ACCELERATING TRADE DIGITALIZATION TO SUPPORT MSME FINANCING

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FOREWORD

Micro, small and medium-sized enterprises (MSMEs) are the backbone of the economy, representing 95 per cent of all companies worldwide and accounting for 60 per cent of employment. They are fundamental to the day-to-day provision of goods and services around the world. Yet many struggle to grow and trade. Among the many challenges that MSMEs face, a lack of access to finance, including trade finance, is frequently identified as a critical barrier to growth. The MSME financing gap is a reality that cannot be ignored and that should be tackled with determination if we wish to ensure that small players are given a chance to thrive.

Digital technologies, from cloud computing to application programming interfaces, to the Internet of Things, artificial intelligence and distributed ledger technologies, open up a range of new opportunities for MSMEs. New business models and new approaches to MSME financing are emerging. The technology is there, making interesting promises. Yet MSMEs continue to struggle to access financing, including trade finance, with ripple effects on their ability to grow and trade. How can we unleash the potential of these technologies?

The current pandemic, which has had a devastating impact on small businesses, has shown that going digital is no longer optional. It is necessary. But digitalization requires more than simply technology. It requires an enabling regulatory environment.

This publication explores how digital technologies can be leveraged to facilitate MSME financing. It provides examples of relevant use cases and discusses

challenges faced by practitioners. While the potential of digital technologies to facilitate MSME financing is significant, this publication shows that a more holistic approach is needed to unleash the potential of these technologies to facilitate the access of MSMEs to finance, including trade finance. Coordinated action on issues ranging from standards, to how to leverage data, what type of data, digital identity, regulation, and how to close the digital divide, is needed. Policymakers, technologists, practitioners, bankers and all other stakeholders must work together to devise, agree upon and then execute a roadmap that will catalyse action.

We need to act big to help small businesses!

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1 | INTRODUCTION

Imagine how different the world might look today if, in 1976, Apple Computers had not obtained the US$ 15,000 in financing they needed to buy the parts to fulfil their first order. How many entrepreneurial visions with the potential to change the world have fizzled out of existence due to a lack of funds?

For many micro, small and medium-sized enterprises (MSMEs) around the world today, access to financing can mean the difference between prosperity and bankruptcy. Working to identify, understand, and ultimately overcome the challenges that MSMEs face in their quest for acquiring financing will help to ensure that the next Apple Computers does not cease to exist before it has a chance to change the world.

This publication seeks to identify some of the most pressing of these challenges, understand them, and explore the potential application of digital technologies to mitigating their impact. To that end, the authors conducted interviews and surveys with experts in the field of MSME financing, including in some cases trade financing, to shed light on these issues and explore the ways that technology can be used. A more detailed description of the research conducted can be found in Appendix A.

This publication will begin by examining some of the challenges that have been identified as impacting MSME financing, as well as the role that the COVID-19 pandemic has had in moulding the landscape. Next, it will move on to examine key digital technologies, their potential benefit to the industry – in particular to MSME financing – a selection of case studies and companies utilizing these technologies,[1] the adoption challenges they face, and recommendations for overcoming these challenges. The technologies in question include cloud computing, optical character recognition (OCR), the Internet of Things (IoT), big data analytics, artificial intelligence (AI), quantum computing, distributed ledger technology (DLT)[2] and application programming interfaces (APIs).

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[1]The authors note that the case studies used throughout this white paper are not exhaustive; rather, they are a selection of use cases/case studies which are intended to illustrate the way technologies are used within MSME financing. Inclusion of case studies, companies, products or services does not imply their endorsement by TFG, ICC or WTO.

[2]From a technical standpoint, the terms "DLT" and "blockchain" are not interchangeable. However, it is currently very common to use them interchangeably in the vast majority of the non-technical literature, project descriptions and the business community. To avoid unnecessary discrepancies, this paper will follow the convention of using the terms DLT and blockchain interchangeably.

