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THE CAPCO INSTITUTE JOURNAL OF FINANCIAL TRANSFORMATION

ORGANIZATION

Can blockchain make trade
finance more inclusive?

ALISA DICAPRIO | BENJAMIN JESSEL

DIGITIZATION

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Can blockchain make trade finance more inclusive?

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ABSTRACT

There is little doubt that blockchain technology will change global trade. The question, however, is how it will impact some of the most intractable issues in trade finance. Last year, U.S.\$15.5 trillion of merchandise exports were transported around the world. Up to 80% of global commerce requires trade finance to provide liquidity and risk mitigation. However, inefficiencies in trade finance today mean that many applications go unfunded. This U.S.\$1.5 trillion trade finance gap is widest in emerging markets and for small- and medium-sized enterprises. Efforts to address these shortfalls have gained limited traction due to the decentralized nature of trade. In this paper, we review the design of enterprise blockchains to explore how changing the architecture of trade finance could impact the drivers of trade finance gaps. By grounding our analysis in the technical architecture of a live, enterprise blockchain platform, we aim to provide a tangible discussion around the technology. Applying blockchain technology to trade finance – regardless of the top of stack application – will directly impact the flow of information, compliance challenges, and profitability in ways that can contribute to a more inclusive trade finance structure.

1. INTRODUCTION

Trade finance reduces risk in the process of trade. Given the number of parties involved, intermediation enables buyers and sellers to transact more efficiently across borders, currencies, and languages. The transaction volumes are huge. In 2017, U.S.\$15.5 trillion of merchandise exports were transported around the world across sea, air, rail, and road.¹ Up to 80% of this global trade requires financing.

However, the same characteristics that make trade finance safer also introduce friction and inflexibility. This has resulted in two persistent problems in the sector. First, trade finance is not easily accessible to everyone and in every region. Shortfalls in supply have persistently pooled in frontier markets and among small- and medium-sized enterprises (SMEs). This has direct implications for the ability of emerging markets to capture the benefits of trade driven growth.

Scalability is a second problem. Many believed that digitization was the answer to the lack of visibility, low profit margins, and “know your customer” (KYC) concerns that drive shortfalls. While digitization has changed the way individual entities in trade finance process information, these benefits have not scaled globally into a connected network. If each node in the trade finance network maintains its own proprietary source of information – as it does today – digital documentation needs to be checked and re-entered at every step of the process. Having many different centralized systems globally create localized data centers that do not interoperate with a broader network.

Digital improvements to non-digital infrastructure can only go so far. A fundamental reorganization of the system is required to impactfully change trade finance enough to address the shortfalls and gaps.

Over the past two years, we have witnessed a wholly different solution emerge. Blockchain technology presents an open technology layer that enables programs to connect and scale.² The decentralized architecture of a blockchain can serve as a better foundation for interoperation along a global and intermediated process like trade finance.

Trade finance is inherently decentralized; trying to match centralized architecture to this decentralized process has led to the siloes and problems we face today. By changing the structural foundation of trade finance, the technology presents an opportunity to narrow gaps in an unconventional way. Having a decentralized, yet trusted and secure record of information shared between relevant parties can reduce frictions while maintaining the efficiencies of intermediated trade.

In this paper, we take a design approach to explore whether blockchain could rearchitect trade finance to make it more inclusive. This approach is unusual in that we map the reasons for trade finance gaps directly to the features of the technology itself. Our conclusions are thus independent of the specific use case. They apply equally to letters of credit or open account or trade credit insurance. They are applicable in jurisdictions from Brazil to Thailand.

While public blockchains like Bitcoin are the most familiar to the casual reader, we focus in this paper on enterprise blockchains. The reason is that private permissioned blockchains, built with the requirements of companies in mind, are most appropriate for the particular characteristics of trade finance. Trade finance is highly regulated, cross-jurisdictional, and involves multiple parties confidentially exchanging information. In this paper, we will outline advantages that are general to most enterprise blockchain systems, such as IBM’s Fabric and Ethereum-based forks,³ while also mentioning features particular to R3’s Corda.⁴

As blockchain technology moves from proof-of-concept to live pilot and beyond in 2018, we can offer insight into whether the technology will ultimately narrow trade finance gaps. We explore the impact of blockchains on three fundamental causes of trade finance gaps: compliance costs, profit, and information. Our objective is to show that the benefits of blockchain technology in trade finance can extend beyond driving operational efficiency to actually narrowing market gaps in frontier markets and among SMEs.

