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Digital Islands in Trade Finance: Can a Decentralized System Solve the Network Problem?

Alisa DiCaprio, Alexander Malaket

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Digital Islands in Trade Finance

Can a Decentralized System Solve the Network Problem?

Alisa DiCaprio and Alexander Malaket*

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Abstract

The fundamental lesson from the trade finance experiment with digital innovations over the past decade is that centralized solutions in a decentralized ecosystem do not scale. The result has been today's trade ecosystem where data flows freely within, but not between network participants. Blockchain - as a decentralized system - has the potential to eliminate data siloes and enable existing innovations to scale. But only if application builders incorporate the lessons of past attempts at transformative, global innovation. To facilitate this process, we introduce a network model of technology diffusion to explain the rise and persistence of digital islands. We then apply this model to blockchain in trade finance. This enables us to draw conclusions about the conditions under which connectivity could progress in a meaningful way, and to begin to answer the question "why blockchain?"

1 Introduction

Innovation is difficult in a decentralized system like international trade. It requires scaling across multiple networks and entities around the globe. This characteristic has historically been a significant stumbling block for digital innovations in trade finance. These innovations have to date been sporadic and largely disjointed, giving rise to the term "digital islands." The resulting lack of advancement in the financial supply chain is in contrast to the accelerating rate of evolution in the physical supply chain where 3-D printing, RFID technology and other innovations are transforming nearly every aspect of the flow of goods.

In a departure from centralized solutions, blockchain-based trade finance applications hold the promise of connecting the digital islands that now dot the landscape. But like its predecessors, blockchain is a digital technology. It shares many features with earlier efforts to solve similar problems that ultimately did not scale globally. Blockchain's impact on trade finance will depend on whether solutions incorporate past lessons.

This paper investigates previous digital innovations to identify learnings that can inform and perhaps raise expectations about blockchain. By classifying blockchain in the broader spectrum of attempts to reduce systemic frictions and increase inclusion we consciously highlight both potential stumbling blocks for global implementation and areas where it goes beyond iterative improvements of current initiatives. This serves two purposes - to identify persistent frictions in the trade finance

*Alexander R. Malaket is President of OPUS Advisory Services International Inc. based in Canada, author of "Financing Trade and International Supply Chains", advisor in international trade, trade financing and trade-related international development. Malaket is a member of the WEF E15 Initiative, the World Trade Board and Chair of the ITAC, Global Trade Professionals Alliance, among others. The authors would like to thank the following individuals for their insightful comments on the paper, as these comments led to an improvement of the work: Steven Beck (Asian Development Bank), David Hennah (Finastra), Michael Quinn (J.P. Morgan) and Dave Meynell (TradeLC Advisory). Also thank you to Martin Sim for excellent research assistance and editing.

process and to suggest how current and previous digital solutions can be most effectively targeted for further development.

We employ a framework which recognizes that the widespread adoption of a digital innovation is dependent on both design features of the innovation as well as environmental factors. Design features are determined by the application provider, while environmental factors are more about industry support and whether the ecosystem promotes diffusion and adoption of a particular solution or technology.

This framework is adapted to trade finance by incorporating the network effects particular to this sector. Though trade incorporates many types of networks, we focus on interbank and supply chain networks. This includes both traditional trade finance and supply chain financing, but excludes other trade-related and trade-enabling networks (e.g. logistics, information networks).

Our objective is twofold. First, to identify the environmental and technological limiters to digital diffusion in trade finance. This will answer the question of why digital islands persist. Second to identify what issues persist and what new issues arise in today's efforts to apply blockchain.

First, the paper details the structural reasons digital innovations have had such difficulty proliferating through trade finance networks. Then, the authors provide a retrospective of early digital innovations in trade finance. For each, we compare the historical innovation to blockchain to identify similarities. The next section directly acknowledges the challenges of blockchain as well as the fundamental changes it will require of the sector if scale is to be achieved. Finally, the paper concludes with specific observations and recommendations.

2 Why digital innovation is so difficult to scale in trade finance

Frictions in trade finance are persistent. When banks joined together to form SWIFT in 1973, it was to create a more efficient way to exchange data. Still in 2018, we're pursuing the same goal. In 2015, the average trade transaction requires 40 documents, 60% of which are re-keyed at least twice. Yet these many frictions and inefficiencies were purpose-built to reduce risk in the cross-border commercial process.

There is no shortage of solutions. ERP providers facilitate internal documentation, single window operators seek to reduce documentation at the government level, digital platforms attempt to connect all parts of the trade process. Yet abstracting general lessons about digital innovation has been difficult due to the sheer variety of solutions, many arising from the practical need to take a targeted approach to solving a subset of challenges rather than a macro, holistic approach aimed at addressing the full scope of international trade and trade financing activity.