TABLE OF ABBREVIATIONS

ADB	Asian Development Bank
AI	artificial intelligence
AML	anti-money laundering
API	application programming interface
B2B	business-to-business
DID	decentralized identifier
DLT	distributed ledger technology
ERP	enterprise resource planning
fintech	financial technology
GVC	global value chain
ICC	International Chamber of Commerce
IFC	International Finance Corporation
IoT	Internet of Things
ITC	International Trade Centre
ITFA	International Trade and Forfaiting Association
KYC	know your customer
LEI	legal entity identifier
ML	machine learning
MLETR	UNCITRAL Model Law of Electronic Transferable Records
MSME	micro, small and medium-sized enterprise
OCR	optical character recognition
SME	small and medium-sized enterprise
SSI	self-sovereign identity
TFG	Trade Finance Global
UNCITRAL	United Nations Commission On International Trade Law
WCO	World Customs Organization
WTO	World Trade Organization

2 TRADE DIGITALIZATION AND FINANCING: NEW HOPE FOR MSMES?

2.1 | AN UNMET NEED

The International Finance Corporation (IFC), the SME Finance Forum and the World Bank Group estimate the entire MSME finance gap to be close to US$ 5 trillion,[3] hindering the ability of MSMEs to grow. This gap, however, is not due to a lack of available funds. A 2019 report by the International Trade Centre (ITC)[4] indicated that "in 2018 global funds held US$ 1 trillion of cash-in-hand equity capital that was seeking investment opportunities". Of particular concern is the trade finance gap, which disproportionately affects MSMEs. Despite the low-risk nature of short-term trade finance, the trade finance gap alone is estimated at upwards of US$ 1.5 trillion.[5] The rejection rate of MSME proposals for trade finance is 45 per cent. According to the Asian Development Bank (ADB),[6] "among MSMEs initially rejected that sought alternative financing, 47 per cent were unable to find anything appropriate"; this does not include those firms that do not even apply for financing in the first place.

Several key reasons are commonly put forward to explain why MSMEs, particularly those in developing nations, struggle to obtain financing.[7] These reasons include a greater risk profile combined with MSMEs' lack of additional collateral and of the formal documentation required for financing, as well as more complexities for MSMEs when financing cross-border activities, a lack of awareness of financing opportunities among MSMEs, and proportionally high costs of services, due, in part, to a lack of digitalization. When it comes to trade finance, some issues are related to working capital issues and others to trade finance products, with each creating different challenges.

[3]https://www.smefinanceforum.org/sites/default/files/Data%20Sites%20downloads/MSME%20Report.pdf.

[4]https://www.intracen.org/uploadedFiles/intracenorg/Content/Publications/SMECO2019.pdf.

[5]https://www.adb.org/publications/2019-trade-finance-gaps-jobs-survey.

[6]https://www.adb.org/publications/2019-trade-finance-gaps-jobs-survey.

[7]See in particular https://www.intracen.org/uploadedFiles/intracenorg/Content/Publications/SMECO2019.pdf, https://www.wto.org/english/res_e/booksp_e/tradefinsme_e.pdf and https://www.adb.org/publications/2019-trade-finance-gaps-jobs-survey.

2.1.1 ASSESSING MSME RISK PROFILES: A COMPLEX TASK

Many of the challenges facing MSMEs in their quest for financing stem from their general position in the market.

As per one of the interviews quoted hereafter (see Appendix A for a description of methodology), "There is a lack of appetite among banks to provide funding and support MSMEs businesses" [*3 Bank].[8] This is due in part to the perception held by banks that "the rate of default in loans awarded to MSMEs is much higher than large scale businesses" [*3 Bank] and that MSMEs are often not known to banks and lack a credit history.

Lack of collateral may be a problem as well. Banks often require additional collateral to mitigate risks against MSME borrowers with whom they do not have strong existing relations, but this requirement is difficult for many MSMEs to fulfil, leading to increased rejections. As per one financial technology (fintech) company interviewed, "MSMEs often lack the extensive documentation that helps funders understand the risk profile of their business. This means that the little money banks are willing to provide often goes to larger businesses whose risk is easier to calculate" [*22 Fintech]. Assessment of MSMEs' creditworthiness, i.e. risk assessment, is clearly a central issue for MSME financing. It is important to note, however, the difference between good and bad risks. "Some of the US$ 1.5 trillion trade finance gap is good risk, but some of it is bad risk. We need to focus on the good risk. What we need is to improve our understanding of the good risk within that gap" [*30 Bank]. This is also relevant in the context of domestic financing.

In addition to this, "most MSMEs do not have an effective marketing strategy and so have not been able to successfully sell their ideas to funders" [*3 Bank]. Ultimately, this suggests that, because of an inability to communicate successfully with potential funders through actual documentation or comprehensive marketing, MSMEs are inadvertently withholding information from these funders, which negatively affects their ability to acquire the funding. To acquire funding successfully, MSMEs need to articulate their unique benefits while simultaneously providing necessary "know your customer" (KYC) compliance documentation.

