



AMERICAN
COUNCIL ON
GERMANY

February 2019

**The Feasibility of Blockchain for Supply
Chain Operations and Trade Finance:
*An Industry Study***

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on Transatlantic Business and Finance

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1. Abstract

Blockchain's transformational potential has been heralded across all industries, with some particularly enthusiastic voices even comparing its emergence to that of the early internet protocols communication protocols¹. Over the past few years, we have witnessed several enterprises start their distributed ledger technology (DLT) journey with blockchain as the magic bullet for operational process efficiencies². However, companies have often jumped into early-stage proof of concept (POC) projects without a clear ROI goal or other KPIs defined. There have been no data-based quantifications of impact in terms of investment return or realized customer value, or large-scale feasibility studies focused on process efficiencies. Indeed, many companies continue to invest in their POC, there have been no reported realizations of efficiency claims or even lessons learned³.

This paper presents a data-based perspective on the perceived feasibility of blockchain-based innovation and value creation for supply chain operations and trade finance. While expectations remain high across all regions and industries, none of the study participants indicated a financial or customer value benefit realization to date. While technical implementations were executed without major challenges, a key challenge has been the simultaneous adoption of solutions by different ecosystem stakeholders to drive actual value realization.

A qualitative review of the study results produced critical lessons summarizing the current market perspective on blockchain benefits, key challenges, as well as realization horizons. These results have resounding implications for industries with a vision to implementing and adopting blockchain technologies and can define the nature of a successful implementation of blockchain for supply chain operations and trade finance.

2. Introduction

Global trade is growing significantly, outpacing growth in nominal world GDP. In 2018 alone, the WTO anticipates growth of 4.4% of merchandise trade volume⁴. The Asian Development Bank (ADB) forecasts particularly strong growth in emerging markets, 2018 growth for at 6.0% and 5.9% for 2019⁵. Despite this, inefficiencies abound: ADB estimates the unmet demand for trade finance at ~\$1.5 trillion in 2016, with Asia and Africa accounting for 40% and 25%, respectively⁶. Micro, small, and medium-sized enterprises (MSMEs) face the biggest difficulties in accessing trade finance, representing 74% of total rejections last year.⁷ These are daunting numbers, especially considering that at least 36% of rejected trade finance transactions had been considered viable. Therein, however, lies the promise: it was primarily the cost and complexity of anti-financial crimes due diligence that caused most rejections. To capture this immense value going forward, firms must be willing to fundamentally shift from laborious and paper-based processes to re-define the current global trade finance ecosystem.

Enter Blockchain.

Blockchain describes decentralized software platforms that enable a distributed ledger system [citation]. It allows authorized participants to track and record transactions and assets in the absence of a single central trust authority, e.g., a bank. Blockchain networks have the capacity to create proof of ownership across the end-to-end trade finance process through digital signatures that rely on both public and private encryption keys only known to authorized members, thereby curtailing fraud and collusion. In addition, these networks also enable peer-to-peer exchange of data, assets, and currencies through rules-based smart contracts - a set of promises, agreed on between parties and encoded in software, which are performed automatically when agreed-upon criteria are met⁸. These "smart contract" are run on blockchain in the sense of general-purpose computation that takes place on or distributed ledger⁹. As a result, payment flows are more efficient, transparent and cost-effective, while also providing temper-proof record keeping¹⁰.

Benton et al. (2018) describe the general benefits that blockchain can bring with regards to provenance.¹¹ In particular, they describe how until recently, creating an

accessible and reliably auditable trail of information was cost prohibitive. In addition, they point to the competitive advantages that emerge from the efficiencies blockchain promises to bring. They note that particularly in the SCM space, blockchain promises to streamline regulatory and documentary processes, and potentially even remove the need for audits in many situations.

The implementation of such a nascent technology is not without its challenges. Key issues include the general lack of familiarity among market participants, as well as the need to integrate this technology with existing legacy systems. Critically, not all market participants are incentivized to partake in this revolution. For example, the business model of many mid-market trade credit funds relies on the very existence of information asymmetry and the lack of market transparency.

Supply chain and trade finance however stand to benefit handsomely. Clark Thomson from Consensus hypothesized that within the financial services realm, trade finance stands to benefit significantly, especially given its mostly paper-based processes. He points to the vast potential for the automation and streamlining, enablement of consistent insurance vehicles and risk modeling, and the ability to make capital flows cycle independent. However, to enable the seamless and fully-integrated adoption of blockchain within the broader trade finance ecosystem, the industry must be called upon to take concrete, global steps that facilitate and accelerate sustainable digitization.

When speaking with Alisa DiCaprio, the head of research at R3, Ms. DiCaprio pointed out that small and medium-size enterprises (SMEs) are the group most interested in new solutions. Currently, SMEs are at the mercy of banks. Oftentimes, these organizations avoid trade finance products not because they are too expensive, but because they cannot get them at all. Here, blockchain could render SMEs operations more transparent, thereby assisting in credit checks and KYC processes, as SMEs are often times too immature to properly signal their fitness to be financiers. However, SMEs will not be the ones driving the adoption process. A feasible approach will heavily rely on market leadership by key buyers to ensure the establishment blockchain technology standards. Banks will, at least initially, operate nodes on behalf of SMEs. In addition,

particularly for the participation of smaller suppliers, infrastructure and subsidies for the operation of blockchain nodes are a realistic prospect.

However, while many initial efforts have been undertaken across the industry, few studies addressing tangible benefits have been published. Furthermore, there are no studies that provide a data-based industry perspective on the perceived feasibility of using blockchain from the trade finance space.

This paper thus aims to quantify the market perspective with regards to the potential and limitations that DLT has vis-a-vis the operational processes underlying the existing trade finance business model. We analyzed the perceived applicability to supply chain financing and trade finance processes. Specifically, we investigated how industry experts assess to what extent industry participants expect blockchain-based solutions to impact traditional instruments such as letters of credit and trade credit insurance, as well as operational process. To that end, we conducted SME interview with a series of trade finance and insurance experts to assess existing projects as well as to analyze in-flight blockchain POCs. In addition, we implemented a comprehensive field study to assess the current pulse of the trade finance industry, and to quantify the perceived feasibility among ecosystem representatives.

By addressing these questions, we provide a first, data-based, in-depth analysis of the current market perspective when it comes to the adoption of blockchain-based technology for SCF processes. Practitioners can therefore gain a perspective how the industry perceives current developments, and where others stand in the blockchain adoption journey. In addition, we provide an overview of perceived hindrances to xx, and put these in perspective for each of the industry branches covered (i.e., finance, insurance, technology, and government).

The remainder of this paper is structured in six sections. First, we present the literature review on benefit and feasibility assessment for supply chain finance and trade finance. Subsequently, we describe our study method, both for the deep-dive expert interview and the comprehensive market pulse survey. Next, we present the results of pulse survey, which we conducted amongst trade finance industry experts – along with a discussion of the results. We conclude the article by discussing its theoretical and

practical implications, pointing to its limitations and suggesting paths for further research and exploration.