In fact, the proliferation of solutions has introduced a secondary problem. Individual entities or services may be highly digitized, but because of the multiparty nature of trade and the need to maintain data security as well as regulatory compliance, problems are solved at the entity level not at the industry level. This silo effect has rendered the trade finance sector incapable of achieving material levels of digitization or of fully capturing the value created by digitalizing historically paper-based processes.

This section introduces our 2-factor framework to explain the extent of disruption from different episodes of innovation in a standard way. Diffusion (or, scale and scope) of innovations in trade finance is dependent on two factors, the characteristics of the technology and its environmental context.

The environmental context is particularly challenging in trade finance. After presenting the framework, we highlight two noteworthy features of the ecosystem that make scaling any solution a challenge. These are: the network structure of trade finance and the lack of a global standards body that has the political, legal and commercial force necessary to create enabling conditions for innovation across the ecosystem.

Table 1: Diffusion framework

Technology characteristics		**Environmental Context**
Relative advantage (utility of adoption)		Competitive context (competitive pressure)
Complexity (of the technology)	**digital innovation**	Organizational context (management support)
Compatibility (with user needs)		

Source: adapted from Oliviera et al (2014)

2.1 Indicators for digital diffusion

The difficulties described above have not discouraged attempts to reduce the frictions in trade finance. However, they also do not offer a great deal of insight into how blockchain will fare in the same environment. In order to have a consistent framework for understanding the diffusion of digital innovations in trade finance, we repurpose a model used to understand the diffusion of cloud computing.

The framework includes two factors and a total of five elements. They reflect that diffusion of innovation is dependent upon the characteristics of a technology and upon the environmental context in which that technology is designed and deployed. Those which are independent of the innovation itself, such as competitive pressure, or notably in trade finance, the regulatory context. And factors like compatibility with user needs that are very much in the control of those designing and deploying a particular innovation.

Consideration of these five elements helps to sharpen our focus around key lessons arising from the outcomes of recent digital innovations. It also provides an overarching logical guide to evaluate the variety of different solutions using blockchain in trade finance.

2.2 Network structure creates friction

The primary reason digital diffusion is difficult in trade finance is that trade finance innovations are often characterised by network effects (Ackerberg and Gowrisankaran, 2006). That is, the benefits to any single actor increase as more actors adopt the innovation. The variety of networks involved in a trade finance transaction add complexity as the costs and benefits will vary by actor.

Networks are a fundamental part of international trade and trade finance. A single trade transaction crosses a number of different networks. Each consists of various actors of different types that interact throughout the process. For the purposes of this paper, we consider two distinct types of networks that underpin the financing of international trade: interbank networks (also referred to as Correpondent Banking) and supply chain networks, with the latter including physical and financial supply chains.

The global interbank network is the primary channel through which traditional trade finance operates.[1] Financial institutions operate as nodes in a banking network and the links between

[1]These networks are fundamental to the proper functioning of traditional trade finance solutions such as long-established Documentary Letters of Credit, which typically involve the participation of a buyer, seller and at least two banks. The banks enable the verification and exchange of shipping documents against some form of payment or undertaking to pay at an agreed due date. The existence of a correspondent relationship between the banks acting to enable a Documentary Credit transaction is fundamental to the efficacy of these trade financing mechanisms.The challenge of bank networks is that the links cross national boundaries. In addition, the links between banks can encompass diverse transaction types including interbank deposits, payment flows, derivatives, and many others. For the purpose of this analysis, we focus on trade finance interactions and therefore bank-to-bank linkages, often correspondent relationships, together with the linkages or relationships that exist at the level of the trade flows themselves, through global supply chain ecosystems.

nodes are the correspondent relationships (BIS, 2016). Interbank networks are homogenous, tiered and low density. This means that all nodes are of the same type, and links are theoretically possible between any of them. There are a limited number of central nodes and a larger number of peripheral nodes. (Alves et al, 2013). Central nodes are typically global banks with large numbers of correspondent relationships, numbering several thousand or more.

Few innovations have successfully proliferated through interbank networks.[2] Though senior practitioners have argued that greater leverage of internet-enabled platform-based trade challenges the traditional value-addition of correspondent networks. As eBay, Alibaba and others shift from retail, low-value transactions to wholesale, business-to-business flows, this issue will come to the fore, but for purposes of this discussion we limit reference to this evolution as an illustration of things to come.

The supply chain network is the artery through which trade flows, underpinned by Supply Chain Finance (SCF). SCF is available through banks, non-bank providers as well as Financial Technology (FinTech) firms and is attracting an increasingly diverse range of providers. These networks are largely technology and platform-enabled already. SCF encompasses a range of techniques that can apply across the transaction lifecycle, from pre-shipment to post-shipment and post acceptance of an invoice. Certain techniques like Payables Finance, are most commonly delivered through technology-enabled platforms.

While some supply chain networks have quickly adopted innovations, the relatively new connection to SCF precludes definitive conclusions. Some elements of SCF such as Factoring are well-established, while the more comprehensive SCF proposition is so new that the industry has only recently (2016) published a standard set of definitions covering an initial group of SCF techniques. This contributes to the character of SCF networks to date, including the reality that these networks resemble an incomplete web exhibiting limited diffusion still under development.