One tool that may help in this realm is a digital identification system for companies that permits a legal entity to be identified quickly and unambiguously; such a tool would underpin a global digital identity system.[9] Without a global digital identification system, finding information about an MSME in a sea of metadata is difficult, if not impossible. Such a system would increase transparency and underpin the advantages offered by fintech, allowing greater inclusion of MSMEs in the global economy by facilitating customer onboarding,[10] credit approval processes and the identity validation of potential clients. It would also increase access to finance for MSMEs in emerging markets by making the flow of reliable information about small companies easier.[11]

Recognizing the value of a global identification system for companies, the G20 spearheaded work on a global legal entity identifier (LEI) in 2011.[12] Launched in 2014, the LEI has, however, seen limited adoption, as only 1.8 million companies had acquired an LEI by the end of 2020. Other similar initiatives include the Data Universal Numbering System (DUNS), a proprietary system developed and managed by Dun & Bradstreet that assigns a unique numeric identifier (a DUNS number) to a single business entity, and the Trade Identification Number (TIN) developed by the World Customs Organization (WCO) – not to mention the various DLT-based

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[8]Note: Throughout this publication, where quotations are used from interviews or qualitative survey results, they will be cited in this format: square brackets containing an asterisk, an anonymized identifier and categorization of the firm.

[9]Digital identity is a set of validated digital attributes and credentials for the digital world, similar to a person's identity for the real world. A digital identity serves to uniquely identify a person or company. Digital identity fundamentally requires digital identifiers.

[10]Customer onboarding refers to all activities involved in introducing a new business customer to a company.

[11]https://www.adb.org/sites/default/files/publication/505076/adb-brief-109-legal-entity-identifier-tfp-survey.pdf.

[12]The LEI is administered by the Global Legal Entity Identifier Foundation (GLIEF - https://www.gleif.org/en/). It is a 20-digit code based on the ISO 17442 standards, which provides a unique identification to participating parties. Just like a passport or a car registration number, each LEI contains information about companies, such as "who is who", and "who owns whom", and "who owns what". In order to help drive adoption of the LEI, the ICC recently established a working group on mass adoption of the LEI.

initiatives that have flourished in recent years (see Section 3.3.2 on DLT). More recently, the B20 Saudi Arabia, together with Business at OECD, proposed to investigate the feasibility of a global value chain (GVC) passport, which would allow firms to be accredited throughout the relevant GVC as credible partners, and would prove compliance with the relevant financial regulations and requirements, thereby avoiding the burden of having to re-apply for accreditation multiple times across multiple borders.[13]

2.1.2 COMPLEXITIES FOR FINANCING CROSS-BORDER ACTIVITIES

Cross-border activities entail complex risks, particularly linked to foreign transactions and legal procedures. The ADB Trade Finance Gap Survey indicates, for example, that KYC and anti-money laundering (AML) concerns, which become amplified when transacting in multiple jurisdictions, are the eminent reason for rejections of MSME financing and that 20 per cent of trade finance applications are rejected due to a lack of additional collateral. In domestic environments, KYC and AML risks not present include fluctuating foreign exchange rates, higher local interest rates, unfamiliar legal environments, and prudential regulatory and financial transparency risks. Add to these any sort of geopolitical instability or economic uncertainty, and conditions become challenging, at best, for most MSMEs.

According to a WTO report,[14] "many local banks may lack the capacity, knowledge, regulatory environment, international network, or foreign currency to support import-export related finance". As local banks most often serve MSME clients, particularly in developing economies, this may explain why "few banks are focusing on MSME trade finance needs" [*14 Fintech]. This may stem from the complexities associated with financing cross-border activities. While this is the case, cross-border activities cannot be considered in isolation; domestic activities, such as financing domestic trade and transactions, are also important for MSMEs to achieve success in international markets.

2.1.3 LACK OF AWARENESS AMONG MSMES

MSMEs do not possess the same magnitude of knowledge as funders. This affects both their ability to identify potential sources of funding and their level of comfort when pursuing innovative financing methods. One of the bank respondents [*3 Bank] noted that in most cases, "MSMEs are not fully aware of the various government grants and other initiatives to support their type of business" and that they "are not taking advantage of various innovative solutions geared towards supporting MSME business".

Beyond this, even when MSMEs are aware of the options available to them, many still struggle with a lack of understanding of the processes and criteria for acquisition. A fintech respondent [*13 Fintech] relates one discussion during which "the MSME actually drew attention to the fact that, had they known the process upfront in terms of what would impact the decision-making process, they could have addressed these requirements and secured the funding". Not only do MSMEs often lack knowledge of the funding potentially available to them, including alternative financing options, but they can also lack knowledge of what it is necessary to do in order to acquire that funding. One of the fintech respondents [*14 Fintech] points out that, "while MSMEs talk about access to long-term capital, financial institutions talk about debt. The right conversation is not happening. MSMEs are asking for the right thing but from the wrong institutions".