¹ WTO, 2017, “World trade in 2016,” World Trade Organization, <http://bit.ly/2oQZ6IG>

² All blockchains are distributed ledgers, but not all distributed ledgers “batch” information together into a chain of blocks. For simplicity, the term blockchain and distributed ledger technology (DLT) are used interchangeably in this paper.

³ An enterprise fork is an adaptation of a public cryptocurrency codebase to make the technology more suitable for companies.

⁴ Corda is unique among enterprise blockchains in that it operates a point-to-point transaction model. This means that only participants involved in a given transaction or exchange of data are privy to the data involved in those transaction. In our example, each node transacts on behalf of their clients and shares only the information that is needed to complete the transaction.

2. TODAY'S TRADE FINANCE NETWORK STRUCTURE ENABLES PERSISTENT SHORTFALLS

Trade is conducted through either bank-intermediated risk-mitigating instruments, such as letters of credit, or directly between buyers through open account. While most global trade flows are covered by open account, companies in Asia and the Middle East are heavy users of letters of credit, with 77% of export letters of credit originating in Asia alone. Risk parameters vary depending on when finance and/or risk mitigation is provided, and differ between pre-shipment and post-shipment finance.

Inefficiencies in trade finance means that nearly U.S.\$1.5 trillion of demand for trade finance is rejected by banks [ADB (2017)]. The consequence in many cases is that those trades do not happen. A practical example: in a survey of 1,336 firms, respondents report that in 60% of cases when their application for trade finance is rejected, they fail to execute the transaction.⁵

Figure 2: Reasons banks reject trade finance applications (% of rejections)

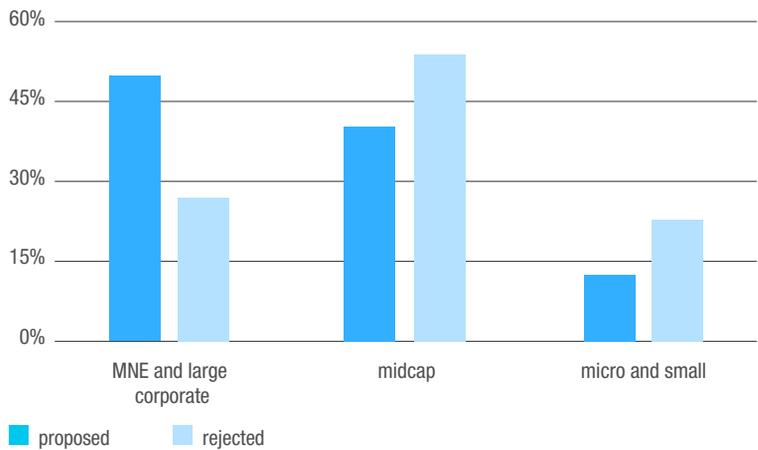
KYC CONCERNS 29%	NEED MORE INFORMATION 21%	NOT SUITABLE FOR FINANCING 20%
LOW BANK PROFITS 15%		

Source: ADB 2017 Trade Finance Gaps, Growth, and Jobs survey

2.1 Trade finance data is centralized to maintain security

In trade finance today, each party to a transaction maintains their own account. These are repeatedly shared, checked for discrepancies, verified, and updated. This process introduces three structural features that contribute to gaps. First, the cost of verifying and checking is high. This is because each individual entity in the transaction needs to ensure that the documents they receive are compliant with regulatory requirements. Entities also need to confirm

Figure 1: Proposed and rejected trade finance transactions (by firm size, 2017)



Source: ADB 2017 Trade Finance Gaps, Growth, and Jobs survey

the information that they expect to see about the transaction – are the goods in the purchase order the same as the goods in the invoice?

Second, there is a dependence on correspondent banking limits. Bank-to-bank (correspondent) relationships are central to the current trade finance architecture. Yet thousands of correspondent relations have been severed over the past few years due to cost and regulatory factors. This dependence on correspondent banking networks limits the flexibility of trade finance.