2.3 Governance structure and lack of global standards deters scale

A second environmental barrier to innovation is that there is no single standard-setting or governance body that covers buyers, sellers, banks and logistics operators and other members of a trade or supply chain ecosystem across the globe. A single supply chain can involve a global buyer trading with a community of multiple thousands of suppliers and service providers around the world, with large numbers based in developing markets lacking Information and communication technology (ICT) infrastructure. The creation, promulgation and adoption of standards (industry practice, technology, rulemaking, etc) is commensurately difficult.

There is a further challenge that different jurisdictions have different rules governing trade instruments. This means innovations devised in a given jurisdiction may not be legal in other jurisdictions. The United States' Uniform Commercial Code (UCC) for example specifically allows electronic Letters of Credit, but requires other negotiable instruments to be transacted on paper and signed (i.e. UCC Article 3). One solution - discussed below - is the use of rulebooks.

Where rules are widely adopted and applied - like the Uniform Customs and Practice for Documentary Credits (UCP) that govern the use of Documentary Letters of Credit in trade finance - there is a high level of consistency across jurisdictions. This introduces certainty in markets where domestic rules are otherwise nonexistent or unclear, and presents a concrete example of the far-reaching, positive effects of a globally accepted set of "standards" around the usage of trade finance mechanisms like Documentary Credits.

Without a single, globally recognized and authoritative body to determine the legality of innovations, trade finance innovations have in the past defaulted to a single platform where all participants agree to a rulebook or incremental improvements on parts of the process that do not cross jurisdictions. While a supply chain can introduce sector-wide quality standards or a single jurisdiction can enable electronic documents, as soon as the transaction crosses to a non-member entity, the benefits of the innovation are reduced or lost completely.

[2] This network is relatively static. The only major change in the characteristics of the network being the degree of post-crisis de-risking activity, which has created the unintended outcome of disconnecting certain markets (primarily developing economies) from correspondent networks, from the ability to access trade finance, and thus from the ability to benefit through international trade.

Each of the topics highlighted in the foregoing section bring sharply into focus, some important systemic reasons for limited scaling related to innovations in trade financing.

3 Four digital innovations in trade finance

The potential that blockchain presents in this environment is that it introduces digital innovation at the industry level. It is not specific to banks or corporates, it can incorporate digital or paper documents, and it can connect to legacy systems and non-blockchain platforms in ways that should facilitate global adoption. Applications can cover any part of the trade process. However it faces the same environment as previous digital innovations.

Will the outcomes this time be different?

To find out, we detail the mechanics behind the extent of diffusion attained by four levels of digital innovations (Table 2) in trade finance. The examples each appeared poised to change trade finance globally, but thus far have settled into localized rather than global impact with limited diffusion and limited success in leveraging positive network effects. Blockchain innovations can occur at any or all of these levels, so this exercise is particularly instructive.

The analysis using the innovation framework helps us distill the specific features - technological or environmental - that presented a problem. As expected, the inhibitors to individual technological innovations are largely environmental rather than about the specific technology. Since the environment that prevails today is, in all material respects, the same, blockchain applications may be expected to face the same limiters. However even as blockchain applications target the same painpoints as their predecessors, blockchain as a platform is also reorganizing the environmental context. This has some interesting implications, which we will cover in the next section.

In each subsection, we first describe the innovation. We then evaluate the extent of diffusion based on both the technological and environmental indicators. With the challenges clarified, we then conclude each section by looking at how these issues can be expected to impact blockchain.

Table 2: Levels of digital innovation in trade finance

Level	**Example**	**Part of trade lifecycle**	**# FIs using**	**Designer**
Internal (Bank)	AI/OCR	Verification	No Independent Data	FIs
Document	eBL	Shipping	75	Logistics companies
Instrument	BPO	Financing	27	FIs, ICC/SWIFT
Standards	eUCP	Financing	65 (estimated)	ICC
Industry	Blockchain	Full lifecycle (P2P/OTC)	31% of 2018 blockchain engagements are banks	FIs, corporates, logistics, governments

Source: authors assessment. eBL data from Bolero and SWIFT. Data from 2017-2018. Bank data from Gartner. Estimated eUCP data from essDOCs.
Note: Optical Character Recognition (OCR), electronic Bills of Lading (eBL), Bank Payment Obligation (BPO), International Chamber of Commerce (ICC), electronic Uniform Customs and Practice for Documentary Credits (eUCP)

3.1 Internal digitalization

The first, and most basic level of digitalization in trade finance is internal systems innovations. Digital upgrades in internal bank systems have been happening for many years. We would expect this level to be the least dependent on environmental factors since innovations are entity-led. This level of innovation is discreet and aims to address internal issues while to some degree serving as a patch to the digital islands problem rather than solving it.

