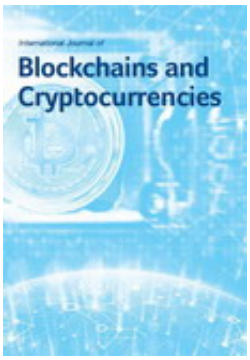
INDERSCIENCE PUBLISHERS
Linking academia, business and industry through research



International Journal of Blockchains and Cryptocurrencies

ISSN online: 2516-6433 - ISSN print: 2516-6425
https://www.inderscience.com/ijbc

Application of blockchain technology in trade finance

G.V.S. Nalini, B. Sindhu

DOI: 10.1504/IJBC.2024.10065428

Article History:

Received:	27 February 2024
Last revised:	01 June 2024
Accepted:	01 June 2024
Published online:	26 July 2024

Application of blockchain technology in trade finance

G.V.S. Nalini* and B. Sindhu

School of Management Studies,
JNTUH, Kukatpally,
Hyderabad, Telangana, 500072, India
Email: nalini12blockchain@gmail.com
Email: Sindhu999@jntuh.ac.in
*Corresponding author

Abstract: Innovations are due to the problems faced. Traditional trade finance faces two important problems: firstly, trade finance in the context of international trade involves many participants, including banks and financial institutions, and secondly, numerous documents are to be prepared and shared with the parties concerned. Blockchain technology with its promising basic features like accessibility, traceability, immutability and digitalisation reduces the number of participants, processing time, and minimises costs in trade financing. This paper is an attempt to find the problems involved in traditional trade finance and the adoption of blockchain technology to resolve these problems. The structure of this paper has three parts: the first part deals with the adoption of blockchain technology to resolve the problems in traditional trade finance; the second part deals with an outline of the blockchain trade consortium; and the third part deals with challenges in the adoption of blockchain and vectors to improve the performance of blockchain technology.

Keywords: trade finance; traditional trade finance; blockchain technology; blockchain-based trade finance consortium; vectors of development.

Reference to this paper should be made as follows: Nalini, G.V.S. and Sindhu, B. (2024) 'Application of blockchain technology in trade finance', *Int. J. Blockchains and Cryptocurrencies*, Vol. 5, No. 1, pp.67–81.

Biographical notes: G.V.S. Nalini is a PhD research scholar from SMS, JNTUH, on: Implementation of Blockchain Technology in Banking, FS, SCM & HCM presented five research papers in national & international conferences.

B. Sindhu, Professor, Director and Chairperson, Board of Studies, University college of Management Studies, JNTU Hyderabad; MBA, PhD in Business Management from Osmania University, Hyderabad and has more than 22 years of experience in teaching, training & research. She qualified in the JRF and UGC-National Eligibility Test (NET) Conducted by University Grants Commission (UGC) New Delhi in 1997. She has published 109 research papers in international and national journals and conferences/seminars. She has authored four books. She is an Editorial board member and reviewer for many management journals.

This paper is a revised and expanded version of a conference paper entitled 'Application of blockchain technology platform in trade finance' presented at the *National Conference on Blockchain and Smart Contracts*, NIT, Trichy, 7–10 November, 2019.

1 Introduction

> "The power and advantages of Decentralisation are becoming increasingly clear. We deserve a financial system where no one can be censored or excluded from full participation".
>
> Silvio Micali, Founder, Algorand.

Trade finance is financing for international trade to minimise, the financial risks in terms of international cash flows. International trade transaction involves two important participants, first, an exporter transferring goods and requiring payment on some agreed terms second, Importer, who is willing to buy goods and make payments as per the agreement. As international trade takes place between exporter, in one country, dealing with importer from another country, three types of risks are possible, namely, payment risk for exporter, exchange rate risk between the two countries and corporate risk for exporter, due to nonpayment by importer.

Objectives of the study:

- Listing the problems faced by traditional trade financing and role of blockchain technology in resolving them.
- Review of literature on the adoption of blockchain technology in trade finance,
- List of blockchain platforms used in trade finance.
- Review of challenges on adoption of blockchain technology, vectors to improve blockchain based trade finance.

Scope of the study:

- The research study is confined to application of blockchain technology in trade finance only.

2 Review of literature

2.1 Traditional trade financing

Traditional trade financing requires repeated checks, paper documentations and verifications involving many participants making the trade transactions more expensive and time consuming (Werbach, 2018). Trade Finance requires bank's support in the international trading process involving four parties namely, exporter and exporter's bank, importer and importer's bank (Committee on the Global Financial System, 2014). For smooth exchange of goods, the exporter requires financial help in the production, shipping and receiving the final payment from the importer (Schmidt-Eisenlohr, 2013). Trade finance helps both sellers and buyers to fulfil their bilateral contractual obligations (World Trade Organization, 2016). Further, trade finance provides financial instruments such as Letter of credit, factoring, forfaiting, to a great extent these instruments minimise the risk against fraud (Ahn and Sarmiento, 2019). Authors assert, three types of payments which are commonly followed in the international trade, cash in advance, open account and letter of credit (Schmidt-Eisenlohr, 2013; Ganne, 2018; Wang et al., 2019; Niepmann and Schmidt-Eisenlohr, 2017; Ahn and Sarmiento, 2019).