3. Literature Review

A systematic literature review was undertaken to estimate the breadth of the literature search space. Because blockchain remains a new technology, the search horizon was limited to five years. Given the large number of articles discussing the general features of blockchain, to ensure quality in blockchain discussion and credibility in the selected resources, only peer-reviewed scholarly articles were captured [12]. The term *blockchain* is commonly used but other terms such as a digital ledger, distributed ledger, shared ledger are common. To ensure comprehensiveness, the keyword string to collect articles related to blockchain technology is determined as (blockchain OR “distributed ledger” OR “distributed ledger technology” OR “DLT”). To narrow down the research scope to trade finance and supply chains finance, only articles including ‘trade finance*’, ‘supply chain*’, and ‘value chain*’ were selected.

Several articles analyzed pointed to the various potential and benefits that blockchain can contribute to supply chain management and trade finance. However, none of the publications analyzed provided data-based figures or were based on a representative study of industry experts. The assessments therefore remained opinion-based. Indeed, Judith and Martin (2018) point out that existing data on suppliers and FSPs are scarce, and that the moderating effects of SCF market adoption and technological processes, such as blockchain-based SCF, require additional research¹³.

As part of the IBM / Maersk case study, van Kralingen (2018) quantifies potential benefits as part of the IBM / Maersk case study, estimating that supply-chain operations that could reduce costs by approximately 10 percent, and increase total global trade volume by approximately 5 percent.¹⁴ Similarly, Nash (2016) describes how a blockchain-based pilot at Walmart led to Walmart reports that a more transparent and accurate record of transactions on a blockchain could lead to benefits including safer food products, enhanced flow to provide fresher products to customers, and boosted consumer trust, albeit without citing specific improvement metrics.¹⁵

“The challenge with trade finance and supply chain today is that participants are forced to use disparate digital systems bridged by paper-based processes, with little or no common standards. These digital ‘islands’ work well when everyone is on the same network, but as soon as there is a lack of connectivity with certain participants using different solutions, things quickly revert to paper and manual processing.¹⁶

In their 2018 paper, Mao et al go beyond the mere traceability of goods alone. The authors describe a system to strengthen the effectiveness of supervision and management in the food supply chain. The system gathers credit evaluation text from traders by smart contracts on the blockchain and uses machine learning for semantic analysis.¹⁷

In their 2018 literature review, Tribis et al. point out that among the 40 papers reviewed, a key gap appeared to be the absence of any data-based performance evaluation within an industrial context¹⁸.

Hofmann et al (year) report findings, which suggest that the blockchain and DLT could deliver substantial benefits for all parties involved in an SCF transaction, promising to expedite the processes and lower the overall costs of financing programs.¹⁹

Given the lack of primary research-based assessment, a comprehensive study among trade finance professionals was sorely needed to quantitatively shed light on the perceived feasibility and expectations of blockchain technology adoption in the market.

4. Methods

Data for this empirical assessment was collected via (1) long-form interviews with industry experts within the trade finance ecosystem, and (2) through the execution of a research study with 191 industry participants familiar with DLT technology.

Expert Interviews

Expert interviews were conducted with representatives from traditional financial service firms, Fintech start-ups, DLT technology leaders, trade insurance and logistics providers, as well as government entities in both the United States and Europe with the goal of painting a comprehensive picture of the current status of the DLT adoption journey with a focus on trade finance. While the adoption maturity varies, both traditional companies like Wells Fargo and start-ups like Skuchain unequivocally recognize the disruptive potential that DLT technology can bring to the existing marketplace. The road to unlocking this potential, while paved, may nonetheless require several years. Even established technology leaders like ConsenSys and R3 reckon that the true value realization enabled by blockchain technology will ensue only once all ecosystem stakeholders have taken the plunge together.

Type	Companies
Financial Services	Wells Fargo, American Express
Insurance	Chubb, Stenn International
Technology	R3, Consensus
Logistics	Euler Hermes
FinTech	Skuchain

Table 1: A list of companies interviewed as part of the expert interviews

Research Study

The initial list of prospective participants for the quantitative research study were sourced from bases on their affiliation with global trade. The group that was surveyed included representation from finance and insurance industries, as well as DLT technology providers and government / regulatory entities. The regional representation included the United States, Europe, Africa, South America, and Asia. All participants were informed that they would receive a copy of the final report if they participated.

The survey consisted of a total of 25 multiple choice and free-text questions, aimed at probing into different topics with regards to the current adoption of, as well as the outlook with regards to future applicability of DLT for the respective organization. The topics analyzed included (1) the individual's expectation of benefits from DLT solutions, (2) the perceived challenges as part of this implementation, (3) operations-related considerations, and (4) a summary of trade finance-related considerations. All questions asked within the research study are included as part of the appendix.

Of the 1,429 that received the survey, 191 individuals completed the questionnaire. Given the "cold" nature of this survey approach, a response rate of 13.4% was considered high. Of all the survey participants, 48% represented Finance, 29% Insurance, 12% technology providers, and 10% regulatory and legal professions. Representation from Europe was strongest with 47%, followed by North America (21%), Asia (10%), the Middle East (9%), Africa (8%), and Latin America (7%).

5. Results

Half of all the survey respondents indicated that their own organization had direct experience with regards to implementing blockchain technology. Among the participants that indicated direct experience, we inquired where they are in the blockchain adoption journey. Here, results appeared mostly aligned. The only outlier was amongst the insurance representatives. Here, 75% indicated that they were currently conducting market collaboration activities.

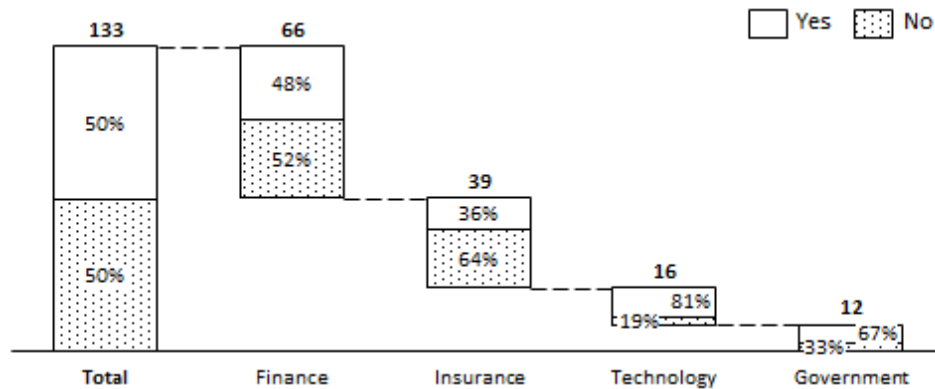


Figure 1: Does your organization have experience with blockchain technology?