Local or community banks, which are most likely to have banking relationships with SMEs, may not have the necessary correspondent relationships to facilitate an international trade transaction. One global bank reports that the cost of doing due diligence on a bank was of the order of U.S.\$75,000 in 2015. When global banks began shedding correspondent relationships in recent years, it was mainly emerging markets that were cut off.⁶

Finally, the use of the cloud, while increasing, is limited in transaction banking. Deploying new digital solutions in banks is slow due to the need to get security approvals. Historically, the standard has been ringfencing data and not allowing any integration. However, given recent high profile hacks, it is clear that centralized data stores are vulnerable regardless of how carefully the data is fenced in.

⁵ ADB, 2017 Trade Finance Gaps, Growth, and Jobs survey

⁶ IMF, 2016, "The withdrawal of correspondent banking relationships: a case for policy action," International Monetary Fund, <http://bit.ly/2abkYln>

2.2 Today's architecture is characterized by gaps in emerging markets and SMEs

The way data is shared in trade today exacerbates the inherent challenges of emerging markets. In 2017, the ADB estimated a global trade finance gap of U.S.\$1.5 trillion dollars. Furthermore, 40% of global unmet demand for trade finance was pooled in Asia Pacific and Africa.

However, the problem is about more than geography. SMEs in every jurisdiction face shortfalls in access to trade finance. Banks report that 74% of their rejections go to SMEs. These companies worldwide have reported the lack of trade finance as one of the major constraints to their businesses. Globally, they are impacted by the higher cost of screening and higher interest rates. Credit constraints on smaller exporters are higher than those faced by larger firms, to the point of reducing the range of destinations for business or stopping the SME from exporting altogether.

2.3 Digitization improves efficiency, blockchain unlocks trust without centralization

When banks were surveyed on their reasons for rejecting trade finance proposals, their responses fell into three main categories: lack of information, low profit, and KYC concerns (Figure 2). The single undercurrent to all of these causes is lack of visibility into the trade or the client, leading to a "perceived risk" that is higher than what the bank is willing to accept.

Digitalization has made important inroads in all of these areas. Regtech seeks to automate KYC reporting, fintech solutions create new sources of information with which to evaluate firms, and digitization initiatives have focused on reducing the cost of trade finance. Each of these has important potential implications for inclusion by disrupting pieces of the trade finance process.

Even as digitization has sought to address parts of the problem, it has also exacerbated its causes in other ways. As banks have implemented new digital solutions, there has been an explosion of destination platforms. That is, the platforms do not interoperate with each other. Digital solutions work as long as all parts of the trade are on the same platform. In global commerce, where a single trade may involve 20 entities, 100 pages of documentation, and 5000 data field interactions,⁷ siloed digital solutions make problems worse.

Enterprise blockchains aim to resolve these difficulties with interoperation. There are two features of enterprise blockchains that allow them to retain the benefits of decentralized systems, while addressing the shortcomings of public blockchains for this use case. Enterprise implementations of blockchain technology are better able to meet the data privacy requirements of international trade, as they avoid public broadcast of all information to all parties.⁸ Further, depending on the architecture, they can address the scalability limitations of public blockchain systems.⁹

3. DOES BLOCKCHAIN TECHNOLOGY HAVE FEATURES THAT CAN NARROW TRADE FINANCE GAPS?

If today's trade finance architecture enables the persistence of gaps, does this mean that a technology that promised to rearchitect trade finance will narrow them? There is a lot riding on this contention, and some blockchain applications have focused specifically on this area. While we hope that the trade finance applications built on blockchain platforms will accomplish this goal, the sheer scope of different applications makes it difficult to evaluate the potential disruption of each claim.

In this section, instead of looking at the promise of blockchain applications, which is enormous, we look at the mechanics of the technology. Does the technology itself have or enable features that address some of the reasons for trade finance gaps?

By grounding our analysis in the technical architecture of a live, enterprise distributed ledger platform, we aim to provide a tangible discussion around the technology of blockchain. Some of these benefits are inherently enabled by the blockchain platform itself, while others allow producers of applications to drive the benefits. We cover the three drivers from Figure 2: low profitability, regulatory concerns, and information.