[13]https://www.b20saudiarabia.org.sa/wp-content/uploads/2020/09/Final-B20-Business-at-OECD-on-GVC-Passport-28082020.pdf.
[14]https://www.wto.org/english/res_e/booksp_e/tradefinsme_e.pdf

To overcome this, there is a need to educate and advertise more, and also to simplify and standardize the application process. In light of the COVID-19 pandemic, however, many financial institutions are providing customers with resources to improve their business plans and financing applications with the aim of improving acceptance rates for pandemic-related financial aid. This is a promising step in the right direction.

2.1.4 HIGH COSTS OF SERVICE FROM A LACK OF DIGITALIZATION

Another factor affecting MSMEs' ability to acquire finance is the high cost of service[15] often associated with MSME financing, in particular trade finance, due, in large part, to a lack of automation as a result of a non-digitized environment.[16] "Without automation, manual handling costs will stay too high to serve a big portion of the MSME market" [*9 Fintech]. This is because "the processing costs of trade finance transactions are far too high in relation to low-value or single transactions, the predominant transaction type for MSMEs" [*10 Fintech].[17] This creates an unfavourable situation for MSMEs as they seek out financing, as finance providers are incentivized to allocate their resources elsewhere. A "lack of digitalization of MSMEs together with small loan sizes, can lead to a high cost of service" [*26 Consultant] and subsequently, a low appetite for providing funds.

This same paradigm also applies to access to credit insurance, if the portfolio of debtors is not optimal, for instance if it is too small or concentrated. Most clients of credit insurance companies in short-term trade are MSMEs.[18] Increased digitization can lower costs and create capacity for servicing small firms. From an MSME perspective, striking the balance between complying with new trade agreements and investing in new technologies is a key challenge and distraction when one considers their limited resources and investment.

Results from the ICC Global Survey on Trade Finance[19] also suggest that some of the difficulties experienced by MSMEs may arise due to the banks that serve these firms. MSMEs tend to be served more often by smaller local or regional banks, rather than larger global banks. Smaller local or regional banks tend to be better able to form close relationships with MSMEs and to foster a sense of trust with these clients. The ICC study, however, indicates that it is the local banks that lag behind the most in terms of digitalization. Only 25 per cent of local banks think that digitalization will provide benefits for their operations, and only 55 per cent project any cost savings as a result of digitalization, due mainly to the perceived cost of change weighed against the potential benefits. This is compared to 59 per cent and 90 per cent respectively for global banks. On top of this, less than half of local banks have a digital strategy. This lack of digital appetite in the banks servicing the most disproportionately underfinanced companies contradicts the belief held by 55 per cent of local banks that they are best positioned to service MSMEs in terms of digitalization.[20]

"Electronic documents sit at the uncomfortable intersection of 19th-century legislation and unsophisticated 21st-century operators"

- ICC Digitalisation Working Group

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[15]http://documents1.worldbank.org/curated/pt/995331545025954781/Financing-Solutions-for-Micro-Small-and-Medium-Enterprises-in-Bangladesh.pdf, https://www.oecd.org/finance/G20-OECD-High-Level-Principles-on-SME-Financing.pdf, https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2019/02/11/Financial-Inclusion-of-Small-and-Medium-Sized-Enterprises-in-the-Middle-East-and-Central-Asia-46335Asia (imf.org).

[16]The cost of finance is a combination of intermediation costs, including processing costs, and the level of risk of clients.

[17]It is important to note, however, that trade finance transaction processing costs may be very different according to the financing instrument being used. A letter of credit, for example, is often more expensive to process than receivable financing instruments, due to the number of documents processed.

[18]https://econpapers.repec.org/article/sprweltar/v_3a150_3ay_3a2014_3ai_3a4_3ap_3a715-743.htmsurance (repec.org)

[19]https://library.iccwbo.org/content/tfb/pdf/2020iccglobaltradesurveyvweb.pdf

[20]https://library.iccwbo.org/content/tfb/pdf/2020iccglobaltradesurveyvweb.pdf

From these studies, it seems evident that although digitalization efforts could help improve the service delivery for MSMEs, the challenges that persist have all but eliminated the incentives for local banks to pursue digitalization. As the ICC Digitalization Working Group[21] articulated, digitization and "Electronic documents sit at the uncomfortable intersection of 19th-century legislation and unsophisticated 21st-century operators". This leads to too few cost-effective choices of new technology provision for smaller banks. Technology is often seen as too costly and too futuristic, as a luxury suitable only for large banks, or as an opportunity for new digital banks, but not for local banks in developing countries.

