Blockchain Technology and Trust Relationships in Trade Finance

Michał Kowalski

zeb. consulting,

Head Office - Hammer Str. 165, 48153 Münster, Germany

Warsaw Office - Ul. Królewska 18, 00-103 Warsaw, Poland

Email: michal.kowalski@zeb.pl

Zach W. Y. Lee*

Durham University Business School, Durham University,

Mill Hill Lane, Durham, DH1 3LB, United Kingdom

Email: zach.lee@durham.ac.uk

Tommy K. H. Chan

Newcastle Business School, Northumbria University,

City Campus East 1, Newcastle upon Tyne, NE1 8ST, United Kingdom

Email: tommy.chan@northumbria.ac.uk

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* Corresponding Author

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Abstract

Blockchain technology has been advocated as a possible solution to enduring trust issues among trading partners in trade finance. We conducted in-depth interviews with industry experts to examine how blockchain technology influences the trust relationships among trading partners. Our results show that the technology enhances trust relationships by (1) improving the security of transactions and data exchanges, (2) facilitating the expression of benevolence, (3) enhancing the efficiency and the quality of communication, and (4) increasing the predictability of trading partners. The paper concludes with implications for both research and practice.

Keywords: blockchain technology, trust relationship, trade finance, FinTech, distributed ledger

1 Introduction

Trade is closely correlated with human evolution. For centuries trade has influenced economic conditions, public policies, living standards, and the degree of financial inclusion globally (Salvatore, 2012). International trade flows have been estimated to grow at a rate of 4% annually and will reach US$24 trillion by 2026 (International Chamber of Commerce, 2018). Trade finance plays a critical role in international trade. Specifically, up to 80% of trade worldwide uses some form of trade finance (International Chamber of Commerce, 2018). It is capable of addressing some enduring issues in international trade. For instance, importers do not prefer paying before receiving goods, whereas exporters wish to obtain payment when goods are shipped. Trade finance bridges the gap between importers and exporters, minimizing the credit risks of both parties.

Trade finance is, however, not a silver bullet for all enduring issues in international trade. It has been hampered by trust issues rooted in the multifaceted nature of international trade, such as involving multiple trading partners and intermediaries as well as varying laws and regulations across countries (International Chamber of Commerce, 2018). Essentially, trade finance processes require repeated verification, checks, and confirmations of paper documents as well as mutual trust among parties (International Chamber of Commerce, 2018), rendering them costly and inefficient (Werbach, 2018). Specifically, trust is not transferable and banks have varying levels of reputation. The involvement of multiple banks and intermediaries often prolongs document exchange processes. Additionally, trade finance is susceptible to financial fraud (Ho, 2018). For instance, a batch of goods could be financed multiple times from different banks, or trade documents could be faked to obtain finance. Consequently, comprehensive and repetitive inspections of trade documents became necessary, which in turn drove up transactional costs and prolonged concerning processes.

Advancements in trade finance are, thus, needed not only to address trust issues inherent in international trade but also to enhance its efficiency and to reduce transactional costs.

Blockchain technology has the capability of addressing trust issues in economic transactions and freeing trading partners from the necessity of implementing mechanisms to signal or convey trust (Economist, 2015). A blockchain refers to "a fully distributed system for cryptographically capturing and storing a consistent, immutable, linear event log of transactions between networked actors" (Risius & Spohrer, 2017, p. 386). Blockchain technology is based upon three technological pillars – decentralization, distributed consensus mechanisms, and cryptography – which may afford the realization of trust-free economic transactions (Hyvärinen et al., 2017). Blockchain technology is considered a game changer not only because of its potential to alleviate trust issues in economic transactions (van Wersch, 2019), but also because of its capability to offer a more cost-effective, secure, and efficient solution for data exchanges (Egelund-Müller et al., 2017). The earliest adopters of blockchain technology were financial institutions that saw its potential to improve escrow transactions or the settlement of securities (Swan, 2015). The trust-ensuring capabilities inherent in blockchain technology transform the provision of financial services (Fanning & Centers, 2016) and eliminate the need for intermediaries (Cai, 2018).

The majority of studies on blockchain technology have focused on its designs, features, and applications to the wider community. Although the technology has been purposively designed to solve trust issues (Beck et al., 2018; Risius & Spohrer, 2017), fundamental issues such as whether and how it contributes to trust-free economic transactions have not been systematically examined. Against this backdrop, this study investigates how blockchain technology influences the trust relationships among trading partners in the context of trade finance. Specifically, we endeavor to answer the following research question:

How does blockchain technology influence the trust relationships among trading partners in trade finance?

The rest of the paper is organized as follows: first, we present a research background on trade finance and discuss blockchain technology as a solution to trust issues in trade finance; then, we discuss the research method followed by results; and, we conclude the paper with a discussion on implications for both research and practice.

2 Research Background

2.1 Trade Finance

Trade finance represents all banks' activities that support trade transactions (Committee on the Global Financial System, 2014). The necessity to use trade finance stems from the indispensability to distribute risks among trading partners involved in the exchange of goods and to bridge the gaps among the production, shipping expenses, and respective payments for the goods (Schmidt-Eisenlohr, 2013). Thus, the nature of trade finance is dualistic. First, it equips both sellers and buyers with short-term borrowings needed to fulfill their bilateral contractual obligations (World Trade Organization, 2016). Moreover, trade finance provides instruments that protect one side of the contract against fraud from the other (Ahn & Sarmiento, 2019).