⁷ BCG, 2017, "Digital innovation in trade finance: have we reached a tipping point?" Boston Consultancy Group, SWIFT focus whitepaper.

⁸ No risk department would agree to having each node contain identical copies of the entire transaction history. Even though there is some technology being introduced in public blockchain systems to address privacy concerns, the technology can be too immature for enterprises. In addition, often enterprises do not want information shared with other parties, even if that information is "encrypted." Corda technical Whitepaper, <http://bit.ly/2bxmifg9>

⁹ Buterin, V., 2016, "Ethereum platform review," R3 Research Papers

3.1. Low profitability

Low profitability comes from two sources: the bank’s cost of processing a transaction and the expected revenue. SMEs will naturally provide a smaller expected profit as their transaction volume and frequency may be expected to be low.

The cost and time to process a trade transaction can be significant due to the variety of actors and steps that are involved. Much of the cost arises from delays, friction, and additional effort needed to handle trade data. This is underpinned by the fact that trade finance is a linear process that is heavily reliant on paper documents. The paper documentation is carried from port to port along with the cargo, checked, signed, faxed to the various parties, including banks, with very little visibility of the whole process by any single participant. Manual checking is time consuming, and can be error prone. Bottlenecks also occur frequently because no party has overall control over or visibility into the full process.

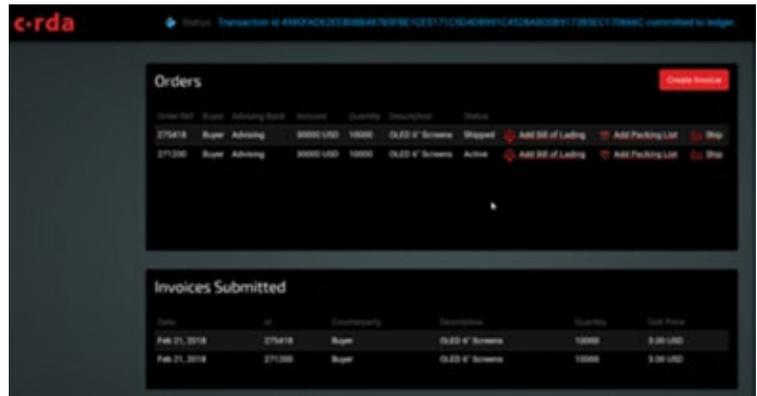
Delays can have real cost implications. Take demurrage, a payable charge to the owner of a chartered ship in respect of failure to load or discharge the ship within the agreed time. These charges can add up to U.S.\$150 per container per day,¹⁰ which may not seem like much, but when applied to a whole vessel, such as a Panamax fleet ship, the cost can reach U.S.\$750,000 per day of delay.

These costs are further exacerbated by distant markets, banks that lack direct correspondent relationships, and small firms. For these entities, the time needed to execute a transaction, the prevalence of errors and amendments, and the need to verify all parts of the transaction due to the need to establish provenance of paperwork¹¹ contribute to low profitability.

There are several technical elements built into enterprise blockchains that impact the cost and time of processing. Steps are eliminated when relevant parties maintain the same version of the truth. Having automatable processes will speed up steps that cannot be eliminated. Both oracles and signatures (or multiple signatures) from trusted parties can trigger other events on a blockchain, removing delays for information dependencies.

Blockchain features that can address profitability are: (1) single truth layer, (2) automatable processes, (3) oracles, and (4) signatures, multiple signatures (multisig).

Figure 3: Status of different orders shared with relevant parties



Source: Letter of credit demo, <http://bit.ly/2FVeDz9>

All of these features lead to the elimination of confirmation steps as parties can trust that the information that they see is the same as other parties.

One of the major cost multipliers in trade transactions is the passing back and forth of the same documents multiple times. For example, there are typically 19 steps (without amendment) in a letter of credit. By having a single truth layer, we can potentially eliminate seven of these steps immediately.¹²

As one example, Figure 3 illustrates the seller’s screen in an on-ledger letter of credit transactions. This is a snapshot of the key data forms that are included.