2.1.5 THE COST OF CAPITAL AND BASEL REQUIREMENTS: AN ADDITIONAL CHALLENGE?

There has been debate surrounding the possible unintended consequences of Basel III requirements.[22] These debates led the Basel Committee on Banking Supervision to make several revisions reflecting the low risk of trade finance and improving its regulatory treatment.[23] It is important to note, in this regard, that studies conducted by the Financial Stability Board[24] and the World Bank[25] do not "identify material and persistent negative effects on SME financing in general, although there is some differentiation across jurisdictions. There is some evidence that the more stringent risk-based capital (RBC) requirements under Basel III slowed the pace of SME lending growth at the most 'affected' banks (i.e. those least capitalised ex ante) relative to other banks", but "these effects are not homogeneous across jurisdictions and they are generally found to be temporary. [...] Stakeholder feedback suggests that SME financing trends are largely driven by factors other than financial regulation, such as public policies and macroeconomic conditions".[26]

This conclusion is consistent with the literature on the effects of bank capital regulations and with stakeholder feedback that MSME financing is largely driven by factors other than financial regulation. In spite of this, questions are being raised about how to provide a more favourable framework for assessing MSME credit risk through digital innovations and taking into account new analytics provided by fintech companies in a Basel environment.

Other concerns have arisen from the termination by many international banks of correspondent banking relationships after the financial crisis of 2008-09 and their reduction of overall exposure towards developing countries and MSMEs (de-risking). While some practitioners have become increasingly concerned about de-risking as a possible result of these requirements, where financial institutions have terminated or restricted business and correspondent banking relationships in order to avoid, rather than manage, a risk-based approach, analysis by international financial institutions, trade institutions, multilateral development banks and academics provides a more nuanced picture. De-risking can also be the outcome of commercial decisions by private financial institutions, and of changing market shares in a post-financial-crisis environment.[27] Nevertheless, the boost that beneficial capital weightings could have on MSME lending should not be completely discounted, as some practitioners noted. At the very least, it could form one part of an overall support strategy at local, regional or international levels and could encourage banks to re-examine their approach.

[21]The ICC Digitalization Working Group was established in 2017 by the ICC Banking Commission to coordinate work relating to the digitalization of trade finance (see https://iccwbo.org/media-wall/news-speeches/icc-banking-commission-launches-working-group-digitalisation-trade-finance/ for more information on the Working Group).

[22]Basel III is an internationally agreed set of measures developed by the Basel Committee on Banking Supervision in response to the financial crisis of 2007-09. The measures aim to strengthen the regulation, supervision and risk management of banks (see https://www.bis.org/bcbs/basel3.htm).

[23]https://www.wto.org/english/res_e/booksp_e/tradefinsme_e.pdf.

[24]https://www.fsb.org/2019/11/evaluation-of-the-effects-of-financial-regulatory-reforms-on-small-and-medium-sized-enterprise-sme-financing-final-report/ edium-sized enterprise (SME) financing: Final report - Financial Stability Board

[25]https://openknowledge.worldbank.org/handle/10986/33011.

[26]https://www.fsb.org/wp-content/uploads/P291119-1.pdf.