Three types of payment methods have been commonly used in international trade, including the cash in advance, open account, and letter of credit approaches (Ahn & Sarmiento, 2019; Ganne, 2018; Hwang & Im, 2019; Niepmann & Schmidt-Eisenlohr, 2017; Schmidt-Eisenlohr, 2013). With the cash in advance payment approach, the importer facilitates a payment or partial payment using his/her local credit line to the exporter before the goods have been produced or shipped (Ahn & Sarmiento, 2019; Ganne, 2018; Schmidt-Eisenlohr, 2013). While this arrangement is highly beneficial to the exporter, it is less

attractive to the importer because he/she bears all the risks associated with the transaction (i.e., risks that the exporter does not deliver the goods stated in the contract). In contrast, the opposite holds for the open account payment approach in which the goods are shipped and delivered before payments are due (Ahn & Sarmiento, 2019; Ganne, 2018; Schmidt-Eisenlohr, 2013). Another widely adopted payment approach in trade finance is the letter of credit (L/C) approach through which both import and export banks act as intermediaries between trading partners (Ahn & Sarmiento, 2019; Ganne, 2018; Schmidt-Eisenlohr, 2013).

The L/C approach, with the use of financial intermediaries, presents a solution to the dilemma that the exporter does not want to produce or ship their goods without payment whereas the importer does not want to pay for goods before receiving them (Dewey, 2019). The L/C approach is a "combination of bank guarantee issued by a bank upon request of the buyer in favor of the seller (normally through an advising bank) and a payment at sight or at a later stage against presentation of documents which conform to specified terms and conditions" (Grath, 2012, pp. 50-51). The L/C approach mitigates the risks among trading partners but increases their transactional costs because of the use of intermediary import and export banks. Therefore, due to this major disadvantage, the L/C approach is mainly used in transactions characterized by a substantial deficiency of trust among trading partners (International Chamber of Commerce, 2017). Indeed, the L/C acts as a deed by which banks guarantee that the payment for the goods will be made on time and in extenso if the exporter fulfills his/her contractual duties specified in the preceding agreement.

Despite the multitude of trade finance options, their major and common disadvantage is that they rely heavily on some forms of trust. Namely, in the cash in advance and open account settlement approaches, one needs to trust that his/her trading partners will fulfill their contractual obligations (Ahn & Sarmiento, 2019). For the L/C approach, however, the uncertainty regarding the integrity of trading partners is so high that one needs to rely on

neutral third parties. The letter of credit approach has been considered a relatively secure payment method in international trade and has served as a building block of "trust" among trading partners (Committee on the Global Financial System, 2014). The L/C approach, however, has several drawbacks. While it addresses some of the trust issues in trade finance, it comes with additional transactional costs. Specifically, trading partners have to cover the fees associated with the use of financial intermediaries. Furthermore, the L/C approach is susceptible to errors as a consequence of numerous repetitive inspections and authentications of trading documents (Deloitte, 2018). Moreover, the current design of the process still does not fully protect involved partners from fraud (World Trade Organization, 2019). For instance, a common fraud in trade finance stems from the fact that multiple invoices could be issued for the same batch of goods that are then used to raise finance simultaneously. Consequently, trade finance banks have to accept the resulting bad debts as a cost of business (Morris, 2019; O'Neill, 2018; Wragg, 2018). These frauds have rendered banks susceptible and skeptical towards trade finance requests.

2.2 Blockchain Technology as a Solution to Trust Issues in Trade Finance

A blockchain is a group of cryptographically encrypted blocks of information bounded together in a chain (Zhao et al., 2016). It is an enciphered database shared, verified, and executed by a network of participants (a.k.a. nodes) who have their own, immutable version of the ledger (GOScience, 2016). The network of participants performs and supports transactional activities through the computationally achieved consensus mechanism and replaces the intermediaries traditionally needed to instill trust among trading partners (Ducuing, 2019), forming the foundation of trust-free economic transactions (Risius & Spohrer, 2017). With blockchain technology, actors do not need to trust their human counterparts or institutions, but rather they need to trust the technology itself (Finck, 2018).

Such characteristics of blockchain technology have been known as "trustless trust" or "trust-by-computation" which are capable of revolutionizing economic transactions that have traditionally hinged on mutual trust among human agents (Ducuing, 2019).