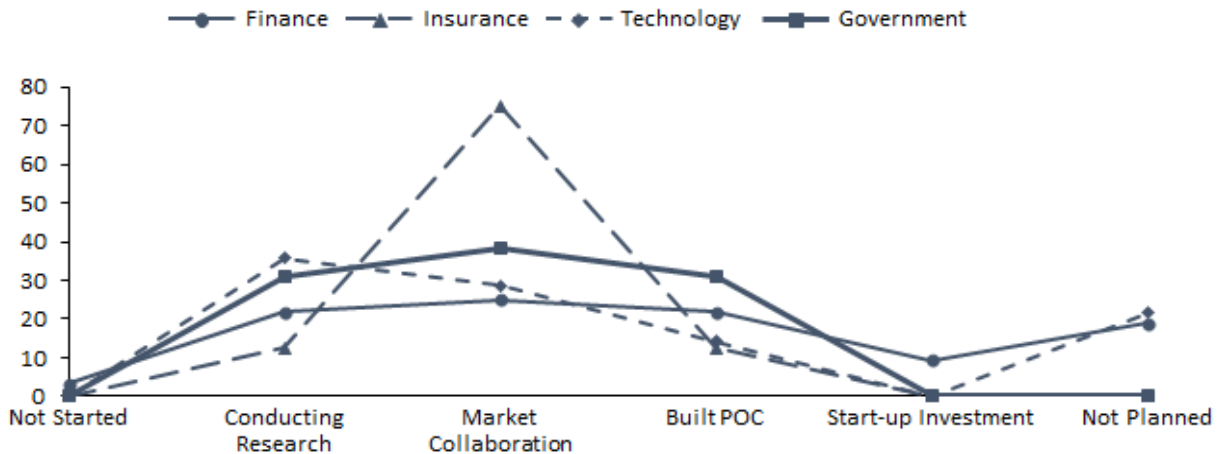


Figure 2: Where are you in the blockchain adoption journey?

We structured the review of the study results in four distinct buckets: benefits, challenges, operations, and trade finance. Analyzing the results in the groups allows us to point out interesting trends and contrasts (e.g., high benefits expectations without any realizations). This approach also helps the reader absorb the information provided.

Benefits Realization

A key area of interest is the ability of blockchain technology to deliver value for adopting organizations. We thus included a series of questions aimed at the value generation potential, financial or otherwise, that blockchain technology can bring.

When inquired after the overall benefit potential from blockchain for their organization in general, the vast majority (82.7%) of participants indicated that they do expect benefits to be realized (i.e., strongly agree, agree, or somewhat agree). Approximately 12% indicated that they were undecided, and only 4.5% voiced their skepticism.

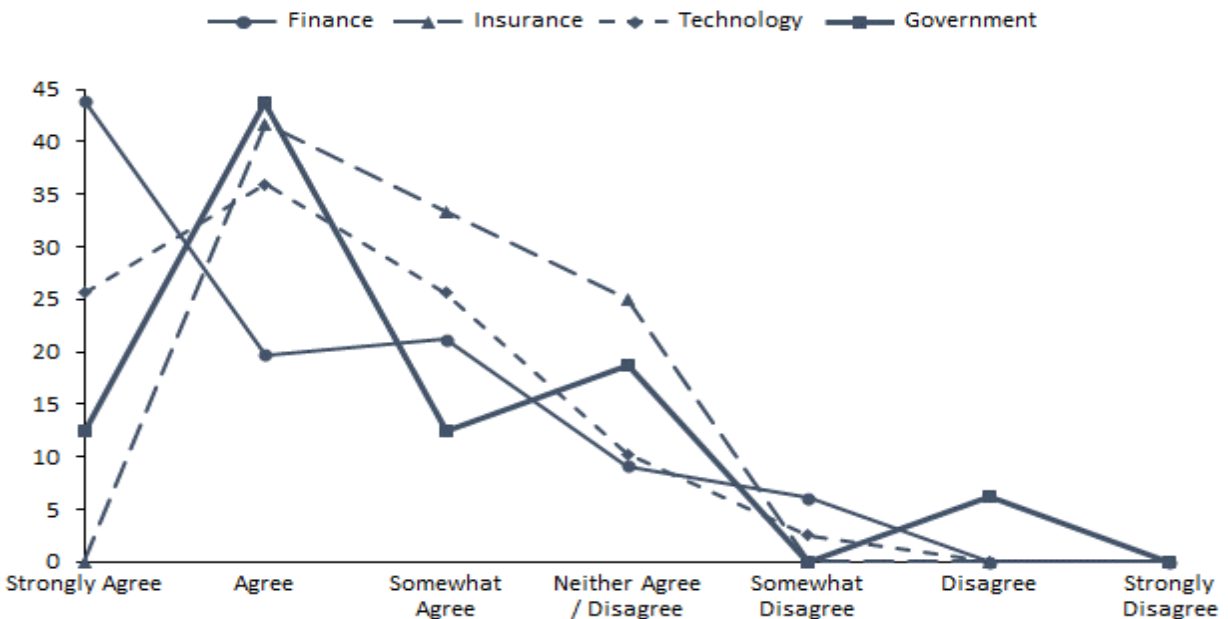


Figure 3: My organization will benefit from implementing blockchain technology.

We subsequently asked all participants which areas within their organization that believed would stand to benefit the most from the introduction of blockchain technology. We setup answer possibilities between business, technology, and operational benefits in order to measure the type of benefit that the individual groups would expect.

While finance, technology, and governmental institutions appear to see the potential for benefits across the board (i.e., business, technology, and operations), representatives from the insurance space indicated that they do not expect any operational benefits within their space whatsoever. Interestingly, participants also indicated that they look to blockchain technology to help establish interoperability standards.

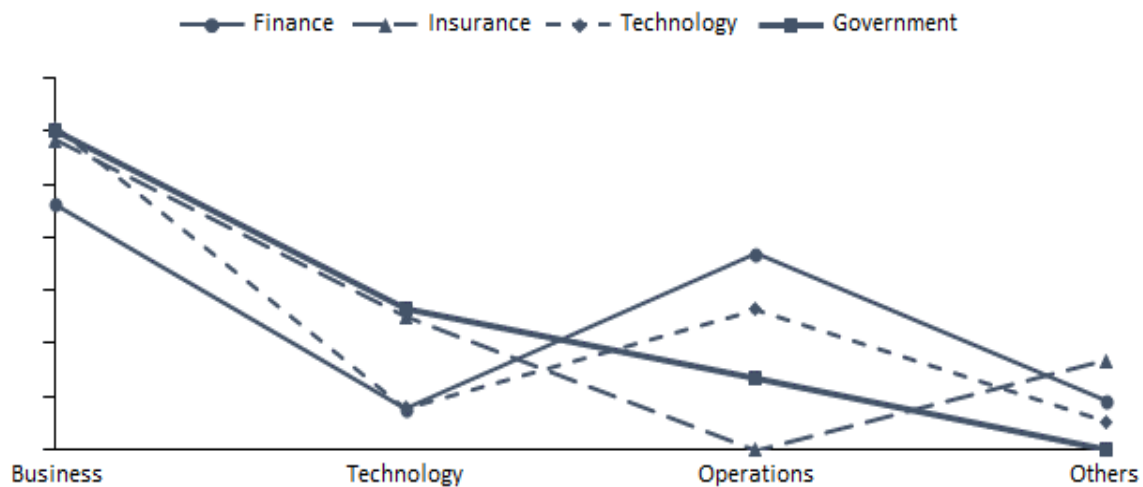


Figure 4: Which areas within your organization could benefit the most from blockchain?