[27]http://www.fatf-gafi.org/media/fatf/documents/reports/Guidance-Correspondent-Banking-Services.pdf.
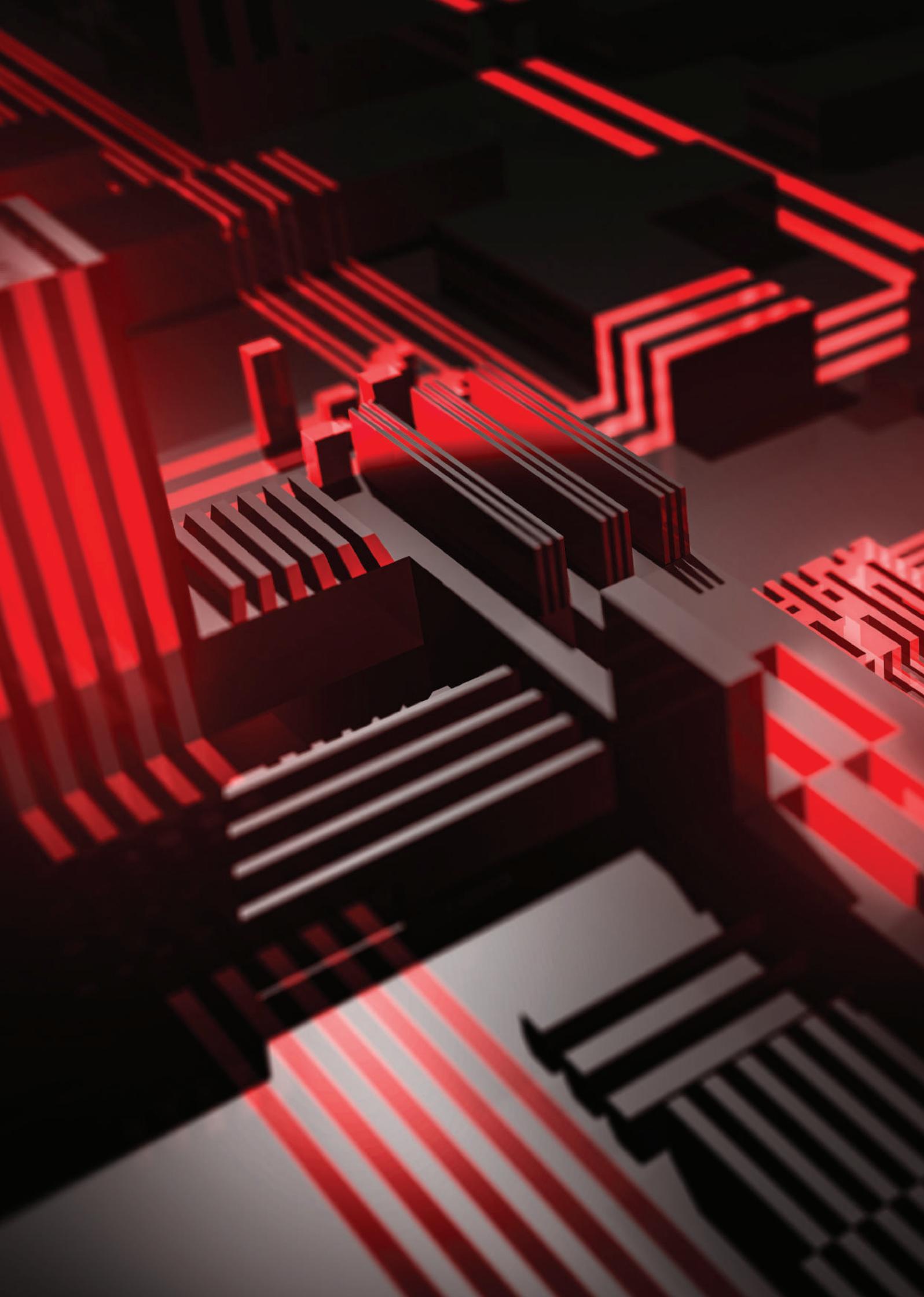
2.2 | COVID-19: A CATALYST FOR DIGITALIZATION?

There is hardly an industry in the world that has not been impacted by the COVID-19 pandemic. As pandemic-induced closures and shutdowns came into force, many banks and other entities in the finance chain found that they needed to make changes. According to the ICC Digitalisation Working Group's report, *Digital Rapid Response Measures Taken by Banks Under COVID-19*,[28] the largest trade finance process disruptions have been related to the physical transfer of paper documents and negotiable instruments and the requirement for authorized signatures. Largely, these have come about as a result of a lack of physical employee presence at the usual places of business, coupled with the inability to print and transport documents. Operating under "normal" processes has not been an option. To cope, banks have been forced to create or scale up ad hoc digital processes.

According to the ICC Global Survey on Trade Finance,[29] banks have helped customers through the COVID-19 crisis by relaxing many of the rules surrounding financing terms, original documentation rules, and "wet ink" (or manual) signatures. While these are promising signs for trade digitalization, the survey also indicated that many banks have not received significant meaningful support from government authorities to facilitate trade on digital terms.

This lack of governmental support, even in the context of a pandemic-ridden world, is particularly worrisome for the prospects of trade digitalization. This is because, as the ICC Digitalisation Working Group[30] notes, one of the biggest reasons why digitalization has not yet been adopted is the notion that a digitalized process can only ever reap the benefits of its least digital link. If one party in the supply chain, such as a governmental customs authority, still requires physical original documents laden with wet-ink signatures, then the entire process must be at least partly paper-based from the beginning. This has led some firms to question why they should lay out the large capital investment necessary to digitize their processes when their digital work will still be bogged down by paper requirements along the chain.

Nevertheless, the desperate necessity for paperless workarounds has set the industry on a digital course. As the ICC[31] puts it, "the current crisis catalyzes and accelerates a significant reduction (perhaps ultimately elimination) of paper in trade and trade finance transactions".