Research on blockchain technology has grown with the ongoing speculation of its applications (see Hawlitschek et al., 2018; Klarin, 2019; Risius & Spohrer, 2017). Blockchain technology is known as the core component and the underlying technology of Bitcoin and has received early scholarly attention (Yli-Huumo et al., 2016). Besides, blockchain technology research has also examined a wide spectrum of issues surrounding its designs, features, and applications across different contexts, such as startup financing (Ahluwalia et al., 2020), supply chains (Kamble et al., 2019; Nærland et al., 2017), taxation and auditing (Hyvärinen et al., 2017; Schmitz & Leoni, 2019), e-residency (Sullivan & Burger, 2017), energy distribution (Hou et al., 2020), and the Internet of things (Lin et al., 2017; Marsal-Llacuna, 2018). Specifically, issues pertinent to the technology itself, such as its security architecture, data malleability, authentication, and cryptography (e.g., Beikverdi & Song, 2015; Bos et al., 2014; Decker & Wattenhofer, 2014), have been widely examined. Furthermore, the wider applications of blockchain technology across industries have been investigated (e.g., Beck et al., 2016; Kochovski et al., 2019; Sturm et al., 2019), with the financial industry being mostly examined (e.g., Chang et al., 2019; Egelund-Müller et al., 2017; Guo & Liang, 2016; Loebbecke et al., 2018; Notheisen et al., 2017). Identifying the benefits of blockchain technology has been the focus of these studies. While prior studies on blockchain technology have shed light on its designs, features, and applications to the wider community, whether and how the technology contributes to trust-free economic transactions have been underinvestigated (Beck et al., 2018; Risius & Spohrer, 2017).

Furthermore, we have witnessed increasingly more publications on blockchain technology and trade finance (e.g., Bogucharskov et al., 2018; Buitenhek, 2016; Chang et al.,

2020; McDaniel & Norberg, 2019). For instance, Bogucharskov et al. (2018) examined the adoption of blockchain technology in the trade finance process; Buitenhek (2016) examined the application of blockchain technology in banking; Chang et al. (2020) explored a potential paradigm shift in trade finance utilizing blockchain technology; and McDaniel and Norberg (2019) considered the potential role of blockchain technology in international trade, focusing on how the technology affects trade finance, customs procedures, and the provenance of goods. However, we notice that trust is not the focus in these studies, and there is a lack of a systematic examination of how blockchain technology influences the trust relationships in trade finance.

Trust refers to "the willingness of a party to be vulnerable to the actions of another based on the expectation that the other party will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (Mayer et al., 1995, p. 712). In other words, trust could be regarded as the expectation and obligation that an exchange will take place between a trustor and a trustee. The trustor is the party who trusts, whereas the trustee is the party who is trusted (Mayer et al., 1995). Trust is a basic element in almost all interactions between humans (Gambetta, 1988), including trade. Trust has multiple positive impacts on economic transactions, including simplifying transactions, eliminating the need for contracts, reducing transactional costs, and encouraging cooperation (Arrow, 1974; Hawlitschek et al., 2018; Loebbecke et al., 2018). While trust facilitates economic transactions, the deficiency of trust among trading partners in trade finance represents a major barrier to international trade (Chang et al., 2019).

Blockchain technology, however, presents potential solutions to these enduring trust issues in trade finance (Lehmacher & Mcwaters, 2017). Specifically, blockchain technology is capable of addressing issues related to interpersonal trust and technology trust (Sadhya et al., 2018). Interpersonal trust refers to trust built among involved parties (Loebbecke et al.,

2018). In trade, interpersonal trust arises when one knows his/her trading partners, believes in his/her goodwill, and/or shares common norms, leading to an expectation that all will behave acceptably within trade (Ostrom, 1990). However, interpersonal trust building is often limited to a small scale and becomes more difficult to achieve as the number of participants increases (Loebbecke et al., 2018). Conversely, technology trust manifests when a trustor places trust in a technology instead of a human agent. In this case, the technology (e.g., blockchain technology) becomes a trustee, a recipient of trust. Trust in technology reflects individuals' beliefs in the trustworthiness, reliability, and capability of a technology to perform certain tasks (McKnight et al., 2011).

Specifically, the technological architecture of a blockchain reduces the need for institutional governance and interpersonal trust by instilling trust in and within the technology itself (Notheisen et al., 2017). In contrast to legacy systems that require the use of a trusted third party, a blockchain is a *decentralized ledger*. What it entails is that a centrally supervised database that is replaced by several separate and local databases. Each transaction is broadcast to every node in the network, maintaining both its transparency and long-term sustainability (Zheng et al., 2017). Besides, once a new block is created, it has to be approved by the majority of nodes via a *distributed consensus mechanism* (Zheng et al., 2017). Once a consensus about its validity is reached, a new block will be added to the chain. Through such a distributed consensus mechanism, trade finance transactions will be recorded sequentially and permanently. The technology not only provides an indelible audit trail for the life of trade assets, verifies the authenticity of assets, and reduces compliance costs (Belin, 2019) but also improves national regulators' abilities to audit and track financial records that serve as a single point of truth should disagreements occur in trade (Moyano & Ross, 2017). Furthermore, the security of the blockchain network is further ensured through the use of *cryptography* (Caseau & Soudoplatoff, 2016). A standard blockchain-based interchange

requires a user to encrypt the data with a receiver's public key, which subsequently functions only in combination with his/her private key (Szewczyk, 2017). In this way, sensitive data are shared only with intended users.

In summary, the trust architecture of blockchain technology allows the automation of transactions based on self-enforcing rules. It makes the entire process inherently error-free and secure as well as reduces the need to trust trading partners, ensuring that transactions take place in a mutually agreed way. Against this backdrop, an investigation into how blockchain influences trust relationships among trading partners in trade finance presents a valuable opportunity to further our understanding of the dynamics of interpersonal trust and technology trust as well as the promises and challenges associated with the technology.