A second set of questions aimed at the benefit horizon with regards to time. We wanted to know (1) how quickly participants expect to see a tangible benefit in general and (2) when they expect to see any return on investments from blockchain technology. For both, we provided mutually exclusive answer choices grouped into five distinct buckets, i.e., (1) already, (2) in 1-3 years, (3) in 3-5 years, (4) in 5-10 years), and (5) never.

When it comes to the general impact of blockchain technology, we different horizon expectation by industry. The majority (42%) of Finance respondents indicated an expectation of a fundamental impact within 1-3 years (Figure 3), while expecting tangible returns only later, i.e., in 3-5 years. Among the technology and governance respondents, the majority (44%) expected an impact in 3-5 years. Technology respondents also expect

benefits within the same time frame, while the expectation amongst the governance participants is equally distributed across all the horizon buckets. Representatives from the insurance industry had the longest expectation horizon for both impact and benefits: for both categories, the largest group of respondents (42%) expects an impact and benefits only within a 5-10-year horizon.

When asked if they expect a true moment of disruption, the vast majority (70%) of affirming respondents originated within the Finance group. Perhaps interestingly, though not surprisingly for people familiar with the latest rounds of blockchain POCs, not a single participant indicated having realized any benefits (financial or otherwise) now,

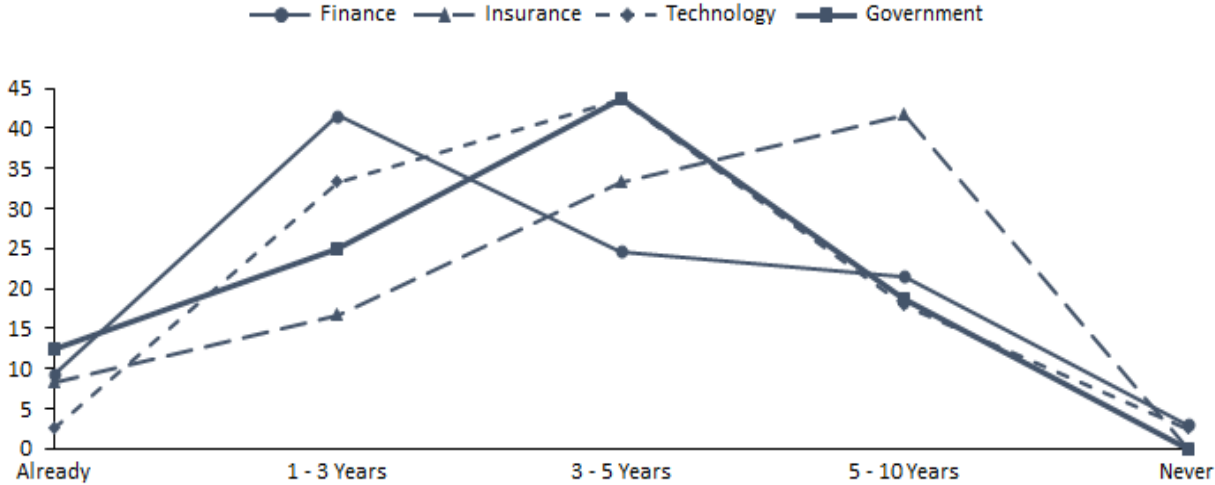


Figure 5: The spread of blockchain will fundamentally impact the operations of my industry...

Challenges

In addition to the benefits of blockchain, we also asked all participants about their perspective on the key hindrances and bottlenecks when it comes to the implementation of blockchain.

First, we asked participants about (1) the key hindrances that they see when it comes to the adoption of blockchain in the first place, and (2) specifically about the challenges that blockchain might bring when integrated into existing systems.

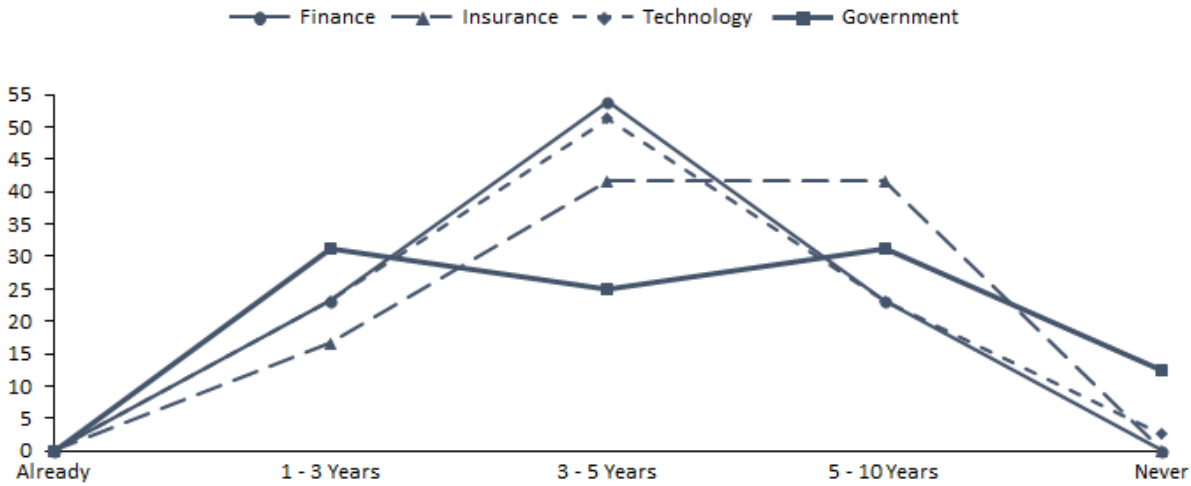


Figure 6: Investments in blockchain will produce tangible returns (i.e., cost reductions or customer value creation) ...

As depicted in Figure 5 below, the three key concerns, consistent across the board, are (1) a perceived lack of subject matter expertise, (2) regulatory & legal uncertainty, and (3) the perceived risk of low adoption overall. The concern of low adoption was particularly strongly expressed by representatives within the realm of insurance and government.

Surprisingly, for insurance respondents, the lack or absence of industry standards do not seem to be a point of concern. In addition, all groups do not seem to be particularly concerned with regards to the availability of talent in the marketplace.