The impacts of COVID-19 could accelerate a shift in the actual providers of financing.[32] According to the 2020 Dubai Multi Commodities Centre (DMCC) "Future of Trade" Report,[33] "over 80 per cent [of executives at medium to large-sized businesses in the United Kingdom, the United States, and China] were considering switching from traditional banks to alternative lenders for trade finance". If this materializes, this transition could:

*"be a giant leap forward for MSME financing in terms of modernization and growth. A newcomer entering the market would want to streamline the process and make it as simple and cost-effective as possible. As the only way to do this is through technology, this would supercharge the digital transformation of this industry, meaning better processing, better accessibility, better security, and all that for a lesser cost" [*17 Fintech].*

However, who these alternative financiers are, and the extent to which they can aid MSMEs to access finance, including trade finance, remains to be assessed.

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[28]https://iccwbo.org/content/uploads/sites/3/2020/04/2020-icc-covid-response-banks-3.pdf.

[29]https://library.iccwbo.org/content/tfb/pdf/2020iccglobaltradesurveyvweb.pdf.

[30]https://iccwbo.org/content/uploads/sites/3/2020/04/2020-icc-covid-response-banks-3.pdf.

[31]https://library.iccwbo.org/content/tfb/pdf/2020iccglobaltradesurveyvweb.pdf.

[32]http://newsletter.itfa.org/not-a-bank-not-a-fintech-the-rise-and-rise-of-alternative-finance-by-shannon-manders-itfa-consultant/

[33]https://www.futureoftrade.com/

3 | THE ROLE OF TECHNOLOGY

Many of the challenges that face MSMEs in their search for financing are broad in scope and cannot easily be addressed by any single solution. As one of the fintech respondents [*22 Fintech] observes, "It is easy to say that technology is the answer here, and while innovation will help banks distribute trade finance assets to smaller investors and better understand the risks associated with MSMEs, there is also a greater change needed". At this early stage of the adoption of such technological innovation, there is very little evidence to suggest that it is being utilized by corporates and MSMEs just yet. That said, it is difficult to dispute that technological innovation and the various emerging technologies in the industry are a critical piece in the puzzle of overcoming these challenges.

While acknowledging that technology is not a panacea, the remainder of this publication will examine the role that technology plays in the ecosystem, and will examine some of the digital technologies that seem poised to play a crucial role in paving the way towards a comprehensive solution.

It is also important to note that MSMEs are often not aware of the opportunities that digital technologies can offer them and of the solutions that alternative financiers can provide. They are often under the impression that technology is simply not for them and view it as complex and costly. This may be due to the idea that some digital trade technology solutions focus more on trying to explain the technology itself rather than simplifying the explanation and service offering to MSMEs, leading to a lack of audience engagement. Continual efforts to make MSMEs aware of the plethora of opportunities available to them are important. Governments may have a role to play in this respect to raise awareness and provide education for MSMEs.

3.1 | TECHNOLOGICAL INTERPLAY: STRONGER TOGETHER

Over the past several decades, digital technology – from AI to the IoT and DLT – has slowly begun to penetrate supply chains, trade and trade finance. Figure 1 illustrates the complex interplay between digital tools and demonstrates how each technology relies on the capabilities of others to deliver its most powerful benefits. Some of them work to collect and deliver data, others analyse and interpret this data, and still others provide the infrastructure which allows this communication to occur.

Take, for example, the role of the IoT in this relationship. IoT devices and sensors on their own provide minimal value. However, when they are combined with the secure transmission capabilities of DLT and the analytical capabilities of big data analytics tools enabled by AI, they are able to deliver meaningful and actionable information.

Based on this, the technologies that will be presented and investigated in subsequent sections of this publication should not be thought of in isolation, but rather in the context of their mutually complementary profiles. Figure 1 depicts some of the interactions that these digital tools have with one another.