List of problems in traditional trade financing:

- creation of manual contracts and excessive paper work
- multiple number of participants in the transaction
- duplication of documents such as bill of lading
- absence of traceability of goods
- delayed time line
- delayed payments.

2.2 Blockchain technology

A blockchain is a digital, immutable, distributed ledger (DLT) that records transactions in shortest time. Blockchain is a protocol for exchanging value over the internet without involving any intermediary.

Distributed ledger technologies DLT: Distributed ledger technology (DLT), also commonly referred to as blockchain technology, which is its most commonly used form, is a database technology that allows the creation, secured transfer (with finality) and storage of information, which are not centrally controlled and administered. As a ledger technology, DLT could potentially be applied to any sort of financial transaction relating to payments, Banking and supply chain, Capital markets and risk management, public sector, and to make compliance with know your customer (KYC) requirements. The transparency of these records may also facilitate the supervision of financial institutions by authorities. In trade finance blockchain technology works as distributed ledger, helping to know KYC details, helps in asset tracking and visibility of transactions and digital payment system through letter of credit (L/C) which reduces financial risks and facilitates smooth trade flow settlements. In the blockchain, Distributed Ledger (DLT) model, the documents like Letter of credit etc., will be encrypted and immediately transmitted to all the parties namely, importer, exporter, importer's bank and exporter's bank there by reducing the documentation and processing time and providing accessibility of the documents to all the parties involved.

Key elements of blockchain technology: A blockchain consists of blocks, chains, nodes in the network and this network are named as the blockchain as it comprises interconnected blocks created by computers using the internet, which save the transaction records of the participants. The prime idea behind the functioning of this technology is for recording crypto currencies transactions on the blockchain network (Till et al., 2017; Zhang et al., 2018; Scott et al., 2017) blockchain is a network of computer systems for entering transactions between participants which duplicates and distributes copies of a digital transaction recorded. This technology has been employed in the banking and financial sector to ensure data privacy and security and further it allows for secured, safe financial transactions as demonstrated by crypto currencies in the initial usage of this technology. Blockchain comprises interconnected blocks having digital records, serves as a database having volumes of records of transactions, contracts across numerous computers. This system minimises mistakes and inaccurate interpretation of the financial information and provides safe and secured transactions.

Satoshi Nakamoto is the inventor of the crypto currency Bit coin, was the first person to publish a research study, in 2008, as an paper titled, Bit coin: A Peer-to-Peer Electronic Cash System", explained about the working of this technology. According to his findings this technology is based on thousands of nodes using computers, allowing peer-to peer transaction, eliminating intermediaries. Nakamoto (2008).

The author refers to the blockchain technology as a complete distributed system structured cryptographically to capture data and store huge volumes of transactions between network participants and related information (Risius and Spohrer, 2017). As per the studies of the authors, blockchain technology is built upon three technological pillars namely, cryptography, decentralisation, distributed consensus mechanisms and distributed consensus mechanism, which provides trust-free, immutable transactions. Hyvarinen (2017). Blockchain technology has potential to minimise trust and issues in the transactions (van Wersch, 2019), its structure is designed to solve trust issues especially in the context of international trade. Beck et al. (2018), Risius and Spohrer (2017), further, it has the capability to provide more efficient, secure and cost-effective solutions while sharing data between the parties involved (Egelund-Müller et al., 2017). As per the research studies of the authors, the inherent and immutable transactions, characteristics of blockchain technology is capable of transforming the financial services Fanning and Centers (2016), the first adopters of the blockchain technology in financial institutions realised its potential in improving the efficiency in the settlement of securities Swan (2015), Peer-to-peer transaction eliminates.

Table 1 illustrates key elements of blockchain are P2P Network, Immutability, Transparency, Distributed ledger, cryptography, Smart contracts, which make the transactions, secured and transparent.

Table 1 Key elements of blockchain technology

Elements	*Description*
P2P network	It is a network between members in the chain for transactions eliminating any intermediaries such as Banks and financial institutions. Once a transaction is executed, the information will be transmitted to every member in the network and the copy of transactions which can be stored for future reference
Immutability	Transactions entered in the blockchain network are immutable which means the information entered in the block, cannot be deleted, edited or modified
Transparency	Transactions entered in the block are visible to the participants who can view, check the information at any point of time from anywhere
Distributed Ledger	It is the core component of blockchain technology which keeps a track of all the transactions entered in the blockchain network. All the transactions are recorded in the database which can be accessed by any member in the network. This is very useful for Banks and financial institutions and supply chains
Cryptography	Each transaction entered in the blockchain is verified, secured and encrypted, two keys will be generated, a public key and a private key, to the participants, to unlock the ledger. This arrangement helps in maintaining security of the information entered in the block
Smart contracts	A smart contract is an agreement entered between the participants, with a set of rules or preconditions to be carried out on blockchain. The main aim of the smart contract is to eliminate intermediaries

Source: Table prepared by the author

Role of smart contracts in the trade finance: Smart contracts are self-executing contracts, entered directly into code by the parties concerned with the terms relating to payment and shipping of goods. Smart contracts offer a high degree of automation in trade finance processes. This automation makes the verification and compliance checks, reduces time delays, delays in payment, improves efficiency and reduces cost.