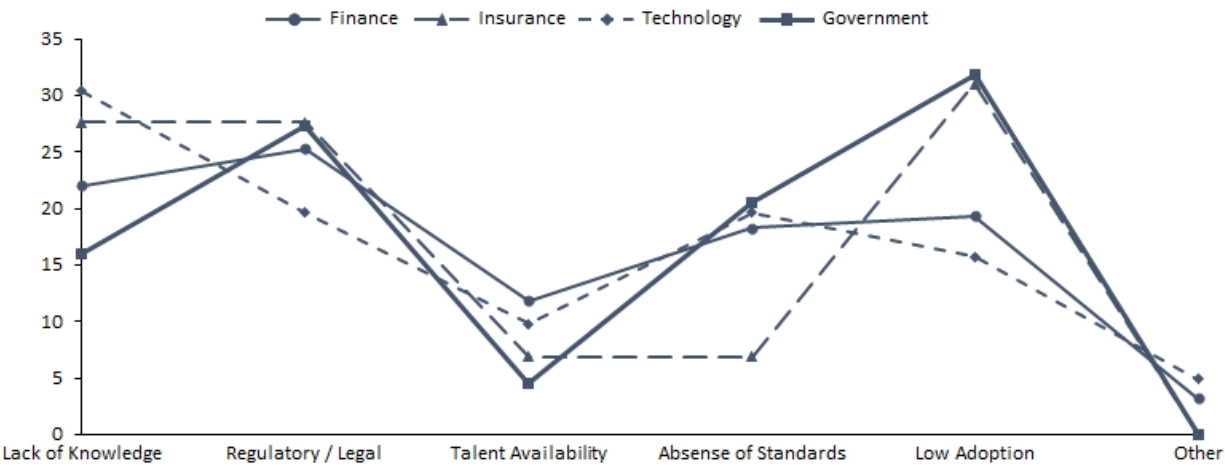


Figure 7: Which of the following may hinder the implementation of blockchain?

When asked specifically about potential integration challenges, the key concern for respondents across the board was the current absence of industry standards (Figure 6). In addition, all groups cited the general lack of experience when it comes to the implementation of DLT.

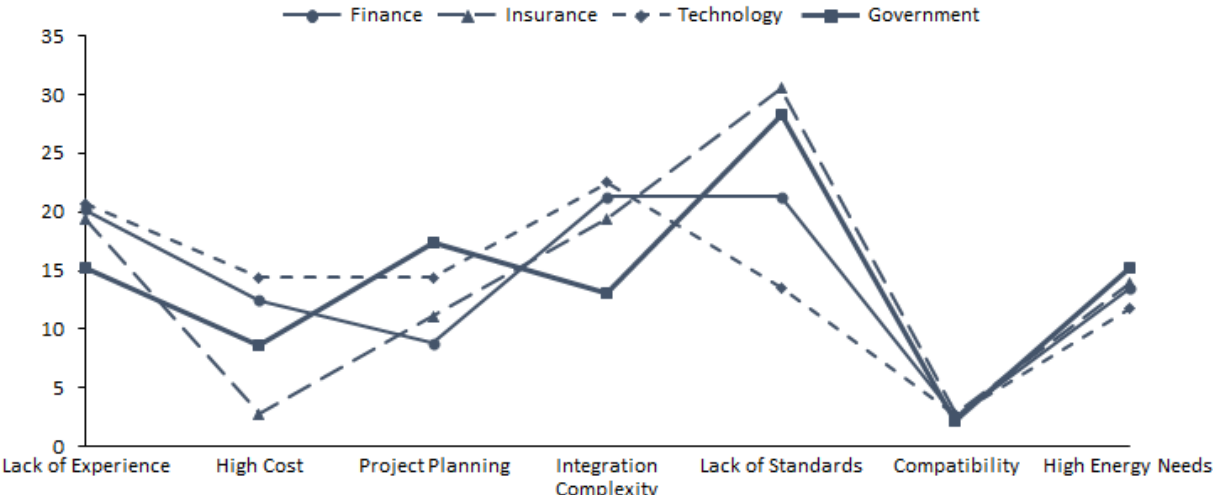


Figure 8: What are key challenges for integrating blockchain into existing (legacy) systems?

When asked about the overall talent availability for blockchain implementation in general, respondents’ opinions were consistent across all in-scope industry group. Overall, respondents acknowledged a lack of available talent today. From an outlook perspective, participants were divided as to whether the talent will be available eventually (40%), or whether it will not (46%).

When asked about potential operational risks with regards to blockchain-based operations, the key areas of concern included the absence of legal authorities (21.7%), the risk of hacking (18.3%), and the possibility of fraud (16.3%) in general. When separately asked about relevant legal considerations, the notion of jurisdictional uncertainties, especially with regards to smart contract laws, was consider the biggest concern by far (32%).

Operations

In the next section, we asked all participants about their concrete experience, as well as their expectations, when it comes to the implementation of blockchain-based products and services. We were interested in their preferred mode of implementation, as well as in the type of blockchain they were looking to deploy.

Overall, respondents indicated a strong preference for blockchain implementation using packaged-type products (e.g., SAP). When asked explicitly, 61.3% indicated that they would prefer using a non-proprietary product, while only 14.4% stated that they would prefer to build a solution in-house.

When asked about their preferred blockchain flavor for implementation, all industry groups indicated a strong preference for consortium-owned blockchain deployments. Effectively none of the participating respondents indicated a preference for public blockchain technology.

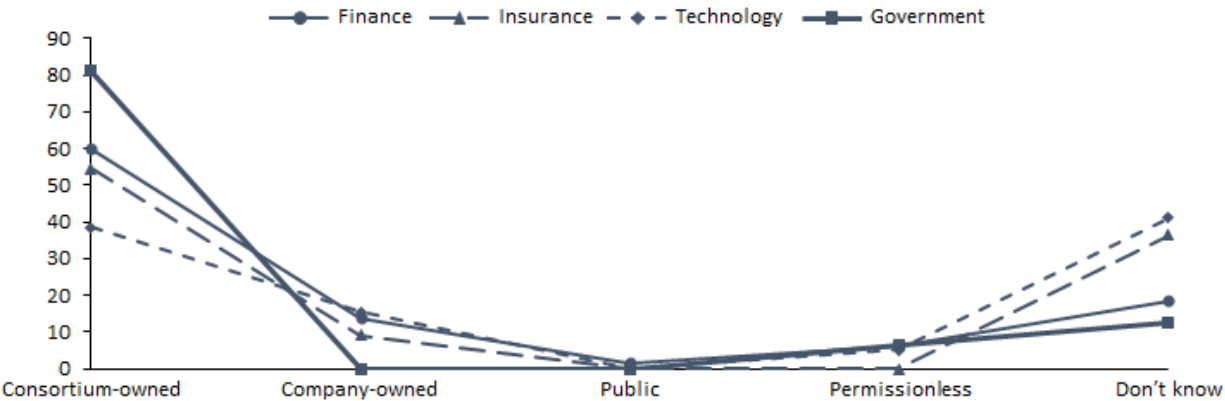


Figure 9: *What kind of blockchain do you think will be the key for large-scale adoption?*

Also, in accordance with the selected blockchain approach, most participants (52%) indicated the same preferences when it comes to the question of network interoperability. for a multi-lateral approach (i.e., a blockchain that is run and maintained by an industry consortium). In addition, 32% of participants indicated to lack the knowledge to make an informed decision when it comes to interoperability.