In any transaction on the blockchain, there is a single source of verified data that is immutable. As a result, all parties can have confidence that the information on the screen is verified, and is the same as what their counterparties see on their screens. The data is accurate and reliable from the beginning.

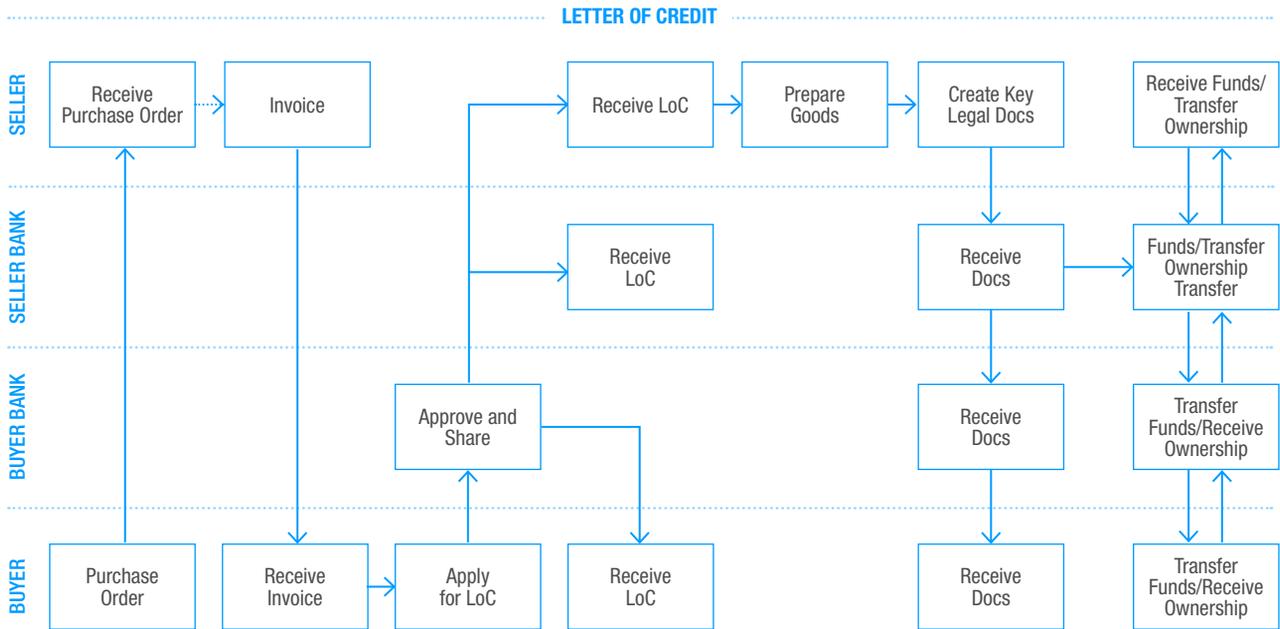
Having a single source of truth shared between relevant parties reduces costs that are due to errors associated with repetitive verification. This will shorten the time to financing because it reduces information float (the time until information is available) and increases real time visibility of trade. Faster information transfer with fewer errors will reduce the additional costs associated with riskier trades.

¹⁰ Czajkowski, A., “Demurrage, detention, per diem... Oh my! 6 tips to avoid additional charges,” Shapiro, <http://bit.ly/2H5WEFR>

¹¹ Default is not the reason that cost and profit is a problem. Default rates for trade finance are below 1%, and recovery even then is on the order of 80% (ICC trade register). The problem of cost and profitability is related to paperwork and verification and checking.

¹² Author’s calculations using a pilot version of a Letter of Credit on Corda.