Internal digitalization takes many forms. We focus here on AI/Optical Character Recognition (OCR) in transaction banking, one of the more recent iterations of digitalization which is being developed and tested for eventual application to the full document management process. This is an interesting case where the technology clearly addresses a painpoint, but adoption has not yet progressed beyond several disconnected entities.

The problem AI/OCR seeks to solve is the cost and errors associated with verification of external documents. The document management process encompasses verification and all related elements, including resolution of any discrepancies and compliance checks. The more advanced implementations of AI/OCR in the market today target a subset of activities, with compliance checks showing the real potential of this technology. Document verification is people and process intensive, time consuming and costly. With discrepancy rates on initial presentation averaging 70% over a period of several decades, this is a material issue in traditional trade finance.

Discrepancies matter because of their role in trade delays. The presentation of documents by an exporter in support of a drawing or request for payment under a Documentary Letter of Credit is a key part of the transaction lifecycle under a Letter of Credit and determines whether payment or financing can be extended. The process is time consuming, and subject to operational risk and outright disagreement between banks and parties to the transaction. This can lead to material delays, and even unintended outcomes at the transaction level, such as a refusal of the shipment by the importer and significant financial loss for the exporter.

The potential benefit from applying AI/OCR is that it could increase productivity in operationally intensive tasks by as much as 50% (BCG, 2016). AI/OCR has proven its efficacy in the area of document-related compliance checks, which require the system to identify and analyze every noun in each document presented, verify that noun against a series of lists and thereby effect the necessary checks related to sanctions, US Office of Foreign Assets Control and other such aspects of extensive regulatory and compliance verification. Following testing and refinement, AI/OCR technology has proven highly effective at discerning potential non-compliance and has also been very effective at avoiding the triggering of "false positives" - a perennial challenge in compliance-related operational processes.

While the benefits of AI/OCR are clear, there is limited application of this technology in its full potential. One large global bank developed and launched its own in-house system in late 2016. The system is able to recognize each document, categorize it into several broad buckets (e.g. invoices, insurance), and then further organize it into sub-categories. This has streamlined the manual process of scanning and checking each document by employees, freeing them up for other tasks. Another AI/OCR solution adds the functionality of scanning in different languages other than English.

Using our 2-factor framework, we can see that diffusion stumbles on two issues. The first is the technology itself. Even though OCR is a relatively mature technology that targets one of trade's biggest pain points, the complexity and cost of the AI feature of the AI/OCR combination is high. This greatly reduces the relative advantage of implementation, despite its clear need.

The other issue is related to the environmental characteristics. Beneficially for adoption, there are no strict regulations when it comes to internal digitalization beyond a requirement to adhere to data privacy laws. However, there is incomplete alignment at senior management levels, partly because operations units do not typically report in to line of business heads, thus the objectives and success metrics (which differ significantly) do not necessarily support the deployment of AI/OCR. The need to overhaul a major component of an existing technical architecture and process further discourages adoption. These factors among others curtail the diffusion of the technology throughout the industry.

The localized success of this innovation has two important lessons for blockchain. The first is that the spread of an innovation isn't only about solving a problem. AI/OCR is a clear solution to an existing problem. But there are not - to our knowledge - comparably evolved competing solutions to the first-mover industry leader. Internal digitalization is very much dependent on

making a clear value proposition to management. Without competition and interest, innovations pool locally. Even if blockchain can deliver positive relative advantage and compatibility along with low complexity, diffusion will be limited without a convincing business case.

The second lesson is that timing matters. AI/OCR is not a solution to the digital islands problem, but rather a fix to the problem that they create. In the current transaction banking architecture, the benefit from such a solution is important, but isolated. Blockchain applications in trade finance also target document verification. However, digitalization is important to capture full gains, while AI/OCR is applicable to paper documentation. These two innovations - digitalization and AI/OCR - can have important scale benefits by linking together to address markets and sectors with different characteristics.

3.2 Digitalization of key documents

The second level of innovation - digitalization of documents - occurs outside of financial institutions. This is distinct from banks' efforts to digitize documents at the trade finance transaction level, and rather refers to efforts to digitize documentation in the wider context of trade.

In most cases, electronic versions of standard trade documentation have diffused globally, but not deeply. That is, they are accepted in farflung locations, but the vast proportion of the market has remained paper-based. The International Air Transport Association reports that only 50.8% of airway bills are electronic in 2017, for example. The reason is that changing the format of a shared document introduces an entirely new problem of the regulatory environment.

Electronic trade documents addresses two sources of friction. The first is improved security. It is easy to lose or forge a paper document. A second benefit is that electronic documentation provides efficiency and cost savings. The transfer of paper documents takes many days and requires couriers, which is costly when there are large volumes of documents. The delay caused by the physical transmission of documents drives requirements for financing, which introduces another layer of cost. Electronic trade documents can be passed between parties instantly at the click of a button. They are also less likely to contain errors, which can lead to costly delays in shipping.