3 Research Method

3.1 Sampling

We use purposive sampling and target key informants with knowledge and experience of blockchain technology and trade finance. Purposive sampling is one of the most commonly used sampling approaches in qualitative research in which researchers sample deliberately instead of at random (Moser & Korstjens, 2017). Key informants are selected based on the premise that they hold specific and expert knowledge about the investigated phenomenon as well as are willing to share information and insights with the researchers. The selection of key informants is based on the researchers' judgment on identifying the most informative participants (Moser & Korstjens, 2017). Furthermore, purposive sampling ensures that different categories of respondents within the sampling universe can be represented in the final sample and that their unique yet different perspectives can be revealed (Robinson, 2014).

Due to the novelty and complexity of blockchain technology and the relative unfamiliarity of the general public with it, sampling key informants is necessary to obtain valuable information to understand how blockchain technology influences the trust relationships among trading partners (Robinson, 2014; Tongco, 2007). The targeted respondents need to possess certain knowledge about blockchain technology and trade finance. To guarantee germane and balanced discussions, we contacted representatives from various organizations, including consultancy firms, banks, and financial technology (FinTech) companies. After conducting seven in-depth interviews with participants with diversified industrial backgrounds, similar responses were obtained, signaling data saturation (Ness, 2015). Data saturation is a guiding principle in the data collection of qualitative research and indicates that closure can be attained because new data yield redundant information (Strauss, 1998). Descriptive information about the participants is presented in Table 1.

Table 1. Descriptive Information of Participants

Participant Pseudonym	*Type of Business*	*Position*	*Experiences with Blockchain and Trade Finance*
P1	FinTech	Chief Corporate Development Officer	Two years of experience in a regulatory technology startup, specializing in the implementation of digital currencies and blockchain-based financial ecosystems.
P2	FinTech	Co-Founder & Chief Operating Officer	Six years of experience in building scalable private and permissioned blockchain for digitizing currencies and storing encrypted documents.
P3	Consultancy	Director (Technology Risk & Strategy Division)	Experienced in advising on the suitability of blockchain solutions in current business models for multiple clients from Europe, the Middle East, and Africa.
P4	Consultancy	Senior Manager (FSI Strategy &	Experienced in building proof of concept on blockchain-based trade

		Operations Division)	finance platform for a major Central and Eastern Europe bank.
P5	Consultancy	Manager (Financial Services Division)	Experienced in advising on the suitability of blockchain solutions in current business models for multiple clients from Europe, the Middle East, and Africa.
P6	Consultancy	Consultant (FSI Strategy & Operations Division)	Experienced in building proof of concept on blockchain-based trade finance platform for a major Central and Eastern Europe bank and conducted extensive research on central bank-issued digital currencies.
P7	Bank	Head of Global Transaction Banking Products Division	Twenty years of involvement and nine years of direct supervision of a trade finance team of a top five international bank, and involvement in the implementation of *we.Trade* finance platform in a world-leading international bank.

3.2 Data Collection and Analysis

We conducted interviews to collect qualitative data to understand how blockchain technology influences the trust relationships among trading partners in trade finance. Interviews are a useful tool that allows researchers to build a holistic view of the investigating phenomenon by culling from a deeper pool of informants' knowledge, thoughts, and feelings (Berg & Lune, 2016). Semi-structured interviews are used because they give some leeway to probe beyond the original script of the interview while ensuring a certain level of methodicalness and consistency (Berg & Lune, 2016). Hence, we would not be limited to their preconceived beliefs resulting in foregone conclusions but can explore areas initiated by interviewees (Berg & Lune, 2016).

The interviews are divided into two parts. The first part contains questions about informants' general outlook on the characteristics and adoption of blockchain technology. The second part contains questions relating to the interplay between blockchain technology

and trust relationships in particular. The interview questions were developed based on the six perspectives of the model of trust (Hurley, 2006). We started the interviews with introductory questions to allow the participants to familiarize themselves with the broader context of the study prior to delving into the details of the study (Kvale & Brinkmann, 2009).

The interview process follows strict procedures. After a date for a meeting or telephone interview was set, the informants were sent the interview script. These actions were taken to ensure the quality of the collected data stemming from a higher level of preparation by the interviewees from both the epistemic and mental perspectives (Bell et al., 2018). It has been pointed out, however, that a script serves only as a guide and that participants are encouraged to share their perspectives on a subject openly. With consent from participants, interviews were audio-recorded and then transcribed. We analyzed the transcribed data by carefully reading and reflecting on them, comparing notes, and resolving differences (Hennink, 2011; Lapan, 2012). Thematic analysis was performed on the transcribed data (Constantiou et al., 2014).

4 Results and Discussions

Following the procedures suggested by Boyatzis (1998), we proposed themes using the prior-research-driven method and performed thematic analysis following the six perspectives of the model of trust (Hurley, 2006), including security, similarity, alignment of interest, benevolent concern, communication quality, and predictability. The names of these six perspectives related to trust are extended to fit into the current context of blockchain technology and trade finance as well as to match the patterns emerging from the interview data.