Figure 4: Flows between nodes on Corda along trade finance lifecycle



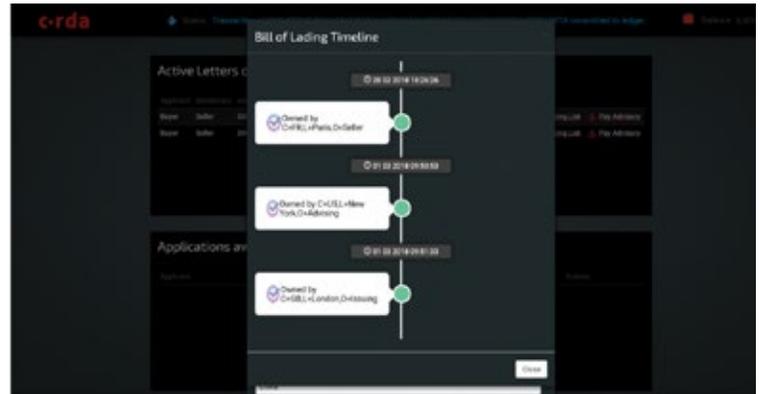
Source: R3

A second way that blockchain can address profitability is by automating some steps that currently have a long lag time. On Corda, flows enable coordination from different nodes to trigger “transactions,” or updates to shared states between parties that are automated. Figure 4 illustrates the flows in a letter of credit trade lifecycle.

Oracles and third party signatures are two examples of inputs to a blockchain that can trigger an automated process. An oracle is an agent on the blockchain that provides information to the participants of one or more business networks. They source information from real world events, third party data providers, or other blockchain activities. An oracle can push information to a business network either regularly or upon request, and is not party to a trade.

Oracles are meant to provide facts to business network participants. Figure 4 shows an example where an electronic bill of lading (eBL) provider acts as an oracle in a trade transaction. In a trade transaction, ownership of the goods changes throughout the process. The document of title – in this case represented by an eBL – allows the bearer to take ownership. After the goods are ready to ship, the shipper requests the carrier to draft a bill of lading. The shipper exchanges the goods for the eBL from the carrier. The shipper then presents the eBL

Figure 5: Bill of lading timeline with title transfer (illustration of DLT LC platform)



Source: Letter of credit demo, <http://bit.ly/2FVeDz9>
Notes: O=owner

to the advising bank in fulfillment of the documentary submission requirements of a letter of credit. Since each eBL is associated with a unique title registry record – which is maintained by the oracle – the transfer of title from the shipper to the advising bank only occurs after querying the oracle to get confirmation of the registry record number. This also introduces additional visibility into who owns the goods throughout the process.

A trusted third party may also provide signatures to a blockchain. For example, DHL may send a pay out upon signature when goods have arrived at a certain port, triggering the next process automatically, removing frictions. Once the physical cargo has been checked and the data input into the system, an automated contract could instantaneously release the funds from the seller's bank to the buyer's bank. This is one example of a smart contract, and a self-executing transaction. This could significantly reduce the delay between the checking of the cargo and the final release of funds.

3.2 Lack of information (risk management)

A second driver of trade finance rejections is a lack of reliable information. This makes it difficult for stakeholders to accurately measure risk, a problem that is compounded for SMEs.

Where risk is the result of information asymmetries, blockchain can improve risk management. It could enable us to answer questions like: Can this SME perform. Is it capable of delivering quality goods/service

in the timeframe stipulated in a contract. Will it remain solvent for the duration of its obligations?

Recording transactions on a blockchain leads to a treasure of metadata from which financial institutions could answer SME performance risk related questions reliably and efficiently. If all transactions in an SMEs life are captured step by step through a blockchain, that information could be organized to address a root cause of SME finance market gaps.

“Trade finance is inherently decentralized; trying to match centralized architecture to this decentralized process has led to the siloes and problems we face today.”

In addition, the ability to identify the legal entity of a participant in a transaction is fundamental to efficient trade finance. It can act as an organizational anchor – or a master key – from which all other information can be hung. Corda uses X.500 distinguished names to identify participants. To further improve transparency about network participants, many solutions then link to “legal entity identifiers” (LEI).



An LEI is a 20 digit, alpha numeric code. It is connected to key reference information that allows for the unique identification of legal entities participating in financial transactions. The LEI verifies, on an annual basis (i) who's who; (ii) who owns whom; (iii) who owns what. The body responsible for administering the LEI system is, itself, regulated by over 70 central banks around the world.

An important benefit of being able to organize data around entities with canonical identifiers that are used universally across the globe, is that it becomes possible to develop a map that charts out the history of all transactions performed across all participants. This becomes a very powerful tool for reducing fraud, because all the parties involved in a trade are known and have been validated.