Trade Finance

When asked about the potential and specific applicability of blockchain technology for end-to-end process of trade finance transactions, the vast majority of survey responders expressed great optimism. In total, 71% of all participants either strongly agreed or agreed that blockchain will streamline the trade finance process. In contrast, only 6% of participants indicated that they do not expect the process to be streamlined as a result of DLT adoption by their organization.

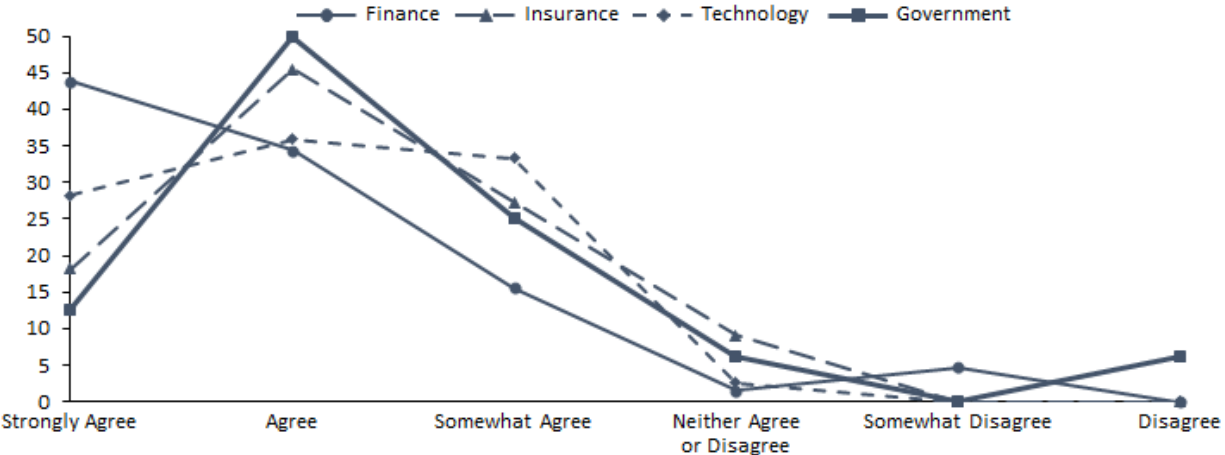


Figure 10: Blockchain can streamline the end-to-end process of trade finance transactions.

Similarly, most survey participants also indicated that in addition to the adoption of blockchain technology itself, the simultaneous modernization of existing legacy system modernization is a key consideration for the enablement trade finance efficiencies.

When it comes to tangible trade finance process benefits, the survey participants responses were once again streamlined: the vast majority expects benefits from process time reductions (41.8%), process transparency enhancements (26.3%), and overall process risk reduction (16.2%).

6. Discussion

In the previous analysis we analyzed four domains to assess the feasibility of leveraging blockchain technology from the perspective of professionals within the trade finance space.

Starting with benefits realization, we observe several surprising trends. From a balance sheet perspective, trade finance is still the bread and butter of lucrative business. Revenues have increased overall, with BCG predicting revenue growth of roughly 4.7% a year for trade finance²⁰. This sort of revenue is in a firm's best interest, as it is recurrent and independent of interest rates, thereby providing a steady income stream. Trade finance provides corporations with complete and integrated transaction banking offerings, presenting an invaluable cross-selling potential. A 2014 East & Partners Trade Finance Report projects that \$1 in trade finance fees can bring \$1.70 in FX and cross-border payment fees, and \$2.25 in other revenue²¹. The fact that most study participants foresaw strong potential for the adoption of blockchain technology can be linked to the intricacy of integrating the above-described processes. We hypothesize that blockchain technology can therefore significantly simplify integration and transactions, especially by leveraging smart contracts.

Another interesting trend was the value expectation by industry. While Finance representatives see value opportunities across the entire spectrum of activities (i.e., business, operations, and technology), representatives from insurance see business opportunities only, and no operational gains whatsoever. On the one hand, one can assume that the very nature of insurance contracts lends itself well for automation, which would fall into the realm of business applications; on the other, the notion of disruption for insurance in general, given the significant simplification of the entire industry that smart contract-based policies could bring about, is not being considered here. Accordingly, when asked about the disruptive potential of blockchain, the majority (67%) indicated they were unsure as to whether there would be such a moment of disruption.

When speaking with Pierre Sin from the Euler Hermes Digital Lab, we gleaned further indicators for the long adoption times for blockchain. Euler had initially started to

research and build solutions independently, primarily to get initial exposure. However, since 2017, the company has focused on collaborating with the main consortiums, as blockchain development is intrinsically a network-based endeavor. The key bottleneck is the establishment of standards. Naturally, with many ecosystem participants, the agreement on shared standards will take time.

Enhancing Transparency

The risk resulting from the lack of visibility in the conventional trade finance model is the primary catalyst for the increasing cost of capital. Using a technology like blockchain is expected to minimize risk and to reduce the cost of capital to shareholders. Essentially, blockchain stands to significantly improve the value chain by integrating the movement of goods, transaction processing, and payments. The technology bridges the chasm between buyer and seller in two ways:

- (1) Reducing the prevalence of manual processes, as well as automating and digitizing paper documentation
- (2) Unifying the wide array of disparate parties involved in the supply chain by establishing shared standards

Streamlining Data

In the current end-to-end trade finance process, a single transaction may exact up to 5,000 data field to document interactions²². As data flows through this process, a decreasing share of these fields (~1%) create value-adding data with roughly 85-90% registered as 'ignore/transmit to the next party'²³. Realistically, there are only 60-80 unique relevant data fields, such as reference numbers, dates, suppliers, and amounts. In the current model, these unique data fields are reused 8-10 times²⁴. This complicates the transaction process, increases the risk of discrepancies and expands the extent of redundant activities, ultimately threatening to significantly delay an already lengthy process and to increase fraud and error exposure. Fraudulent activities in the recent years have been in the billions of dollars²⁵. However, they still only account for a small fraction of the overall trade finance volume, potentially explaining why fraud was only considered a key application case for a mere ~16% of respondents.