> Efforts to digitize transport documents, including bills of lading, have been ongoing for nearly 20 years with significant progress being made only recently. To mitigate the problems highlighted, the International Group of P&I Clubs approved the eBL systems of Bolero and essDOCS in 2010. Both systems are fully capable of performing the three functions of a bill of lading, which is to act as a receipt, a document of title and a contract of carriage.
> Despite the benefits, existing providers of eBLs have limited uptake. As of 2016, around 40 corporates, 60 carriers and logistics partners, and 75 financial institutions are capable of transacting on Bolero. By 2016, it is estimated that approximately 3300 corporates, 27 global banks, 40 freight forwarders and ship agents, and 8 inspectors have adopted essDOCS' solution.

The case we examine here is electronic Bills of Lading (eBL). Diffusion of this innovation is geographically broad, but limited in scope. The two limiters of diffusion in this case are legal uncertainty, and high dependence on network effects.

Despite the convenience of using an electronic version of a bill of lading, there have been persistent concerns over the legality of eBLs as documents of title. Under English Common Law, the bill of lading is a document of title, and the cargo can only be delivered against presentation to the Master of an original of a paper bill of lading. Since an eBL cannot be physically presented to the Master, it was deemed not to qualify as a document of title, which contributed to the lack of adoption (UK P&I Club, 2017). The eBL is now accepted legally as a document of title, however, the network effects are not yet at the level of critical mass that will fundamentally transform industry practice.

Because the eBL operates through a rulebook, all users need to be a part of a central platform. This limits adoption to only those entities that are members. Using the framework we set forth earlier, compatibility with the needs of the users is positive, but the relative advantage of eBLs

is negative due to the high costs of implementation and its reliance on network effects, and the complexity is high as external counterparties are required to adopt the technology too.

Many blockchain solutions seek to incorporate eBL in some form. The reason is that for a digital solution the more documents that are digital, the more efficiencies are gained. This case holds two lessons for blockchain.

The first is that rulebooks - which are the current first best solution for trade finance on blockchain - may not be sufficient. In order to introduce a new product which existing regulations didn't foresee, rulebooks are a reasonable solution. This is how eBLs have proceeded, and in fact how many trade finance instruments work. However, a rulebook requires all parties to the transaction to sign onto the same guiding framework, as has been achieved over time with the near-global adoption of ICC rules. Recent years have seen activity around updating existing legal structures and guidelines including UNCITRAL, eUCP, and UCC. Blockchain is not an exception. To drive adoption, parties that want to be on the network would have to agree and sign on to the same legal framework. This will give participants the confidence that they are covered legally, thereby reducing the uncertainty that plagued eBL in its earlier days.

The second lesson is that centralized solutions in trade finance recreate digital islands. Trade finance is inherently a decentralized network. Any central solution - no matter what its originating point - will have difficulty capturing network effects.

3.3 Digitalization of instruments

Digitalizing trade finance instruments is one of the most straightforward ways that the industry has sought to improve connectivity and efficiency. There are a limited number of examples - electronic Letters of Credit in the documentary trade space and the Bank Payment Obligation (BPO) which straddles both traditional trade finance and open account/SCF. In this section we cover the BPO.[3]

> BPO is positioned between a letter of credit and open account with features of both. Payment and financing decisions are made on the basis of data matching between the importing and the exporting side of a transaction. Data from a Purchase Order, for example, can be compared digitally against data from an invoice, a transport document and an inspection certificate, as a means of demonstrating that the exporter has fulfilled agreed conditions and payment or financing can be triggered.

The benefit of digitalizing instruments is that it replaces the entire workflow. This reduces costs for banks (and potentially for end-clients), shortens transaction times due to faster data matching, and opens new streams of revenue by allowing banks to finance at different stages of a transaction. BPO was a digital innovation that solved a problem articulated by the banking industry.

Yet, BPO achieved local not global success, and thus far, modest transaction volumes. There are a number of different ways that diffusion was limited despite a seemingly strong business case. Several factors have contributed to the current state of adoption of the BPO, including:

- Unclear market positioning and value proposition
- Limited engagement of corporates in the design and deployment of the BPO
- Concerns about fraud risk in a fully digital process flow
- Unclear capital and regulatory treatment of the BPO

It has also been suggested that limited adoption has been the result of an inability to expand beyond the banking network to capture the interest of other parts of the supply chain.

[3]The Bank Payment Obligation is an irrevocable and independent undertaking of an Obligor Bank to pay or to incur a deferred payment obligation and pay at maturity a specified amount to a Recipient Bank in accordance with the conditions specified in an established baseline (ICC URBPO, 2013). It was developed directly in response to the global shift in financing trade towards open account and involves a partnership between SWIFT and the International Chamber of Commerce. BPO can operate as a three or a four-corner model, and is today described as a technology and data-driven framework to enable access to trade financing. It is applicable to transactions that mirror traditional trade finance products as well as in the context of open account trade and SCF.

