the digital space. For instance, in the Azhos supply chain finance use case, the Liechtenstein-based blockchain service provider offers a new form of a supply chain finance solution for the chemical-pharmaceutical industry by integrating blockchain technology with IoT radar sensor technology and a euro-tokenized payment system. As such, blockchain technology enables a proof of existence for supply chain finance by executing reverse factoring smart contracts with the exchange parties.

As for branding strategy, the most prominent use case is non-fungible token (commonly known as NFT). The digital artist Mike Winkelmann (aka Beeple) sold a record-breaking digital artwork, *Everydays: The First 5000 Days*, for $69 million (Kastrenakes, 2021), the National Basketball Association (NBATopShot.com) officially allows consumers to own basketball's greatest moments with NBA Top Shot using non-fungible token, and recently, the Coca-Cola brand offered four unique non-fungible token collectibles that were inspired by shared moments of friendship (Clark, 2021). Importantly, consumers trust the ownership of a non-fungible token in the digital space without referring to any centralized parties or enforcement authorities, and the most intriguing aspect for creators is that blockchain technology enables asset provenance tracking and automated royalty payment for each exchange that occurs on-chain. For this reason, the blockchain-enabled exchange enhances trust in exchange assets as blockchain serves to protect and escrow exchange parties' digital assets in the digital space.

Managerial implications

When applying blockchain as part of marketing strategy, firms might seek three distinct directions: collaborate with decentralized advert exchanges for online advertising, integrate existing touchpoints' credentials with decentralized identity networks, and focus on designing unique non-fungible token collections for digital branding.

First, firms have to change their mindset of heavily depending on the existing centralized advert exchanges, especially when the outcomes do not meet the expected return of investment. Online advertising itself forms an essential marketing strategy as consumers have made 30% more online purchases during their post-Covid pandemic lives (Charm et al., 2020). Nonetheless, in general, firms have to depend on a few tech giants to facilitate their advertisements as publishers in digital spaces, and such a situation has resulted in the challenge of not being able to capture their advert measurement efficiently. Further, online advertising has been critiqued for its advert fraud (e.g., hidden ads and click hijacking) and viewability issues (e.g., bots), as well as its unpredictable fee charges and misleading content. We suggest that firms can assign a small portion of their advertising budget to testing a decentralized advert exchange, as well as to conducting a longitudinal comparison with the centralized advert exchange. Since the blockchain-enabled exchange is a new way of coordinating marketing activities in a trustless environment, firms are advised to recruit a new blockchain marketing team who are able to comprehend blockchain technology as an institutional technology that will change how consumers trust their brands in a transparent ecosystem. For instance, the decentralized advert exchange is considered an autonomous network rather than a centralized firm that may protect the brands. Thus, if consumers submit a complaint report about the brands' inappropriate content or misleading information to the blockchain network, such a report will be publicly available and immutable. The blockchain marketing team must know how to strategize their brand recovery efforts in the blockchain network, such as using the strategy of submitting an on-chain dispute resolution via Kleros blockchain and scrutinizing whether their brands are listed on Avalanche Initial Litigation Offering or ILO. An important remark is that all actors, including consumers, need to pay transaction fees for any exchange or transaction that is executed in the blockchain network; such exchange governance will definitely reduce the chances of unjustified complaints.

The second point is related to one of the biggest challenges faced by most firms—the rising concern around consumer data and privacy. Since the evolution of digital technology in marketing—such as social media (Li et al., 2021a, b), in-store technology (Grewal et al., 2020a, b), mobile applications (Tong et al., 2020), and artificial intelligence (Davenport et al., 2020)—consumers have been concerned about how their personal data is collected, stored, and used by the firms. One possible solution in blockchain marketing is that firms could move away from collecting personal identification information by integrating their current web stores with zero-knowledge decentralized identity networks (e.g., Polygon ID) or using a crypto hot wallet web browser extension (e.g., MetaMask), and further, by making their current web stores operation interoperable with the blockchain networks via a Web 3.0 development platform (e.g., Moralis.io) and a Web 3.0 social media protocol (e.g., Lens Protocol: https://lens.dev/). As such, firms could position themselves as supporting consumer well-being and reduce their risk of customer data breaches (i.e., enables trust in exchange actions), which is in line with the notion of corporate digital responsibility (Lobschat et al., 2021; Rangaswamy et al., 2020).