BCG estimates that blockchain technology can streamline this end-to-end trade finance process, while enhancing transparency and reducing overlap/error, by simplifying, or potentially eliminating altogether, more than 90% of data field interactions²⁶. In addition to its intricate nature, the process behind trade finance transaction also creates a long paper trail and it may take between 5-10 days to exchange all relevant documentation.

Lastly, blockchain entries are updated by each participant on the network to reflect the most recent transaction, thereby obviating the need for multiple physical copies of the same document information. The information is stored on numerous ledgers across various entities on the network. All necessary information can be stored in a single blockchain, which saves time and improves data transparency and accuracy

Challenges

The key adoption challenges pointed out by the survey participants included a perceived lack of subject matter expertise, legal and jurisdictional uncertainty, and overall low adoption.

The notion of jurisdictional uncertainties was also highlighted by Mr. Maloney from Stenn International, a trade finance investment fund. It was pointed out that for reliable operations, Stenn only deals with jurisdictions with more predictable common law situations in place. Another key aspect in addition to legislation is the implementation ability. While India, for example, has strong laws in place, any jurisdictional processes tend to be prohibitively slow, especially when dealing with smaller entities. Indeed, 45% of manufacturing contribution in India comes from SMEs, defined as USD 1m or less²⁷. In today's market environment, the provision of financing for this market is limited and requires technology. If automation were possible, and trades could be aggregated to larger volumes, this would result in an attractive return on capital invested, both for banks and specialty finance companies.

The concern of low adoption was a concern expressed by representatives within the realm of insurance and government. This notion was also echoed by Euler Hermes. While the company has on multiple occasions witnessed consortiums bring together multiple ecosystem participants for test transactions (e.g., banks, insurers, and enterprises), little progress has materialized or operationalized. For once a product is deployed at a larger scale, you find that systems are not up-to-date anymore, and that people lose interest. When EH launched one of their earliest DLT prototypes, significant amounts of internal infrastructure had to be upgraded, due to the required real-time capabilities. Often times, when people describe the advantages of DLT, they are really describing the benefits of the internet – and not DLT-specific aspects.

Another key consideration was the absence of standards, which appeared to be relevant for all participants, except for insurance representatives. Without coherency and unification crossing the two different supply chains (buyers, sellers), the market is vulnerable to fragmentation, a circumstance under which the promised omnichannel consistency of blockchain technology will fail. Hence, the implementation and adoption of

a data standard and protocol is imperative for any blockchain based trade finance service. There has been some progress in this regard in the form of the Bank Payment Obligation (BPO) initiative. Additionally, UCP 600, the latest version of the rules that govern letters of credit transactions worldwide, solves this for letters of credit. DLT-enabled smart contracts need an equivalent set of standards and procedures.

From a business perspective, the biggest operational problem when it comes to servicing trade finance products are paper-based processes. Christopher Lewis, the global head of trade services at Wells Fargo, made this very clear. Ever since the early 90s, when there was a massive push for retailers to source goods overseas, the biggest customer complaint has been to reduce the paper from the system. The initial solution for this was the roll-out of big IT systems, mainly Oracle and SAP; the banks had to build interfaces to “tie in”. Going forward, Mr. Lewis sees the potential for blockchain technology. The biggest advantages from his point of view is the standardization that the adoption process will drive.

In addition, Mr. Lewis sees big potential for the “handling” process of transactions once a blockchain-based solution finds mainstream adoption. He imagines more efficient processes, with local banks (e.g., HSBC) providing financing in Asia, and then “handing over” this transaction to different institutions in different regions. Key hindrances for such a solution today (e.g., transfer of physical shipping documents) would largely vanish, as all information would be available within the decentralized ledger system.

Finally, Mr. Lewis expects a shift of product focus. As of today, US-based SMEs would like to do more business overseas. However, currently, this is only possible via letter of credit, with the supporting bank enabling non-recourse discounting once the goods are shipped and documents provided. The ability of using open account process, however, is limited: these would always require near total insurance coverage to meet regulatory requirements. With a blockchain-based solution, this limitation would not change, but a much more streamlined process could be enabled where financial service, insurance, logistics, and other stakeholders can interact more efficiently.

Integration

One of the most surprising outcomes of the survey was a voicing of strong interest in packaged solution products for blockchain. This trend was notable across all industry representation as part of the survey. This response pattern is also congruent with the respondents' indication of a preference for a consortium-operated blockchain – rather than any shared model. This applies both for the preferred model overall, as well as for the interaction of different blockchain.

The interest in blockchain-as-a-service offerings (whether as a packaged software product or consortium-provided use model) could be the result of the overall lack of knowledge when it comes to blockchain implementations, as well as the notion around a lack of industry standards in general.

The lack of standards within the industry has made integrating the disparate sources of data necessary to grant buyers, sellers, and any required intermediaries' interface to the network has hindered previous initiatives from successfully automating the global trade finance industry. Without having to entirely overthrow legacy systems and introducing a disconnected technology infrastructure, the parties involved in the trade finance process will need flexible tools to map the process documents and payments. The big question is therefore: how can companies best integrate this technology with their existing operating model?

In this context, Euler Hermes explained that clients are very much behind with regards to technology. As a result, ready-made solutions (e.g., R3 Corda) are easier to adopt, since they are significantly more similar to what companies already know and understand. It is because of this that Euler Hermes expects Corda to become the technology of choice with regards to blockchain implementations.

While there are genuine promises of the long-term benefits of blockchain technology, its implementation is costly as it must often be developed for the specific firm in question (did you get estimates for this from any of the interviews?). Additionally, skill sets, and human capital are required to maintain the technology efficiently; hence, firms must train or find qualified personnel. A platform like Corda, for example, only provides a

solution that works like the internet was originally supposed to: an easy way to share information in a standardized, confidential, controlled fashion amongst multiple applications. For Euler Hermes, it appears logical that controlled platforms are only an interim step; once all problems pertaining to security and confidentiality have been resolved, the company expect the emergence and wide adoption of a public platform ala Hyperledger.

A final interesting outcome was the significant number of respondents, across the board, who indicated their concern with regards to high energy needs for blockchain maintenance (13.2%). Given the near complete selection of consortium-operated blockchain ledgers, energy consumption is not a technical concern. This outcome is in line with the beforementioned notion of nascent knowledge, which was amply expressed by the participants themselves.

Trade Finance

The participants' opinions with regards to the potential of blockchain for trade finance operations were in line with the overall market excitement. In total, 93.8% of participants indicated that they believe blockchain will streamline the end-to-end trade finance process. This is amusing, especially since approximately half of these respondents had indicated earlier that they had no experience with blockchain whatsoever.