In addition, for banks, the cost of adoption (versus the cost of usage, which is less prohibitive) is relatively high. Banks wishing to offer a BPO solution to clients require new governance, marketing, risk management and operational policies, procedures and expertise, together with a significant investment in ensuring that the necessary change management has been effected.

Digitalizing instruments has two fundamental requirements in the way that it has been applied. First, all participants in the transaction must be on the same platform to be able to recognize and accept the instrument. Second, it does not change the internal systems of participants, so third party matching is required. This introduces several challenges for network diffusion.

There are three lessons that can inform blockchain. The first is that while it is critical to enable easy integration to other parties, centralization removes many of the gains related to ease of integration. The requirement of having all participants on the same platform was meant to be simplified by only requiring participants to be "BPO enabled." While trade finance blockchain applications today require banks to be on the same platform, end-clients can be onboarded in the usual way and experience less disruption. Even this is quickly changing as platforms are building solutions that open membership while maintaining security.

The second lesson is that dependencies must be identified and addressed early. Data matching in BPO was envisioned to be executed through a variety of matching engines, referred to as Transaction Matching Applications (TMAs). While the SWIFT Trade Services Utility is capable of delivering the necessary functionality, the BPO architecture was intentionally designed to be workable with other TMAs originally expected to be developed by other market actors. The absence of momentum around BPO adoption is perhaps reflected in the reality that, nearly a decade after the first live commercial transaction via BPO, there is, for all practical purposes, only one TMA in the market today.

The third lesson is that the impact on other parts of the business needs to be considered. Commercial realities are such that the positioning of the BPO and the manner in which it was developed, led in part to fears of cannibalization of the fee-rich letters of credit business, as well as to risks of further commoditisation of pricing in the provision of trade finance solutions. The cost and benefits to corporates were seen to be less pronounced and in any case were not actively communicated, which resulted in a small group of core banks, but not peripheral banks, offering it.

3.4 Standards, rules and guidelines to facilitate digitalization

These last digital innovations are different from the ones considered thus far. Here we look at innovations in the standards around how digital documents are exchanged. For purposes of illustration, we consider the rules and guidelines published by the International Chamber of Commerce (ICC) to be a standard, in light of their near-global adoption, highly consistent

Despite the pedigree of the ICC in trade finance related rule-making, the eUCP add-on to the UCP, have shown very limited uptake and application. This is partly because of the limited use of electronic documentation to date and partly because of the state of advancement of the legal and regulatory context around digital trade.

> eUCP was released in 2002 by the ICC. It is the supplement to UCP, meant to address transactions conducted on the basis of electronic documents. This allows presentation of the electronic equivalent of paper documents under the UCP. The first transaction subject to eUCP was not conducted until 2013, more than 10 years after the eUCP was initially published.

Although eUCP has aimed to provide a basis for advancing the provision of trade finance on the basis of digital documents, it has not met the expectations of expanded usage. eUCP required all banks involved in the transaction to use the standard, which proved to be a major stumbling block. Many market players did not use eUCP initially as they waited for their counterparties to adopt it first. The "wait and see" posture was also a factor in the limited adoption of the BPO.

This shows that relative advantage is not positive for the eUCP due to reliance on the network

effect. The use of eUCP is complicated by the typical problems of central electronic storage.[4] With low adoption rates, the network effects did not reach the required level to fundamentally transform industry practices. Furthermore, the difficulty with electronic documentation is that the legal structure is not yet in place globally, thus limiting the applicability to countries where electronic documentation is legally recognized in the same way as paper documents.

The compatibility of eUCP to the needs of users is also negative. Since any electronic format is allowed under eUCP if it is not specified, banks may receive and have to accept documents that they cannot read. This increases liability. Low useage is also due in part to the fact that the move to electronic documentation has been slower than originally envisaged.

The lesson for blockchain is nuanced: market competition promotes diffusion, but standards competition hinders it. Today, as applications using blockchain compete for market share, many are creating their own invoice and purchase order standards. This will not impact the functionality of the solution, but will result in an inability to transfer assets between applications. This is an avoidable problem.

4 Blockchain in trade finance

The static nature of the trade finance ecosystem suggests that blockchain may repeat the same mistakes of prior efforts if it does not actively heed the lessons of history. This section aims to further inform how blockchain can navigate the potential pitfalls, and the requirements for the successful diffusion of blockchain across the supply chain.

4.1 How is blockchain different from previous innovations?

The fundamental difference between blockchain and previous innovations is that blockchain is a decentralized system, and thus not a standalone technology. Instead, blockchain has the potential to link all of the existing digitalization efforts into one concerted effort to revolutionize the supply chain and its financing. Thus far, previous innovations have been developed independently by different parties to solve one part of the process. Each of these innovations is not strongly connected with others, which results in institutions developing and implementing different systems individually. The end result is that none of the innovations gained enough traction to scale. Blockchain can change this, and ultimately enable other digitalization efforts to scale.