Consensus mechanism: A consensus algorithm is a procedure through which all the participants in the blockchain network reach a common acceptance or consensus on the real-time state of the transaction. Proof-of-stake, proof-of-authority and proof of identity are applicable consensus algorithms in the application of blockchain technology in trade finance.

2.3 Traditional trade finance models and the blockchain technology models in trade finance

Traditional trade finance faces few issues and blockchain technology has potential to resolve some of these issues like reducing number of stakeholders and intermediaries, minimising the cost of operation, faster settlement of accounts, providing security and reducing dependence on the banks. In traditional trade finance model, once selling agreement is made, Buyer/Importer requests his banker to issue letter of credit, the same will be sent to the seller/exporter and on receiving this, exporter proceeds to make shipment of goods, and sends, bill of lading and invoice to the Buyer/importer., who takes the delivery of goods and the final settlement will be made by importer's bank to exporter's bank. Buyer/importer., who takes the delivery of goods and the final settlement will be made by importer's bank to exporter's bank.

In the traditional model, buyer or applicant, approaches issuing bank for letter of credit, and prepares the necessary documents and enters into agreement to buy with beneficiary or seller. Seller on receiving the necessary documents and advice from his banker, makes arrangements for shipment of goods.

Traditional trade finance payment methods:

a *Cash in advance*: Importer completes full or partial payment before the goods are shipped (Schmidt-Eisenlohr, 2013; Ahn and Sarmiento, 2019; Ganne, 2018). Though this method is highly beneficial to the exporter, it involves high risk to the importer as there is a possibility, exporter may not deliver goods after receiving the payment.

b *Open account*: In the open account, goods are supplied by the exporter before any payment is made by the importer, where the exporter is at high risk of recovering the payments from the importer (Schmidt-Eisenlohr, 2013; Ganne, 2018; Ahn and Sarmiento, 2019).

C *Letter of credit*: Letter of credit is a guarantee issued by an importer's banker, in favour of the exporter or seller's banker, ensuring payment at sight against the documents confirming the terms and conditions of the trade (Grath, 2012). Four participants are involved in completing the transaction, apart from the exporter, importer, two banks, exporter's bank and importer's banker (Ganne, 2018; Ahn and Sarmiento, 2019; Schmidt-Eisenlohr, 2013). The L/C approach, banks, provide a feasible solution to the issue with regard to shipping of goods by the exporter and receiving the payment from the importer (Dewey, 2019). Banks acting as

intermediaries, sometimes may be exposed to a risk of bad debts, reducing the efficiency of banks (Morris, 2019; O'Neill, 2018; Wragg, 2018).

In contrary to this blockchain based Trade financing, A smart contract will be executed and on the basis of this, the documents get verified and encrypted, enters into a block. Seller makes arrangements for shipment, receives payment from the Buyer.

Blockchain based instruments in trade finance:

a *Blockchain and letter of credit* (*LC*): A Letter of Credit (LC) is an important document ***which guarantees the importer or buyer's payment to the exporter or seller in international trade*** process. Blockchain, when applied to letter of credit through smart contracts, converts the traditional letter of credit into blocks and enters the network.

b *Blockchain and forfaiting*: Forfaiting is an instrument, allowing exporter to get cash immediately by selling accounts receivable at a specific discount rate to either a bank or a financial institution. Smart contract based blockchain platform, enables forfaiting smoother and faster.

c *Blockchain and invoice factoring*: Factoring, is a common type of financing in international trade, exporters sell account receivables or invoices to a third party, or factor, such as Banks or Financial institutions, to meet short term liquidity, where the factor collects the invoice from the importer and deducts fees and commission.

Blockchain based trade finance, the invoices, with the help of smart contracts between exporter and importer, makes it easier to store and share the data, payment is tokenised and completed as per the terms in the smart contract without any third-party interference.

d *Blockchain and trade credit insurance*: In international trade, the major problem for the exporter will be to recover the total sum of the invoices from the importer**.** Trade credit is an agreement between exporter and insurance company, the insurance company undertakes to compensate the risk of unpaid debts on certain agreed limits. Blockchain technology allows the exporter and insurer to sign the smart contract and record it on blockchain, which serves as immutable evidence and helps the exporter to minimise the risk of unpaid debts.