4.1 Improving the Security in Transactions and Data Exchanges

Cross-party trust increases as a result of the enhanced security of a social setting (Volery & Mansik, 1998). Based on the interviews with experts from related industries, blockchain technology is believed to positively influence multiple facets of security and thus trust between parties. Specifically, the distributed consensus mechanisms of blockchain technology are capable of maintaining data integrity and protecting data against malicious modification or destruction. Data are coupled together in a block, cryptographically sealed, and then chained to a previous block. A block cannot be changed without the consensus of the majority of nodes.

"As blockchain is concerned, its undeniable benefit is decentralization. Decentralization is understood not only as data sharing through different channels but also the ability to restrict unauthorized changes in data. Currently, we have one central database, and everyone needs to connect with one hub. If we use blockchain, then, we will be able to solve this problem. It's obvious that no one controls this database, which means that fraud or changes in data are hard to carry out." (P7, Head of Global Transaction Banking Products, Bank)

Additionally, the immutability of data afforded by blockchain technology renders it particularly vital to ensure the security of data exchanges that involve multiple parties.

"Security is definitely increased because the transparency of the exchange increases. Everyone sees that trade has been processed, executed, or that money has been received by the exporter. Because once something is saved on blockchain it is almost impossible to change or delete." (P3, Director, Consultancy)

"It is really difficult to change something once it has been chained into the block. This feature is vital in processes like trade finance, where data flows through many parties who want to be certain that the data are available, true, and have not been manipulated with. If we assume that the parties will place trust in the technology where

information about the transaction cannot be easily changed, then it can enhance security." (P4, Senior Manager, Consultancy)

Furthermore, blockchain uses cryptography. Even though data are disseminated and stored in each node of the network, they can only be decrypted with a user-specific private key. Consequently, unauthorized data access is of a much lower scale because a hacker would need to plan attacks case-by-case instead of just accessing a database with tens of thousands of records in a single attack. Thus, data availability is ensured even when parts of the nodes are hacked or fail.

"It uses state-of-the-art cryptography to secure these data." (P2, Co-Founder & Chief Operating Officer, FinTech)

"In legacy systems, from which everyone downloads data and where everyone connects to one server, a problem arises when they are hacked or failed. In blockchain, there is no such a problem. Even if 10% of nodes fail, 90% still share and confirm the information." (P3, Director, Consultancy)

Collectively speaking, blockchain technology enhances data integrity and protects trading partners against fraud in trade, which in turn enhances interpersonal trust among trading partners.

4.2 Promoting Similarity among Trading Partners through Blockchain Consortia

Similarity among parties is an essential factor influencing trust relationships (Hurley, 2006). Trading partners usually do not possess many similar attributes. Frequently, they are located on different continents, use different banks, and have different practices. Nevertheless, the implementation of blockchain technology can change this situation as a consequence of closer cooperation among trading partners and intermediaries. For instance,

banks can create a consortium that will be responsible for delivering trade finance solutions to others.

"It is not possible to build a blockchain solution alone, so you need to have a consortium. If a couple of banks are willing to change something and willing to make this change happen, then, most [other] banks will follow." (P7, Head of Global Transaction Banking Products, Bank)

Under the setting of a consortium, participating banks will pay a licensing fee for the service provided by this entity and the profits will be subsequently redistributed to its shareholders.

"These consortia are open, but you have to pay a licensing fee. It is a yearly fee. There are different models that charge banks based on the volume or the number of transactions. Banks negotiate their terms to have preferential rates." (P4, Senior Manager, Consultancy)

The consortium not only distributes the costs of initial investment but also assures that banks, which have varying levels of reputation, will have higher credibility because of their affiliation with trustworthy partners on the platform. Such an affiliation with a group sparks bilateral trust (Gulati & Gargiulo, 1999). Thus, the introduction of a consortium to trade finance will enhance the interpersonal trust among trading partners due to their similarity and shared affiliation.

4.3 Aligning Interests of Trading Partners

The alignment of interest promotes the creation of an environment of trust. This is derived from the notion that "if a promise is blatantly against the self-interest of the promising party then it will be legitimately mistrusted" (Lindenberg, 2000, p. 12). In trade, businesses generally tend to mistrust each other because partners all try to maximize their

profits at the expense of others or even by deception (Kaihara, 2003). Nevertheless, blockchain can solve this trust reducing issue with the use of smart contracts. Smart contracts treat rules explicitly and reduce the probability of deception.

"Smart contracts are preprogrammed contracts that [automatically] facilitate payments after each side of the contract fulfills its contractual obligation. Therefore, we can eliminate risks that someone will pay but will not receive anything in return." (P6, Consultant, Consultancy)

Furthermore, as a blockchain is immutable, it is straightforward to validate a claim against a dishonest partner. The consequences of being dishonest on a blockchain-based trade finance platform would be significant due to the transparency of records. These consequences could include longer payback periods or simply being expelled from the platform. However, cheating and deception cannot be completely eliminated from the processes. Specifically, people are creative in devising new ways to cheat despite that blockchain technology being purposively designed to prevent this behavior.