Although blockchain can potentially link existing innovations, it will also face some of the problems that have stymied previous innovations. These include change management, cloud-based deployment, and new governance of trade finance. To assess blockchain and determine if it will achieve global diffusion, we apply the same two-factor, five element framework that we have used previously. In doing so, we attempt to objectively and substantively answer the question raised in the introduction to this paper: Why blockchain?

4.2 Technology characteristics

The first indicator related to the characteristics of the technology is its relative advantage over old technologies. Applications using blockchain as a technology platform have shown their ability to be more efficient than similar instruments. Take for example the recent announcement made by HSBC and ING. HSBC issued a Letter of Credit for Cargill to Dutch lender ING over Corda. The trade finance transaction involved a bulk shipment of soybean meal from Argentina to Malaysia. The exchange was performed in 24 hours, as compared to the five to ten days it normally takes in the existing paper-based system.

The second indicator is compatibility with the needs of users. One of the pain points along the supply chain is the inability of various parties to quickly and accurately share trade documentation with one another. Current paper-based processes take many days and are fraught with errors.

[4] I.e., if the central database becomes corrupt and the bank is unable to retrieve the documents, can the the bank acertain receipt of complete documents?

Blockchain introduces transparency into the trade transaction for all participants. This, in addition to potential savings from efficiency will benefit all parties to the transaction. The proliferation of Proofs of Concept, the related press and industry coverage and the degree of visible discourse around blockchain adds a degree of differentiation in that corporate end-clients are more aware of this evolution and can perhaps help align the development of blockchain solutions relative to market needs.

The third is complexity. This indicator would be a design and governance choice of the industry. There are various architecture choices that are currently available. By evaluating and choosing among the different options, the industry can dictate the level of complexity of the blockchain solution.

4.3 Environmental context

There are also indicators that cover the environment in which the innovation will be deployed. The first indicator here is the competitive context. Dramatic changes in supply chain management have put in motion many changes that will not only enable digitalization, but encourage new business forms. Some of the problems with previous efforts at digitalization arose because they were "before their time". This is no longer the case: the market, and the industry are finally ready to embrace digitalization in the face of increasing pressures.

Another environmental stumbling block is the regulatory environment. The regulatory environment continues to lag practice in some countries. For example, US law requires negotiable instruments to be paper based under UCC Article 3. Electronic negotiable instruments therefore have an unclear legal basis. However, we are starting to see real change in this area. Recently, the European Parliament passed a resolution supporting blockchain technology and affirmed that blockchain should be regulated on the basis of the uses cases in specific industries. This is by far the biggest endorsement given to date by an authoritative body, and can serve as the marker for other regulations.

A third indicator is the organizational context. The idea here is that top management needs to support a digital innovation in order to champion it in the local context. A great deal of education is required to explain decentralized systems, (in comparison to, say, introduction of an electronic version of an existing document). However, unlike previous innovations, corporates, banks and every other part of the supply chain is experimenting with this technology. This gives management insight into the potential of blockchain, and enables them to see tangible benefits.

Ultimately, blockchain technology is still in a nascent stage. It remains to be seen whether blockchain can fulfill its potential in bridging digital islands, or whether it will share a fate similar to that of previous digitalization efforts. What has to be said though, is that blockchain technology can stand on the shoulders of previous efforts. By learning from history and collaborating across the supply chain, blockchain can address the challenges faced by previous innovation, and eventually achieve global diffusion across the supply chain, potentially solving a range of issues for a significant portion of the supply chain ecosystem.

5 Conclusion

The first promise of this paper was to use the lessons of prior digital innovations to highlight the stumbling blocks that are likely to exist for blockchain. Recent examples or digital innovations (with the exception of AI/OCR) all sought to open up siloed data. The biggest hurdle has been environmental rather than technological. The multiple network structure of trade and the core-periphery structure of banking networks have both contributed to the difficulty of driving adoption of innovations linked to digitalization.

Industry leaders have not often sought to collaboratively and strategically influence the rate and scope of diffusion of technology with a view to truly advancing the evolution of the business on a global, holistic basis.