Third, firms should leverage their digital branding by designing unique non-fungible token collections. We suggest that firms could focus on three core elements of non-fungible tokens: being vogue, pioneer, and tangible. *Vogue* refers to the non-fungible token being associated with popularity and easy to recognize; *pioneer* relates to the first generation of a certain collection, the first in the industry, or new forms of non-fungible token; and *tangible* refers to the non-fungible token having tangible values, it could be extended to a physical collection so that consumers could value the exclusiveness and they could manifest the asset in the real world, such as Beeple's combination of both digital and physical art collections. Further, firms should have a well-planned roadmap regarding their non-fungible token collections (i.e., enables trust in exchange assets). For instance, blockchain marketers could consider extending the utility of the non-fungible tokens to the blockchain-based metaverse (e.g., Decentraland and The Sandbox Game), as well as organizing exclusive virtual events for the holders of non-fungible tokens to enhance customer engagement and privileged customer experience.

As for regulator entities, the exchange components (see Table 5) could be utilized to examine how blockchain projects develop corporate citizenship and take care of society-related responsibilities while serving their investors. We suggest that each component of the blockchain-enabled exchange should be cautiously ascertained to determine the trustworthiness of a blockchain ecosystem. Our developed framework facilitates regulator entities a systematic approach to evaluation and thus, it serves to alert investors about some risky blockchain projects that fail to satisfy the mechanisms enabling trust in blockchain exchange, especially projects related to dollar-pegged or algorithmic stablecoin—a digital token where the price is designed to be pegged to fiat money, a cryptocurrency, or to exchange-traded commodities—with lack of transparency, as well as DeFi protocol that offers a relatively high annual percentage yield.

Limitations and further research

The trustworthiness of this research is improved by adopting the six-phases approach thematic analysis (Nowell et al., 2017), a careful choice for the empirical research setting, and a list of informants who had at least three years of blockchain experience and were involved in marketing roles during their projects. Nonetheless, this research setting has its limitations. To ensure confidentiality of the blockchain projects and to protect informants' competitive advantages and identities, the empirical part captures the trust characteristics of blockchain-enabled exchange in a precise but holistic approach.

This study opens several opportunities for further research. An important domain is the investigation of the buyer–seller negotiation highlighted by Ahearne et al. (2021). As evidenced in the blockchain-enabled exchange, in general, buyers and sellers do not know each other during the exchange, because they rely on self-executing smart contracts to perform business transactions; autonomous and self-regulated coordination that takes place in the blockchain network has attenuated the need for negotiation as practiced in the traditional exchange. As a result, it is essential to examine how the trust characteristics of blockchain technology (1) changes in buyers' attitude and behavior, (2) changes in sellers' effectiveness in promoting their products and services, (3) changes in buyer–seller post-transactional processes, and (4) changes in buyer–seller sustained purposeful engagement (Marcos-Cuevas et al., 2016), such as their willingness to switch back to a traditional exchange after a successful transaction on the blockchain.

As for impersonal-relational trust and institution-based trust, both types of trust are in relation to non-human technology (i.e., blockchain) and thus, it is essential to understand their predictive ability and influences on consumer attitude towards a brand that is associated with the blockchain-enabled exchange (Tan & Salo, 2021). For instance, in the context of decentralized-based online advertising, will consumers hold a higher level of positive attitude towards the advertising content or the brand in general? How do consumers respond to ads since they will be rewarded from browsing the ads? What are the relationships between impersonal-relational trust, institution-based trust, inter-organizational trust (i.e., advertisers and producers), brand trust, and consumer ad attitude? Such investigations are important for marketing scholars and practitioners who seek to understand a novel way of coordinating online advertising among the exchange actors and its impact on consumer behavior.

In terms of personalized marketing strategies that highly relate to how marketers utilize consumer data to organize and design more pertinent and timely-manner marketing to maintain a profitable customer relationship (Tong et al., 2020), which have been extensively covered in a special issue of the future of technology in marketing (Grewal et al., 2020a). Such well-grounded research knowledge is discordant with the findings of blockchain-enabled exchange since the core vision of blockchain technology is moving towards consumers self-sovereign identity (i.e., consumers' full control of online data and digital identity; Berg et al., 2018), rather than applying blockchain technology as a real-time data sharing infrastructure among the firms. As such, future research should be conducted to examine how blockchain technology would result in different ways of managing customer relationships that due to a higher level of privacy protection, trust and transparency, and digital marketing security (Rejeb et al., 2020).

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