"When someone is found to be dishonest [in the platform], others will not want to make any transactions with him." (P4, Senior Manager, Consultancy)

"People will stay creative, and they will always be able to cheat. It stems from human nature. It is totally outside the scope of technology." (P1, Chief Corporate Development Officer, FinTech)

"We can always imagine that there is a malicious actor who tries to deceive another party, such as to impersonate one side of the transaction. However, it is a problem with every existing solution. Where there are interactions between humans and the system, there will always be extortion. Technology cannot eliminate this." (P3, Director, Consultancy)

"One can always find a dishonest contractor, and that's why blockchain has been developed. It goes both ways – both importers and exporters might not hold up their end of the bargain. There is still a way that someone sends lead instead of gold. Blockchain can't eliminate that, because one can always find oneself in a situation where someone sends something that resembles what has been stated in the contract but with a lower quality." (P4, Senior Manager, Consultancy)

All things considered, it is reasonable to presume that blockchain technology helps align the interests of trading partners and thus enhances bilateral trust. Nevertheless, it must be noted that a fraction of the network would still take advantage of the technology regardless of its intricacy. Thus, the impact of the alignment of interests on bilateral trust among trading partners will be highly dependent on the extent and effectiveness of the potential disciplinary actions exercised by both the authorities and the management of the trade finance platform, which are beyond the scope of the technology itself.

4.4 Facilitating the Expression of Benevolence through Building Consortia

Benevolence, the "extent a party wants to do good to his partner, aside from an egocentric profit motive (Smith et al., 2006, p. 718)", is crucial in fostering bilateral trust (Mayer et al., 1995). Concerning trade finance, benevolence could be expressed by banks' willingness to sacrifice some short-term profits to create a multibank solution that would benefit not only themselves but also the whole sector. In view of this, it is vital to note that the costs of expressing benevolence are substantial because banks have to integrate the blockchain application programming interface (API) into their core systems as well as provide resources to support the development of unproven solutions. Thus, benevolence in the context of blockchain and trade finance is expressed when such contributions benefit all involved organizations together.

"This kind of joining would require some investments in this consortium. The smaller problem would be the integration with banks' systems and the development of their API. However, what would be more expensive from the banks' perspective would be sponsoring the consortium to ensure it works on a given solution." (P7, Head of Global Transaction Banking Products, Bank)

Expressing benevolence helps maintain long-term trust relationships among trading partners (Lee et al., 2004). The cooperation among banks and their collective investment in building a consortium for trade finance will result in an increase in the bilateral trust among them. Consequently, the clients of banks will be more likely to trust trading partners whose banks have contributed to building the consortium.

4.5 Enhancing the Efficiency and Quality of the Communication in the Trade Processes

Efficient and quality communication foster a psychological link among parties, setting off a perpetuating trust cycle (Hurley, 2011). Existing communication among trading partners in trade finance has been hampered by the error-prone and time-consuming exchange of paper documents. Blockchain technology is capable of improving the efficiency and quality of communication and inducing trust among trading partners.

"There is convenience [in using blockchain-based solutions] because you don't need to create and process [paper] documents. Therefore, it is convenient not only from the side of the contractor but also from banks as they can eliminate costly paper [-based exchange]. The transaction will be available to both sides almost instantly, and each side will know what happened with it. Thereby, it improves not only the communication among trading partners but also trust in processing transactions on this kind of platform." (P4, Senior Manager, Consultancy)

"It makes contact easier because it is a fully electronic one. I could imagine a situation where a contractor electronically notifies the merchant for sending the commodity. Then, it is verified on a border. This information is [then] added to the blockchain and disseminated to other parties. Therefore, even if there are many players involved in the process, they can still communicate directly and efficiently with each other." (P7, Head of Global Transaction Banking Products, Bank)

Inter-organizational communication using blockchain technology ensures that transactional data will always be available to both sides of the deal. The improved speed of communication is attributable to the digitization of trade processes.

"Trade processes can be made faster. In the current situation, we spend lots of time completing and authenticating documents associated with a transaction. If we process them digitally and automatically, we can save a substantial amount of time." (P1, Chief Corporate Development Officer, FinTech)

"In areas such as trade finance or syndicated loans, it will shorten the time needed to process the exchange." (P5, Manager, Consultancy)

The thoughts of the respondents and empirical evidence in the literature suggest that efficient and quality communication is trust-inducing (Thomas et al., 2009). Blockchain-based trade financial solutions are believed to enhance the efficiency and quality of the communication among trading partners and thus improve bilateral trust.

4.6 Increasing the Predictability of Trading Partners with Smart Contracts

Predictability, the general belief that a partner will act foreseeably and consistently (Palmer & Huo, 2013) influences interpersonal trust relationships (Mayer et al., 1995). Specifically, a higher level of predictability is believed to lead to a higher level of mutual trust (Olekalns et al., 2007). In trade, predictability can be referred to as the extent to which

partners are convinced that a shipment will be delivered or paid for according to the prearranged covenant (Ratnasingam, 2003). Respondents coincidentally indicated that the smart contracts built into a blockchain-based trade finance platform can increase trade predictability as they treat contract rules consistently and explicitly. Thus, if an exporter meets his/her contractual obligations, the corresponding payment will be automatically processed without the need for further authorization.