Table 2 shows blockchain based trade finance instruments.

Table 2 Blockchain based trade finance instruments

	Instrument	*Function*
A	Blockchain and letter of credit	A six-stage process is built using smart contracts, between exporter and importer to facilitate payment and transfer of goods
B	Blockchain and factoring	Blockchain based trade finance, the invoices, with the help of smart contracts between exporter and importer, makes it easier to store and share the data, payment is tokenised and completed as per the terms in the smart contract without any third-party interference
C	Blockchain and forfaiting	Smart contract based blockchain platform, makes Forfaiting smoother and faster
D	Blockchain and trade credit insurance	Blockchain technology allows the exporter and insurer to sign the smart contract and record it on blockchain, which serves as immutable evidence and helps the exporter to minimise the risk of unpaid debts

2.4 Benefits of adopting blockchain technology in trade finance

Pilkington (2015) finds that international payments can be transferred using blockchain in only a few minutes which is significant comparing to today's system where it can take up to several days until international payments reach their destinations. Adoption of this technology provides the following benefits.

Traceability: Traceability of products in international trade, is one of the major benefits of blockchain technology, it helps in building trust between exporter and importer and minimises risk and delay in the completion of transactions.

Transparency: All commercial agreements between exporter and importer are encrypted and recorded in the distributed ledger, which makes the records immutable and transparent.

Security: The data and information entered in the Distributed ledger, is encrypted and saved; it provides high security of the data entered.

Efficiency: This technology, with the help of smart contract between exporter and importer, has the capability in enhancing efficiency in terms of reducing cost and time in completing international trade process.

Table 3 shows benefits of adoption o blockchain technology in trade finance.

Table 3 Benefits of adoption of blockchain technology

Benefits of adoption of blockchain
Traceability: The digitalised documents and the goods on transport can be traced at any time
Transparency: It reduces chances of manipulations and frauds
Security: Provides security for the exporters and importers
Efficiency: It reduces the trade processing time as well as cost of trading process
Permissioned sharing: It allows only authorised persons to allow sharing the information

Source: Table prepared by the author

Permissioned sharing: Public key encryption, based on Attribute Based Encryption (ABE) of the blockchain technology, provides privacy and security to the data sharing between the participants.

Like every technology, blockchain technology is also not free from the challenges.

3 Blockchain platforms in trade finance

Consortium blockchain are collaboration of group of banks, Companies, associated with enterprise use, for application platforms of blockchain technology to improve business processes in trade finance.

We. Trade: We. Trade was the first blockchain based platform for banks applied in international trade in Europe, it was developed as trade platform based on Linux foundation, powered by IBM, with an aim of assisting and simplifying international trade process.

Marco Polo: It is powered by R3 Corda DLT platform. The main aim of this network, is to facilitate and simplify trade and to provide working capital solution in the form of receivables finance, factoring, and it provides secured, distributed storage of data, identity management, and asset tracking asset verification. The first transaction on Morcopolo was successfully completed in March'2019.

Komgo: It is a live commodity trade finance which is built on Quorum blockchain infrastructure. It has a specific feature of Standardising and facilitating Digital finance including letter of credit, receivables discounting, inventory financing. It also provides KYC solutions. The first transaction on Komgo platform took place in 2018.

Vakt: It is powered by Quorum, which is designed specifically for oil industry. Vakt connects key parties in the global trade helps in initiating trade between different countries and facilitates financial settlement. Apart from this it also performs functions like confirmation of contracts and logistics and invoice in the global commodities trading.

Cargo X: It is an independent supplier of Bill of lading which is powered by Ethereum network. This has created "blockchain Document Transaction System (BDTS), an open-source protocol to facilitate in tokenising, encrypting, transferring Bill of Lading in the trade process, which facilitates reducing a 10 day document transport time to a few seconds, reducing the paper work and also the cost.

A brief note on blockchain platforms used in trade finance can be seen in Table 4.

Table 4 Brief note on the blockchain platforms used in trade finance

Name	*Powered by*	*Members*	*Function*
We-Trade	IBM	HSBC, UniCredit, Natixis, and others	To facilitate Trade finance
Macro polo	R3 Corda and Tradeix	OP Lab, SMFG, Standard Chartered	To provide better bank service and better trade solutions
Komgo	Ethereum and Kaledio	SGS, Citi, MUFG	To Offer security and efficiency, and solve data exchange issues
Vakt	Quorum	–	To Specifically for Oil industries designed to perform other functions like recap, confirmation of contracts and logistics and invoice
Cargo X	Ethereum	–	To ensure that everything is digitised
Trade lens	IBM	Caixa Bank, UBS, and others	To provide better bank service
E-trade connect	The Hong Kong Monetary Authority	DBS, HSBC, ANZ and others	To provide better bank service
Voltron	R3 Corda	HSBC, CTBC Bank, NatWest and others	To Provide better bank service

Source: Table prepared by the author

Trade lens: Trade lens is formed in August 2018, and owned jointly by IBM and Maersk, it is powered by hyper ledger fabric. The main aim of this being containerised shipping, connecting the entire supply chain ecosystem. This is designed specifically to facilitate supply chain, shipping and documentation it restricts visibility of transaction only to authorised parties.

e Trade Connect: It is an Asia pacific consortium which is managed by Hong Kong Monetary authority. It is Powered by Hyper ledger fabric, aims at building trust among trading participants., by improving efficiency, reducing trade risks, financing by digitalising documents. One specific feature of this is that it has a network of twelve banks and has signed a memorandum of understanding with the European, we.trade.to collaborate with the same technology.