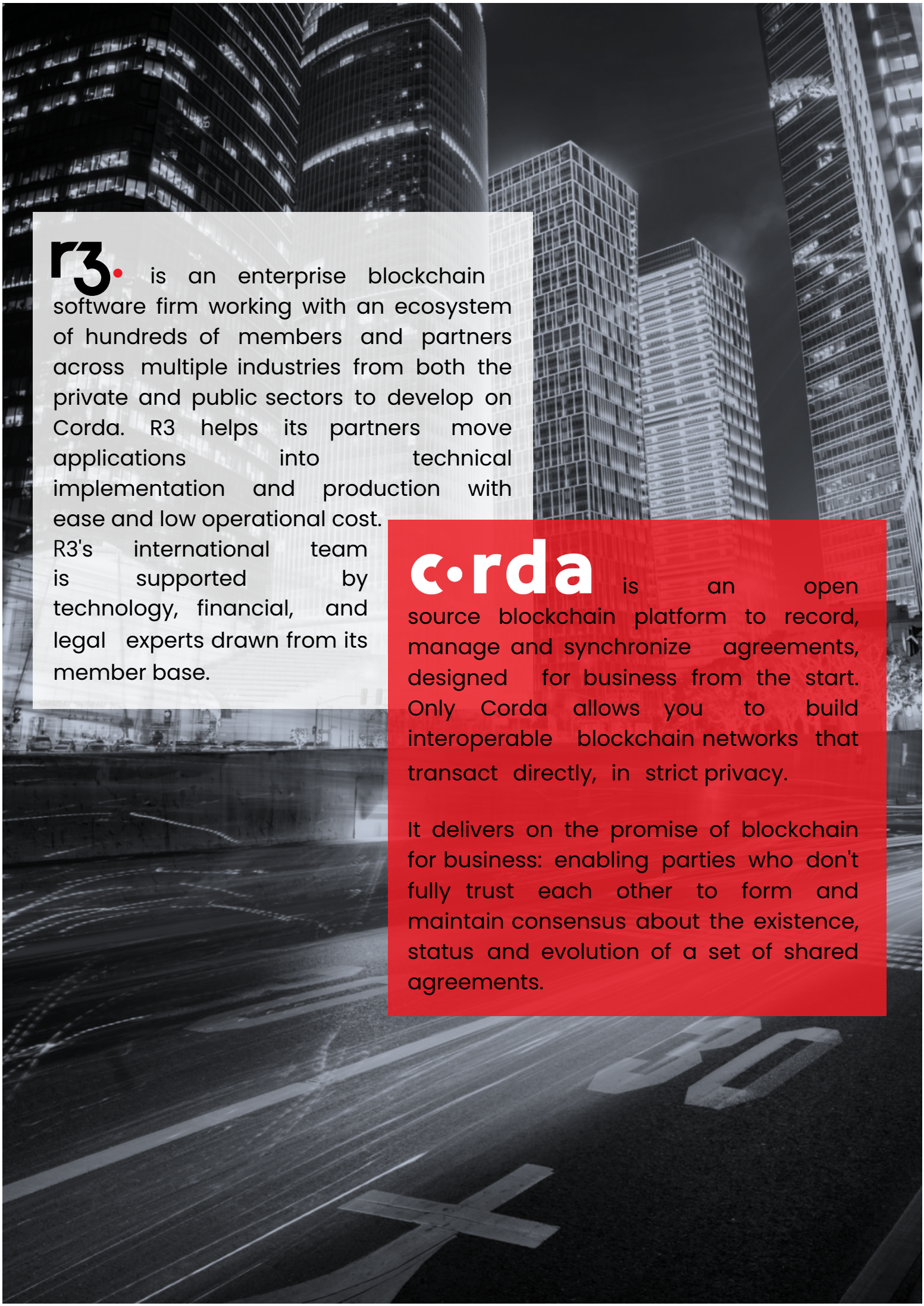
Finally, the absence of an enabling legal structure around electronic documents has also been a recurring issue.

The second promise of this paper was to highlight where blockchain goes beyond the iterative nature of improvements proposed through current initiatives. The purpose of blockchain in trade finance is not to replace existing innovations, but rather to complement them with net-new innovations and to enable them to scale.

While the BPO has not scaled well as a solution, two of the three largest blockchain applications in trade finance are building an instrument that is strikingly similar in structure, but are doing so in consultation with a range of market stakeholders. This suggests that it is an solution that meets a real need. But even if there are new forms of BPO, all of them will require standards and guidelines. These cannot come from the applications themselves. In the language of diffusion - market competition promotes diffusion, but standards competition hinders it.

This leads us to three recommendations for global leaders who are participating in blockchain trials in trade:

- Don't build the solution alone. Trade is about collaboration within and between networks. In order to create diffusion and positive network effects, all parties must be involved in the deployment of technology.
- Collaborate on standards. Today's approach to digital has one major problem. Each solution builds its own destination platform that doesn't connect to others.
- Identify new ways of risk assessment. As blockchain links platforms and opens up new data, it will accelerate diversification of risk assessment methods. This will open up new client opportunities and markets.



R3 is an enterprise blockchain software firm working with an ecosystem of hundreds of members and partners across multiple industries from both the private and public sectors to develop on Corda. R3 helps its partners move applications into technical implementation and production with ease and low operational cost. R3's international team is supported by technology, financial, and legal experts drawn from its member base.

Corda is an open source blockchain platform to record, manage and synchronize agreements, designed for business from the start. Only Corda allows you to build interoperable blockchain networks that transact directly, in strict privacy.

It delivers on the promise of blockchain for business: enabling parties who don't fully trust each other to form and maintain consensus about the existence, status and evolution of a set of shared agreements.