"We can program these [smart] contracts to execute a certain task depending on certain elements, such as sending out the money if the shipment reaches a target. It would be communicated by certain GPS-enabled IoT trackers. If there is a situation that validates the transaction to be correct, then we won't need another authorization. So, everything will be processed in the same way as it was stated in the smart contract." (P1, Chief Corporate Development Officer, FinTech)

"Yes, that's what smart contracts are all about. They are supposed to be automated processes in order to execute specific tasks automatically after a certain action has been taken." (P3, Director, Consultancy)

However, some participants argue that blockchain technology and smart contracts cannot eliminate all risks in terms of trade predictability and the trade process will still need to be based on a certain extent of trust among trading partners.

"To a certain extent, because blockchain is only a part of a larger infrastructure. I believe that blockchain is not an answer to all problems. If some mistakes are made, then blockchain will not always be able to solve them." (P1, Chief Corporate Development Officer, FinTech)

"The transaction will still need to be based on trust. These platforms will not eliminate all risks. These risks will be reduced because everything is validated more quickly and that everyone has access to a full set of information. However, there will

always be risks. For example, the exporter will send a commodity but instead of gold he/she can send lead." (P4, Senior Manager, Consultancy)

"Blockchain will be a tougher solution to commit that kind of fraud because everything we do in blockchain is public knowledge. Thus, this could discourage malicious actors from acting deceitfully." (P3, Director, Consultancy)

To conclude, smart contracts enhance the predictability of trading partners as well as the control and risk management of trade. However, as coincidently indicated by several respondents, blockchain technology is not capable of providing an environment for trust building beyond the technology itself (Hawlitschek et al., 2018). The need for trust does not readily disappear with the use of a blockchain, but rather it shifts to the selection of trusted trading partners and the development of appropriate governance models. Cheating and deception could not be eliminated from the processes because of the intensive human interactions involved, rendering it challenging to conduct transactions in a entirely trust-free manner.

5 Contributions

5.1 Implications for Research

This study advances the literature on blockchain technology in several ways. First, the role of trust has been an emerging research area in the literature on blockchain technology (see Hawlitschek et al., 2018). We advance the current understanding of the applicability of blockchain technology in the context of trade finance from the trust perspective, adding to the literature on blockchain technology that has focused either on technical aspects (e.g., algorithms) or non-area-specific evaluations (e.g., generic applications to the broader community) of the technology.

Second, our study responded to the call for investigations on the role of trust in economic transactions. Specifically, our findings show that the use of blockchain technology in trade finance improves the security of transactions and data exchanges, enhances the efficiency and quality of the communication in trade processes, facilitates the expression of benevolence through building consortia, and increases the predictability of trading partners with smart contracts. All of these factors contribute to enhancing the trust relationships among trading partners. However, although blockchain technology might help align the interests of trading partners, it requires further disciplinary actions from both the authorities and the management of the trade finance blockchain-based platform. While blockchain has been repeatedly confined as "the trust machine", it has been unclear how trust could be enhanced and from what perspectives. This study sheds light on this aspect by examining how trust relationships among trading partners could be enhanced and pointing out perspectives that deserve further scholarly attention.

Furthermore, our study adds to the literature by revealing the role of such disruptive technology in trade finance and highlights the need for further investigations into the boundary and essential conditions of implementing blockchain-based trade finance solutions (Behnke & Janssen, 2019). Specifically, due to its immutable and tamper-proof characteristics, blockchain technology has enormous potential in addressing interpersonal trust issues by transforming transaction processes in trade finance into trust-free ones and inducing trust in the technology itself. However, our findings echo those of Pazaitis et al. (2017) that "when it comes to more complex social relationships, involving sharing of resources and assets, blockchain technology alone does not suffice for people to develop trusted interactions (p.217)." The findings of our study provide insights into the trust relationships in trade finance and highlight the need to investigate further how interpersonal trust could be ensured within as well as by blockchain technology.

5.2 Implications for Practice

This study has several important implications for practice. First, our results provide practitioners with insights into leveraging blockchain technology in trade finance. Our findings reveal that blockchain technology facilitates economic transactions among trading partners by enhancing the security of transactions and data exchanges, the quality of communication, and the predictability of trading partners. However, it is not a panacea for all enduring issues in trade finance. For instance, banks still need to develop protocols to ensure data integrity, and trading partners still need to bear certain risks in trade, such as malicious attacks and deception. Specifically, blockchain technology still suffers from data entry errors, regardless of whether they are by mistakes or with malicious attempts; and the technology may not automatically detect these errors and fraud if the registration is not correct (Crosby et al., 2016). Ensuring correct data entry from human actors plays a crucial role in the implementation of blockchain technology (Loebbecke et al., 2018). Incorporating the blockchain ecosystem with the Internet of things, which further reduces human input, might be a possible solution in this regard.