Voltron: It is a coalition over 50 banks and corporates, built on Corda-powered open industry platform which aims to create, exchange, approve, and issue L/Cs. It functions to serve member banks in financing decisions, provides services at lower rates to their customers. A specific feature of the Voltron is that, it creates trade documents which are digitally made, verified, and processed for smooth trading process. It was launched for the first time in October 2018, this consortium completed first global transaction in April 2019.

4.1 Challenges on adoption of blockchain technology in trade finance

Reviews by various research studies on challenges are cited in Table 5.

Table 5 Challenges on adoption of blockchain technology in trade finance

	Challenges	*Review by authors*
1	Regulatory challenges	Cermeno (2016) and Guo and Liang (2016)
2	Technical challenges	Harwood-Jones (2016), Pennathur (2001) and Bauer and Hein (2006)
3	Scalability challenges	Shojaei (2019)
4	Interoperability	Pazaitis et al. (2017) and Kshetri (2017, 2018)
5	Security and privacy of data	Deshpande et al. (2017), Pennathur (2001) and Bauer and Hein (2006)
6	The integrity of data	Deshpande et al. (2017)
7	Lack of clarity regarding execution of smart contracts	Deshpande et al. (2017)
8	Lack of clarity about the technology governance	Deshpande et al. (2017), Attaran and Gunasekaran (2019), Crosby et al. (2016) and Yeoh (2017)
9	Uncertainty around regulatory aspects	Deshpande et al. (2017), Cermeno (2016) and Guo and Liang (2016)

Source: Table prepared by the author

4.2 Vectors of progress in the adoption of blockchain technology

Deloitte's study on challenges reveals five key vectors of progress that could drive wider adoption of blockchain technology. While the first three vectors focus on increase in transaction speed, standards and interoperability and implementation, and the other two vectors focus on regulatory and expansion of consortia.

4.2.1 Increasing throughput and performance

Barriers: blockchain can be slow.

Addressing the barriers to improve the performance:

- Developing newer consensus mechanisms proved significantly higher performance with reduced time and energy consumption.
- A significant development in the Ethereum platform in a Proof -of -stake system, it can now process 2000 transactions per second as against 15 transactions per second.
- Blockchain developers are exploring newer consensus mechanisms like proof of burn, proof of capacity which is improving blockchain speed significantly and adoption of this technology is proving successful in trade finance, supply chain traceability, healthcare etc.,

4.2.2 Enhancing standards and interoperability

Barriers: Lack of standards and difficulties in interoperability.

Towards addressing the barriers to improve the performance:

A **Standardisation:** Standardisation helps enterprises to validate proofs-of-concept, and integrate with existing systems to provide efficient services.

Example: Membership in Ethereum Alliance which was found in 2018, has increased to around 600 members and also membership in Hyper ledger Foundation reached to 250 organisations.

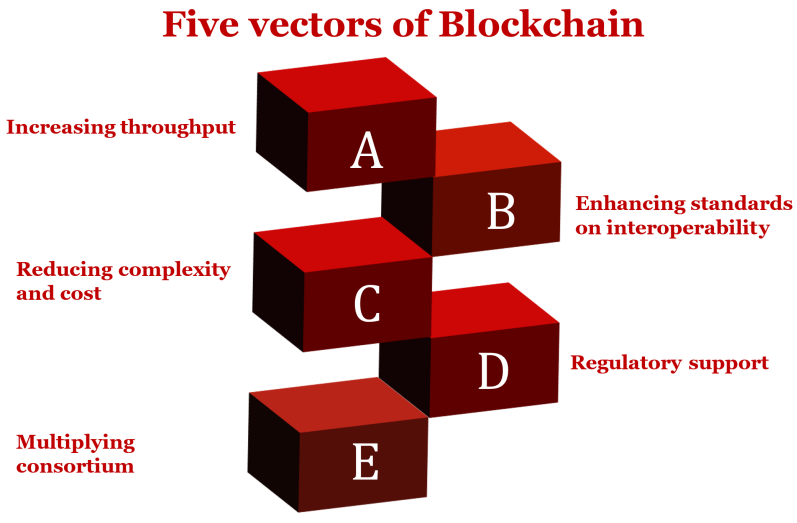
B **Decentralisation:** Another standardisation effort gaining traction is the Decentralised Identity Foundation, a consortium formed to promote standards for blockchain-based identity systems which enables new business models as well as new ways of administering public services. As of now, membership in that consortium has reached nearly sixty organisations.