3.3 Compliance (KYC concerns)

Regulatory oversight plays a critical role in the functioning of the global financial system. Over time, both the diversity of regulations and the size of sanctions fines have increased.

This relates to the third major driver of rejections for trade finance proposals – KYC and money laundering concerns. The cost and complexity of regulatory compliance play an important role in transactions costs. The problem for trade finance is that 29% of rejections are based on KYC concerns.

Enterprise blockchains can address the uncertainty related to compliance via three features. These include live information sharing through a regulator node, active regulation by requiring attestations by third parties that have done KYC checks, and more data for retrospective analysis that may facilitate more effective regulation.

Beyond blockchain's ability to enhance the reliability and efficiency of conducting KYC and anti-money laundering due diligence, the technology can also address two related regulatory issues. The first is uncertainty by regulators. Because regulators only see a trade after it has occurred, their lack of insight shifts the burden of vigilance onto banks. The second is uncertainty by banks. The regulatory environment is complex and not harmonized. Each bank needs to satisfy different levels of regulation.¹³

Blockchain features that can address regulatory compliance are: (1) notary functionality, (2) regulator nodes, (3) attestations, and (4) audit trail.

3.3.1 NOTARY AGREEMENT PROTECTS AGAINST DOUBLE-INVOICING OF THE SAME STATE

Double-invoicing is a common concern in trade finance. It can occur in error where a transaction is mistakenly counted twice, or in a fraudulent setting where a malicious actor intends to game the process. This requires financial institutions to spend time to validate all the transactions to prevent instances of double-invoicing. Standard Chartered, for example, lost almost U.S.\$200 million from a fraud involving counterfeited paperwork, where different banks and trading houses were holding separate titles for the same metal at China's Qingdao port in 2014.

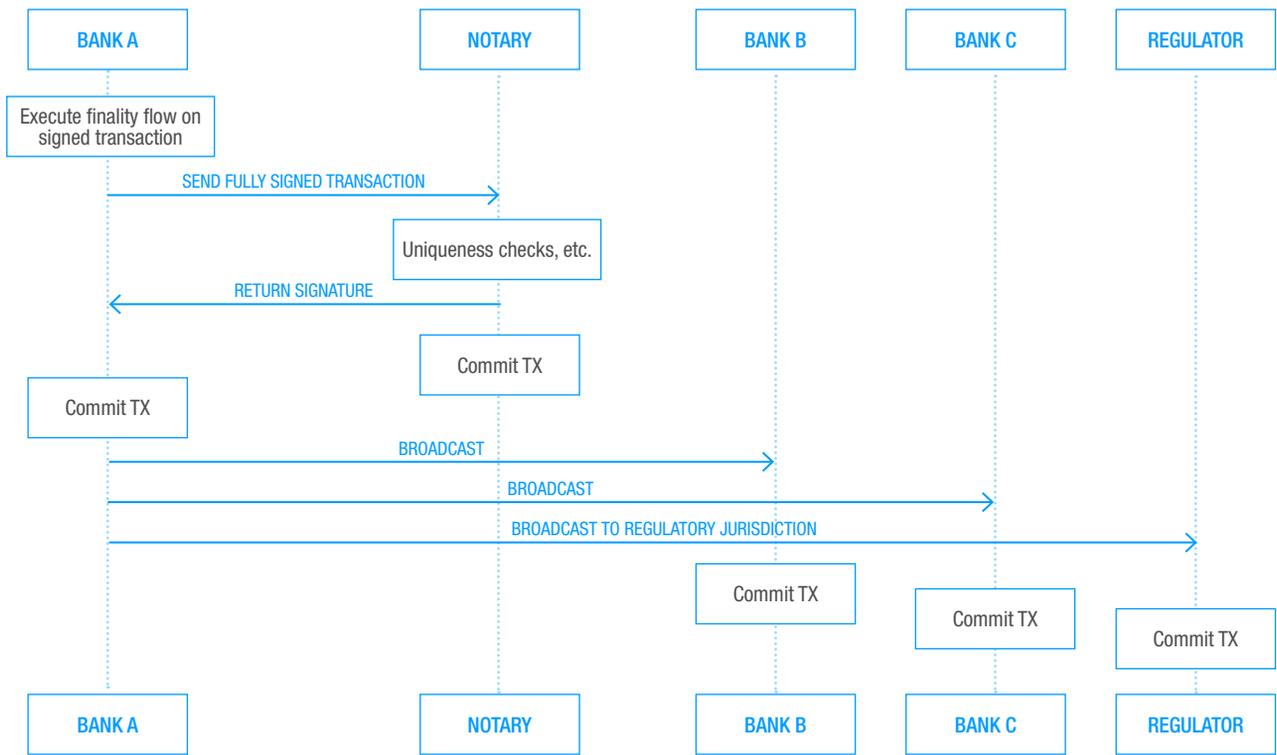
Blockchain technology has the potential to address some of these fraudulent transactions. With Corda, a notary ensures uniqueness of an invoice or payment. This has the potential to make important inroads on the double-spending problem. Because a transaction is represented as a particular state, it is mathematically impossible to re-use the same state more than once. That is, if a particular invoice has a certain number, the same asset literally cannot be sent to two banks – it can only be used once, and the notaries will enforce this. While this does not protect against people creating two separate invoices with different numbers, banks can ensure that a certain state is only used once if they are on the same application.