The benefits most prevalently expected by the participants, such as process time reductions (41.8%), process transparency enhancements (26.3%), and overall process risk reduction (16.2%), is notable. An increase in trade finance accessibility, one of the key advantages from our perspective, and one of the biggest challenges in today's world, was, in contrast, only pointed out by 4% of the participants. This finding is critical, as it reaffirms the strong focus of the industry on blockchain technology for operational efficiencies, and not for the enabling of new products. This is however unsurprising, as earlier estimation has focused on the operations-related cost savings. As the dependence on redundant manual processes and paper declines, blockchain trade finance can cut

costs by between \$2.5 billion and \$6 billion (35%) over 3-5 years²⁸, driven primarily through the following:

- (1) Collaborative digitization
- (2) Intelligent automation
- (3) Smart contract usage

The benefits case for blockchain-based innovation applies primarily to operational efficiencies. These, however, will in-turn enable new products, as well as market expansions, as transaction costs will be cheaper. It will be crucial for the industry to look beyond the operational efficiencies of blockchain alone, and consider other, new products that are enabled by this technology.

DLT has the potential to significantly change the trade finance aspect of supply chain management as it is a natural fit. Blockchain technology will help drive efficiencies through the ecosystem to improve the end-to-end process for all players while significantly lowering its cost.

In the short term, firms are encouraged to champion immediate initiatives to reduce risk, improve service, and reduce the cost-to-serve in documentary trade. As the marginal cost and effort required to serve clients continues to drop, firms should look to small and medium-sized enterprises (SMEs) to build scale. Lower trade finance costs are simultaneously expected to increase demand.

Realizing the benefits of DLT technology, requires the successful aggregation of the following initiatives:

- Facilitating the flow of trade receivables
- Enabling transparency of trade asset movement
- Reducing disputes and fraud to provide delivery and payment certainty.

Understanding the underlying information fabric, i.e. data points that support transactions of a players' supply chain, will help with more accurate risk pricing, and ultimately the creation of new products and services. Data flows must have a unique

purpose and path in their logistic interaction with other entities involved to avoid redundancies and duplications.

Additionally, firms must shift to digitizing documents in order to navigate the ever-evolving landscape of trade finance. Achieving scale and a lower unit cost will be imperative as trade becomes more commoditized and the customer increasingly focused on cost. Currently, it is estimated that the cost of processing physical trade paperwork is \$420 billion; this compliance cost is 5-10% of transaction value.²⁹ Under the right circumstance, digitizing the paper-dominated industry and implementing blockchain technology has the capacity to substantially reduce and eliminate this cost altogether.

In this line of thought, smart contracts are expected to streamline the trade financing process by hardwiring the various elements of an agreement between parties into automatically executing code. For example, imported goods may be scanned immediately upon arrival at the destination, prompting an automatic signal to the smart contract which would then authorize the release of funds to the exporter. In the case where parties require further assurance of delivery, the goods could also be geo-tagged so that the smart contracts would only trigger the release of the funds upon receipt of two confirmations: (a) the scan of the goods upon arrival, and (b) the GPS-based signal confirming that its delivery location is correct.³⁰

The adoption of blockchain technology in trade finance does not necessarily entail a complete overhaul of legacy systems. Banks, for example, should focus on creating a digital ring-fence with internal systems digitized and built around the flow of data. As paper use declines, banks could re-work the interfaces, rather than creating entire new business processes, systems, and data flows from scratch. Banks should see start-up technology firms and FinTechs as potential partners rather than as threats.

7. Limitations

Despite being a first of its kind (or something like that), our study also has several limitations. As we limited our study to the specific impact of blockchain-based technology to supply chain and trade finance, an exciting avenue for future research would be to investigate the projects that the survey participants have already worked on and the result that they have obtained. In addition, when considering the overall ecosystem, it would be informative to determine how many of the participants have already worked collaboratively with other ecosystem participants. However, having derived testable propositions, future research might test them in large-scale studies in related domains.

A further limitation is the large number of participants from European firms. It is plausible to assume that distinct banking and industrial contexts might alter the perspective on the blockchain adoption process as well as benefits expectations (e.g., limited use of electronic banking and strong use of checks in India). However, it is unclear how these contextual changes would impact the results. For example, particularly in regions where suppliers' access to financial markets is more restricted, they might be demanding innovations such as blockchain-based SCF, even stronger than European or American suppliers do.

Finally, our study captures a snap-shot of the feasibility perspective across multiple firms and roles. It would be interesting to study firms longitudinally as this would reveal if each firm follows the innovation adoption process detected in this research.

Our study also reveals further adjacent research topics which might guide researchers interested in the domain of blockchain-based SCF. It would therefore be interesting to broaden the research on upstream innovations to more than one type of innovation (e.g., combination of blockchain and AI-based automation). Second, readers will benefit from an analysis of the SCF innovation from the viewpoint specifically of the supplier to further complement our understanding of upstream innovations. This approach might also reveal further success factors for the implementation of SCF.

8. Conclusion

Blockchain technology has the potential to revolutionize the trade finance process by reducing operational complexity and transaction costs, while also redefining value chain interactions. At its core, blockchain is a decentralized software platform that enables a distribution ledger system (DLT). It allows authorized participants to track and record transactions and assets in the absence of a single central trust authority, such as a bank. Blockchain networks have the capacity to create proof of ownership across the end-to-end trade finance process by using digital signatures that rely on both public and private encryption keys only known to authorized members, thus curtailing fraud.

In addition, these networks also enable peer-to-peer exchange of data, assets and currencies through rules-based smart contracts - a set of promises, agreed between parties and encoded in software, which are performed automatically when criteria are met. As a result, payment flows become more efficient, transparent and cost-effective, while also providing tamper-proof record keeping³¹.

Across the board, market participants see the potential for the adoption of blockchain technology for both operational elements as well as new business products. In addition, there is overall acknowledgement and awareness of the limiting factors and hindrances that have yet to be considered. An additional key observation was that none of the study participants have realized any blockchain delivered benefit, financial or otherwise.

A key challenge to the success of blockchain technology in trade finance is the threat of market fragmentation; there must be a unified series of players consolidated under one seamless technology initiative so that clients may use it. Naturally, given the strong element of network effects in financial services, this has championed a strong focus on the establishment of banking consortiums around the development and adoption of blockchain-based solutions for trade finance and supply chain management.

While significant progress has been made in this space, blockchain technology is still in its infancy; a true set of standards has not been defined yet. As the momentum

progresses, key players will face significant challenges before reaching a seamless and revolutionary integration of blockchain. However, if made aware of such challenges, and with the appropriate knowledge and guidance, firms will undoubtedly be able to take rewarding strides towards integrating blockchain to their current trade finance process.

By analyzing and interpreting directly collect study responses from 150+ trade finance industry leaders, our study marks a first cornerstone in the exploration of this important and fast evolving field of blockchain-based innovation for supply chain operations and trade finance. It furthermore paves the way for future research into ecosystem stakeholder expectations (i.e., expected blockchain adoption timeframes and underlying rationale by different industry branches), as well as the behavior and investment patters that can be expected as a result.

9. Acknowledgements

We thank the American Council on Germany (ACG) for its continued support throughout the research process. We also thank the DZ Bank Foundation for its support of this research report.

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