C **Interoperability and data standards by GSI:** In some specific use cases, the industry is working towards interoperability by adopting data standards in the context of new blockchain applications.

Example: Microsoft and IBM are implementing data standards developed by GSI [Global standards for identification and structured data] in the applications in Supply chain Management.

Figure 1 shows five vectors of progress in the adoption of blockchain technology as suggested by the studies by Deloitte study on Blockchain adoption.

Figure 1 Vectors of progress in the adoption of blockchain technology (see online version for colours)



Source: Figure prepared by the author

4.2.3 Reducing complexity and cost

Barriers: The high costs and complexities involved with developing and deploying blockchain solutions are significant obstacles to the adoption of the technology.

Towards addressing the barriers to improve the performance:

A **Cloud based blockchain technology:** Amazon, IBM, and Microsoft are now providing cloud-based blockchain technology as a service to minimise the barriers and to improve operating Networks.

Further, cloud providers are releasing blockchain templates to reduce application development time and automate the setup of basic blockchain infrastructure.

B **Development of new software platforms:** New software applications such as Sawtooth platforms are aiming to ease the development and deployment of blockchain applications.

C **Apps in preferred languages:** This is the significant development which also allows developers to create apps in their preferred language, such as JavaScript and Python. This vector of progress is likely to promote greater adoption of blockchain technology.

4.2.4 Regulatory support

Barriers: Regulatory issues

Towards addressing the barriers to improve the performance:

A **US legislature bills on adoption:** This year alone, some 17 US state legislatures have considered and passed few bills pertaining to the adoption of blockchain technology. These bills cover few specific areas such as the recognition of cryptographic signatures, use of smart contracts, and the use of blockchains for maintaining tamper free, immutable business records.

B **US Congress Joint Economic Report of 2018**: This report provides a common and coordained regulatory framework to provide clarity for the developers of blockchain.

C **US Financial stability oversight council:** US Federal Trade Commission formed Oversight council, a government body to assess financial risk and also to suggest the ways of improving the technology.

4.2.5 Multiplying consortia

Barriers: Weak consortia.

Towards addressing the barriers to improve the performance:

Blockchain consortia are groups of companies using this technology that collaborate and to advance shared objectives for the technology for educating, conducting research, defining use cases, setting standards, developing infrastructure and applications, and operating a blockchain network, for their members.

A **Increased membership in the consortia:** A recent study counted some 61 blockchain consortia across a dozen industries globally significant growth.

Example: R3, which is building blockchain technology for the financial industry, leads a consortium and its membership has grown from 42 (in 2015) to over 200 (in 2018).

B **Risk block consortium:** In the risk management, specifically in the insurance domain, thirty companies so far have joined the risk block consortium to collaborate on blockchain applications to lower transaction costs while increasing the speed and security of data transfers among participants in the network.

C **Blockchain in transport alliance**: Firms outside financial services are forming consortia of their own, such as the blockchain in Transport Alliance that includes leading players from the logistics sector using the Medi Ledger blockchain platform in the life-sciences sector to resolve counterfeit of goods in medical supply chains.

Growing participation by enterprises such as technology providers, regulators, and governments is a vector of progress in the development of blockchain will help increasing the adoption of the technology.

5 Discussions

The rise of new technologies and innovations, such as AI, IoT, cloud computing, are likely to integrate with blockchain technology and increase the potential of blockchain technology in providing more efficient services in global trade. Blockchain technology has the potential to enable and integrate with new business models and ecosystems in global trade, such as peer-to-peer platforms, decentralised autonomous organisations,

tokenisation, all these can create new values and opportunities for global trade. There are still some challenges and obstacles on technical, environmental and legislative grounds, it will take some time for the blockchain technology to overcome these obstacles. And in trade finance area, Distributed ledger has already made some significant progress and still there are possibilities to explore full potential of this technology.

6 Conclusion

Blockchain technology has the potential to impact trade finance by resolving challenges in the process of trade finance. Adoption of blockchain technology in the trade finance proves to be more secure, immutable and transparent operations. Through leveraging its potential, the technology makes a more resilient trade finance system in the long run. The trade finance industry has made major accomplishments in realising the efficiencies of the blockchain technology, its collaboration with banks like Standard chartered bank, HSBC have proved successful in providing real-time transactions in the trade finance domain.

References

Ahn, J. and Sarmiento, M. (2019) 'Estimating the direct impact of bank liquidity shocks on the real economy: evidence from the real letter-of-credit import transactions in Colombia', *Review of International Economics*, Vol. 27, No. 5, pp.1510–1536.