3.3.2 LIVE REGULATOR OVERSIGHT OF PARTICULAR IDENTITIES OR TRANSACTIONS

As regulations around trade finance continue to grow, the sanctions for violations have also grown. According to FinCen data, the number of suspicious activity reports grew exponentially from 1990 to 2013. In addition, market participants have to generate compliance reports on a regular basis for submission to the relevant regulators. Much of this work is still manual, which leads to high overhead costs.

¹³ In a recent informal survey of global banks, respondents each had a different process for KYC in a supply chain finance transaction.

Figure 6: Corda flow with a regulator node



Source: R3

Enterprise level blockchains enable the addition of a specific type of entity into the transaction that we refer to as a regulator node. This regulator node can be incorporated into the network, and it enables regulators to monitor transactions that occur on a real-time basis, but does not give them the ability to change the transaction. This can reduce the need for manual regulatory reporting and can significantly reduce costs.

Blockchain addresses the cost and complexity of regulatory compliance in an unusual way. While existing regtech solutions have focused on simplifying KYC, this is only one part of a complex problem. By allowing regulators to have direct insight into transactions, the reporting process can become less burdensome by becoming incorporated into the transaction itself.

3.3.3 SIGNATURES BY THIRD PARTIES THAT HAVE PERFORMED DUE DILIGENCE

On a blockchain network, trusted third parties can attest that a particular party is not nefarious. Onboarding of a new corporation, or entity, could involve the signature of an entity that has done due diligence.

3.3.4 MORE DATA CAN ALLOW BETTER RETROSPECTIVE ANALYSIS TO MAKE FUTURE PROJECTIONS OF CRIMINAL ACTIVITY

Immutability of data refers to the fact that a state cannot be changed or modified after it has been created. This creates a clear audit trail into the transaction, as historic states are stored and can be accessed. It will be impossible to tamper with data, and data integrity can be maintained at all times.



4. CONCLUSION

Trade finance gaps will not be resolved until trade finance changes. This kind of thinking is not new. But the technology to make it happen is. Blockchain will impact how trade finance is done. It will become safer, faster, and more secure as banks and corporates move trade onto the blockchain.

Does this mean that blockchain will solve the trade finance gap? Not alone. As it spreads, its hard coded features will improve the potential for trade finance to be more inclusive and available. To take full advantage of the benefits that blockchain has to offer in trade finance, we need to consider three questions while designing top of stack applications: Can outside providers easily contribute data? Does it follow or reuse existing standards and contracts? Will it improve information and data flow?

2018 is the year that proof-of-concepts are moving into pilots and production. As we have learned during the design phase, the problems in trade finance are going to be much harder to solve than they look on the surface. As trade continues to evolve, it has become increasingly urgent that financial institutions are equipped to deliver not only the types of financing needed today, but also the types of financing that will be needed tomorrow.

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