Furthermore, while the decentralized ledger is designed to prevent fraud, it might induce other issues concerning data confidentiality and trade secrets given that all nodes keep a record of all transactions in the network. Efforts and resources are required to handle these issues, and these issues should receive particular attention from practitioners. Specifically, hyperledger, an open-source collaborative effort hosted by the Linux Foundation, has been advancing cross-industry blockchain technologies and applications. The wide array of emerging hyperledger frameworks and tools (e.g., Hyperledger Fabric, Hyperledger Burrow, and Hyperledger Indy) afford configurational flexibility that meets different business requirements, maintaining the benefits of a decentralized ledger while ensuring data

confidentiality among networked participants. For example, Hyperledger Fabric v1.0 enables the participants in a network to transact with other participants in the network without exposing confidential information to those who are not parties to that particular transaction (Federal Reserve Bank of Boston, 2019). Although blockchain technology has its limitations, it is advancing and possesses merits over existing legacy systems and approaches. We expect that, with the aid of maturing hyperledger technologies and tools, polished blockchain-based trade finance solutions will be continuously introduced to meet the needs of the market.

Second, while blockchain technology paves the way for transforming economic transactions into potentially trust-free transactions, it comes with concerns regarding its sustainability and suitability that should not be overlooked. Careful consideration is needed from trading partners to determine whether the anticipated benefits of implementing such disruptive technology in the industry outweigh its costs. It is, therefore, advisable for trading partners to build their technological capabilities and organizational knowledge before developing and implementing any blockchain solutions. These constraints, however, are likely to be resolved by improving current and developing new and sustainable solutions as blockchain technology matures (Glaser, 2017; Notheisen et al., 2017). Furthermore, while smart contracts are a viable solution to accelerate the entire trade finance process, they also entail risks due to the autonomous enforcement mechanisms. Specifically, errors and security vulnerabilities in smart contracts are dangerous because a blockchain carries value and rights to assets (Werbach, 2018). Therefore, organizations need to be cautious about implementing the technology in sizeable complex trade deals, especially in circumstances where the human enforcement of agreements is to be entirely replaced with algorithms.

Third, our findings show that while blockchain technology has brought a revolution in trade, we still need to improve the scale of these solutions to popularize them. In particular, trade finance involves trading partners from across the world, and the global implementation

of blockchain technology for trade finance is the key to unleashing its real power and thus is a must-considered factor for practitioners.

Furthermore, the applications of blockchain technology in trade finance could help overcome barriers and hurdles to financing small and medium-sized enterprises (SMEs) in developing countries. Specifically, approximately 60% of trade finance requests from SMEs are rejected by banks and thus trade transactions are forced to be abandoned (Morris, 2019; Wragg, 2018). These persistent and unresolved issues in trade finance stem from the deficiency of trust among trading partners, imposing huge barriers to international trade and highlighting the need for better alternatives capable of addressing them (Chang et al., 2019). Our results show that blockchain technology enhances trust relationships by improving the security of transactions and data exchanges, facilitating the expression of benevolence, enhancing the efficiency and the quality of communication, and increasing the predictability of trading partners. Emerging and blockchain-based financial instruments enhance the trust relationship among trading partners and reduce the perceived risks towards trade finance requests from SMEs, reducing the friction and costs for them to access capital.

Finally, issues related to the legal and regulatory uncertainty regarding the adoption of blockchain technology for trade finance deserve further attention from legislatures and practitioners. The lack or lag of corresponding laws and legal environments represent some hurdles to be overcome. Specifically, blockchain might induce distrust if it entirely replaces the reliance on individuals, organizations, and authorities with reliance on the technology itself, especially when blockchain technology is positioned as *the sole guarantor* of the concerned legal enforcement (Werbach, 2018). Laws and regulations should accompany the adoption of blockchain technology. Therefore, legislatures across countries should consider the possibility of amending existing laws and regulations to enable the use of blockchain technology in trade finance (BAFT et al., 2018).

5.3 Limitations and Future Research Directions

We acknowledge that this study has a few limitations, which might nevertheless lead to other fruitful research avenues.

First, this study's access to industry experts was finite. Even though the sample was diverse, the results could be skewed to represent the business side more than the technical side of the phenomenon because the majority of respondents were front-end specialists. Future research may widen the research sample to include participants from diverse backgrounds (e.g., back-end engineers) to reveal hitherto undiscovered insights. Besides, the study included respondents from FinTech companies, consultancies, and banks; however, the perspectives of importers and exporters, who are also key users of blockchain-based solutions for trade finance, were not revealed. Hence, it would be necessary for future studies to investigate the role of blockchain technology in influencing trust relationships in trade finance with samples including different trading parties. Furthermore, it is also crucial for future research to focus on a specific type of blockchain-based solution (e.g., smart contract or fraud detection) and its corresponding business model (e.g., subscription vs. transaction fee models) to understand its adaptability and relevance.

Last, studies on the limitations and vulnerabilities of blockchain technology remain scarce, leading to possibly overlooking the limitations and concerns of the technology. For instance, it has been suggested that the 51% attack is a vulnerability that is unlikely to happen (Beck et al., 2016). The reality, however, suggests otherwise. The 51% attack is not uncommon, with the most notable case being the attack on the Ethereum Classic network. A deep chain reorganization combined with double spending was detected, amounting to 219,500 ETC or $1.1M of stolen funds (Bandyopadhyay, 2019). Future research should

account for the continuous development and advancement of blockchain technology and reflect on its limitations and vulnerabilities across applications.

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