Attaran, M. and Gunasekaran, A. (2019) *Applications of Blockchain Technology in Business: Challenges and Opportunities*, Springer Nature, Switzerland AG.

Bauer, K. and Hein, S.E. (2006) 'The effect of heterogeneous risk on the early adoption of internet banking technologies', *Journal of Banking and Finance*, Vol. 30, No. 6, pp.1713–1725.

Beck, R., Müller-Bloch, C. and King, J.L. (2018) 'Governance in the blockchain economy: a framework and research agenda', *Journal of the Association for Information Systems*, Vol. 19, No. 10, pp.1020–1034.

Cermeno (2016) https://www.bbvaresearch.com/wpContent/uploads/2016/12/WP_16-20.pdf uploads

Crosby, M., Pattanayak, P., Verma, S. and Kalyanaraman, V. (2016) 'Blockchain technology: beyond bit coin', *Applied Innovation*, Vol. 2, Nos. 6–10, p.71.

Deshpande, A., Stewart, K., Lepetit, L. and Gunashekar, S. (2017) *Distributed Ledger Technologies/Blockchain: Challenges, Opportunities and the Prospects for Standards*, Overview Report, The British Standards Institution (BSI), pp.1–34, Available at: don't-let-blockchain-cost-savings-hype fool-you.

Dewey, J. (2019) *Trade Finance on Blockchain: 2019 Update: Lending and Secured Finance 2019*, Retrieved from: https://iclg.com/practice-areas/lending-and-secured-financelaws-and-regulations/18-trade-finance-on-the-blockchain-2019-update

Egelund-Müller, B., Elsman, M., Henglein, F. and Ross, O. (2017) 'Automated execution of financial contracts on blockchains', *Business and Information Systems Engineering*, Vol. 59, No. 6, pp.457–467.

Enterprise Ethereum Alliance (2018) *Enterprise Ethereum Alliance Expands Presence in Asia; Appoints Blockchain Expert Kazuaki Ishiguro to Lead Japanese Office*, 19 July.

Fanning, K. and Centers, D.P. (2016) 'Blockchain and its coming impact on financial services', *Journal of Corporate Accounting and Finance*, Vol. 27, No. 5, pp.53–57.

Ganne, E. (2018) *Can Blockchain Revolutionize International Trade?*, WTO Publisher, World Trade Organization, Geneva, ISBN, 9287047618, 9789287047618; Length, 145 pages.

Grath, A. (2012) *The Handbook of International Trade and Finance*, 2nd ed., Kogan Page Publishers, London, UK.

Guo, Y. and Liang, C. (2016) 'Blockchain application and outlook in the banking industry', *Financial Innovation*, Vol. 2, No. 1, pp.1–12.

Harwood-Jones, M. (2016) *Blockchain and T2S: a Potential Disruptor*, Available at. www.sc.com/./2016/./2016-06-16-BeyondBorders-Report-SCB

Hyper Ledger (2018) *Hyper Ledger*, 31 July 2018, View in Article Interledger, "Interledger" (Accessed 11 September, 2018).

Hyvarinen, H., Risius, M. and Friis, G. (2017) 'A blockchain-based approach towards overcoming financial fraud in Public sector services', *Business & Information System*, Vol. 59, pp.441–456, 10.1007/s12599-017-0502-4.

Kshetri, N. (2018) '1 blockchain's roles in meeting key supply chain management objectives', *International Journal of Information Management*, Vol. 39, pp.80–89.

Morris, N. (2019) *Anti-Fraud Trade Finance Blockchain Consortium Launches in Singapore*, Retrieved from: https://www.ledgerinsights.com/anti-fraud-trade-finance-blockchain

Niepmann, F. and Schmidt-Eisenlohr, T. (2017) 'International trade, risk and the role of banks', *Journal of International Economics*, Vol. 107, pp.111–126, doi: 10.1016/j. jinteco.2017.03. 007.

O'Neill, D. (2018) *Can Blockchain Fight Trade Finance Commodities Fraud?*, Retrieved from: https://www.euromoney.com/article/b1bpyrp.9h3g220/can-blockchain-fight-tradefinance-commodities-fraud? Copyright Info=true

Pazaitis, A., Filippi, P.D. and Kostakis, V. (2017) 'Blockchain and value systems in the sharing economy: the illustrative case of back feed', *Technological Forecasting and Social Change*, Vol. 127, pp.105–115.

Pennathur, A.K. (2001) 'Clicks and bricks: e-risk management for banks in the age of the Internet', *Journal of Banking and Finance*, Vol. 25, No. 11, pp.2103–2123.

Pilkington, M. (2015) 'Blockchain technology: principles and applications', in Olleros (Ed.): *Research Handbook on Digital Transformation*.

R3 (2018) *The R*3 *Story* (Accessed 11 September, 2018).

Risius, M. and Spohrer, K. (2017) 'A blockchain research framework', *Business and Information Systems Engineering*, Vol. 59, No. 6, pp.385–409.

Sawtooth (2018) *v1.0.*5 (Accessed 11 September, 2018).

Schmidt-Eisenlohr, T. (2013) 'Towards a theory of trade finance', *Journal of International Economics*, Vol. 91, No. 1, pp.96–112.

Scott, B., Loonam, J. and Kumar, V. (2017) 'Exploring the rise of blockchain technology: towards distributed collaborative organizations', *Strateg. Change*, Vol. 26, No. 5, pp.423–428.

Shojaei, A. (2019) 'Exploring applications of blockchain technology in the construction industry', *Proceedings of International Structural Engineering and Construction*, p.6, 10.14455/ISEC.res.2019.78.

Swan, M. (2015) *Blockchain: Blueprint for a New Economy*, published 24 January, 2015, *Computer Science, Business, Economics*, Reprint in 2018, See http://oreilly.com/catalog/errata.csp?isbn=9781491920497

Till, B.M., Peters, A.W., Afshar, S. and Meara, J.G. (2017) 'From blockchain technology to global health equity: can cryptocurrencies finance universal health coverage?', *BMJ Global Health*, p.2, E000570. 10.1136/bmjgh-2017-000570.

van Wersch, C.L. (2019) *Statistical Coverage of Trade Finance: Fintech and Supply Chain Financing*, IMF Working Papers 2019/165, International Monetary Fund, ISBN/ISSN: 9781498317030/1018-5941.

Wang, H., Wang, Q. and He, D. (2019) 'Blockchain-based private provable data possession', *IEEE Transactions on Dependable and Secure Computing*, Vol. 18, No. 5, pp.2379–2389.

Werbach, K. (2018) 'Trust, but verify: why the blockchain needs the law', *Berkeley Technology Law Journal*, Vol. 33, No. 2, pp.487–550.

Wragg, E. (2018) *Fintech Firm Forms Blockchain Consortium Against Trade Finance Fraud*, Retrieved from: https://www.gtreview.com/news/fintech/fintech-firm-formsblockchain-consortium-against-trade-finance-fraud

Yeoh, P. (2017) 'Regulatory issues in blockchain technology', *Journal of Financial Regulation and Compliance*, Vol. 25, No. 2, pp.196–208.

Zhang, X., Aranguiz, M., Xu, D., Zhang, X. and Xu, X. (2018) *Utilizing Blockchain for Better Enforcement of Green Finance Law and Regulations, in: Transforming Climate Finance and Green Investment with Blockchains*, Academic Press, pp.289–293, https://doi.org/10.1016/B978-0-12-814447-3.00021-(https://www.sciencedirect.com/science/article/pii/B9780128144473000215).

Bibliography

Cai, C.W. (2018) 'Disruption of financial intermediation by fintech: a review on crowd funding and blockchain', *Accounting and Finance*, Vol. 58, No. 4, pp.965–992.

Caldarelli, G. and Ellul, J. (2021) 'The blockchain oracle problem in decentralized finance–a multivocal approach', *Appl. Sci*., Vol. 11, No. 16, p.7572.

Cermeño, J.S. (2016) *Blockchain in Financial Services: Regulatory Landscape and Future Challenges for Its Commercial Application*, BBVA Research, Madrid, Spain, Available at. http://www.smallake.kr/wp-content/uploads/2017/01/WP_16-20.pdf

Chen, Y. and Bellavitis, C.(C.) (2020) 'Blockchain disruption and decentralised finance: the rise of decentralized business models', *Journal of Business Venturing Insights*, Forthcoming, Stevens Institute of Technology School of Business Research Paper, Available at: SSRN: https://ssrn.com/abstract=3483608 or http://dx.doi.org/10.2139/ssrn.3483608

Golia, N. (2018) *Insurance Blockchain Consortium Risk Block Adds 12 Members, Cybersecurity Tools*, Digital Insurance, 21 August.

Ho, H. (2018) *Trade Finance: An Introduction to the Key Challenges*, Retrieved from: https://medium.com/hashreader/trade-finance-an-introduction-to-the-key-challenges

Kerner, M. (2018) *Simplifying Blockchain App Development with Azure Blockchain Workbench*, microsoft azure, 7 May, 2018, AWS, "AWS Blockchain Templates" (Accessed 11 September, 2018).

Kshetri, N. (2017) 'Blockchain's roles in strengthening cyber security and protecting privacy', *Telecommunications Policy*, Vol. 41, No. 10, pp.1027–1038.

Nakamoto, S. (2008) *Bit Coin: A Peer-to-Peer Electronic Cash System*, Manuscript, National Conference of State Legislatures, "Blockchain Legislation–2018 legislative session".

Salvatore, D. (2012) *Introduction to International Economics*, 3rd ed., Wiley, Publication of text book.

Tanenbaum, A.S. (1988) *Computer Networks*, 2nd ed., Prentice-Hall, Upper Saddle River, NJ, p.254.