Figure 1: The interconnectedness of digital technologies in trade[34]
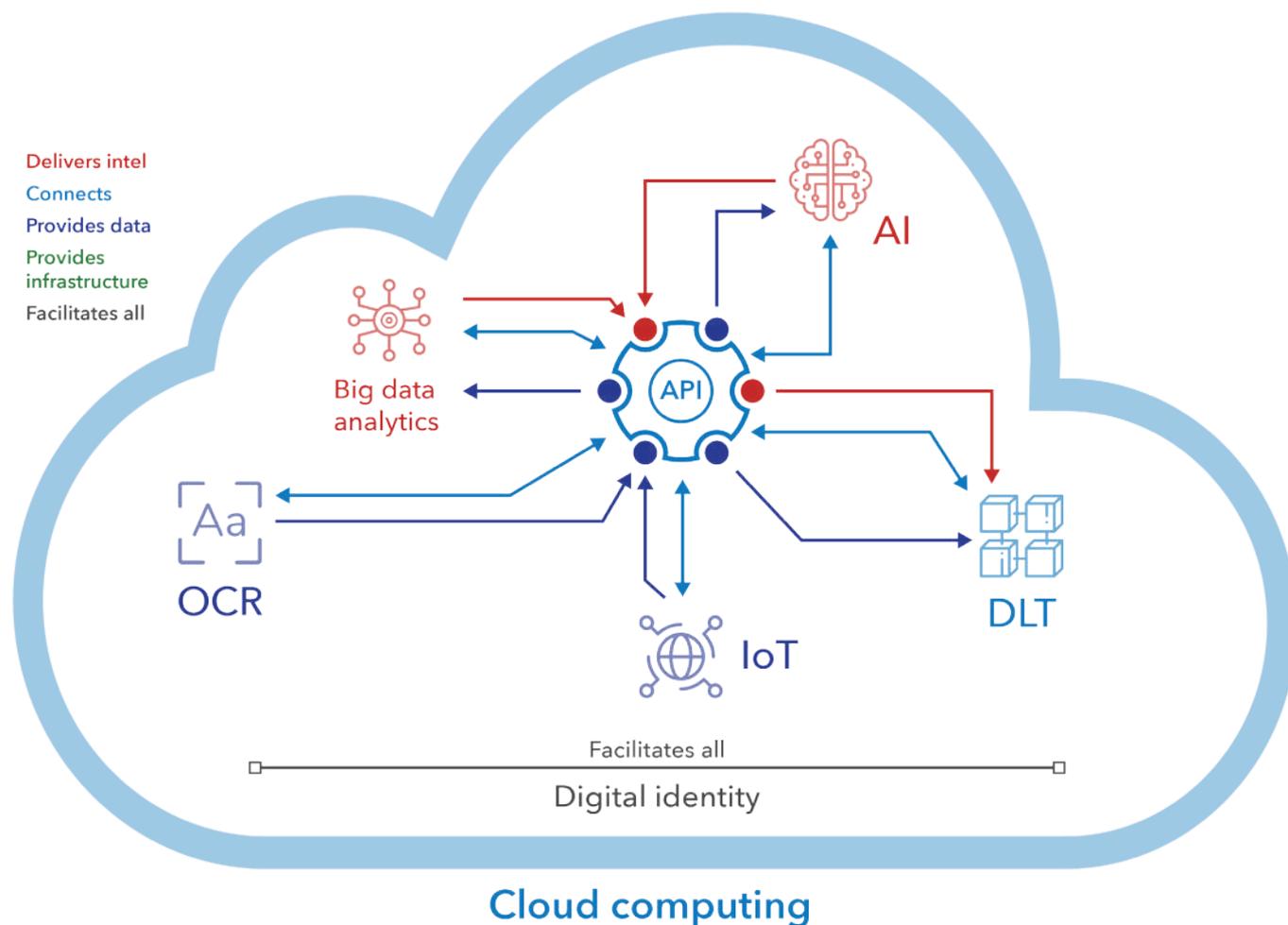
Cloud computing

Digital technologies – in particular the combination of Big Data, new algorithms and cloud computing – have been driving the rise of platforms and what is now referred to as the platform economy. The platform economy is reshaping global trade. Many of the most valuable companies globally are now based on a platform business model, such as digital marketplaces that enable groups to interact and transact. When it comes to MSME financing, in particular trade finance, many projects discussed in this publication take the form of platforms. These platforms often leverage several of the digital technologies that will be examined in this publication. The platform economy opens vast new opportunities but also raises considerable new challenges. A detailed explanation of the platform economy is beyond the scope of this paper.

3.2 | THE TECHNOLOGIES TRANSFORMING MSME FINANCING

To better understand the role that digital technologies play in trade and financing for MSMEs, a survey of 105 industry professionals was conducted (see Appendix A). The quantitative results of the administered survey can be seen in Figure 2,[35] which positions each technology based on its perceived adoption difficulty and industry impact. The figure has been divided into four quadrants, titled "rapid rewards", "lucrative challenges", "small wins", and "downstream ambitions". The positioning of each technology within these quadrants helps to depict visually where developmental effort should be focused.

Figure 2: Perceived industry impact versus difficulty adopting
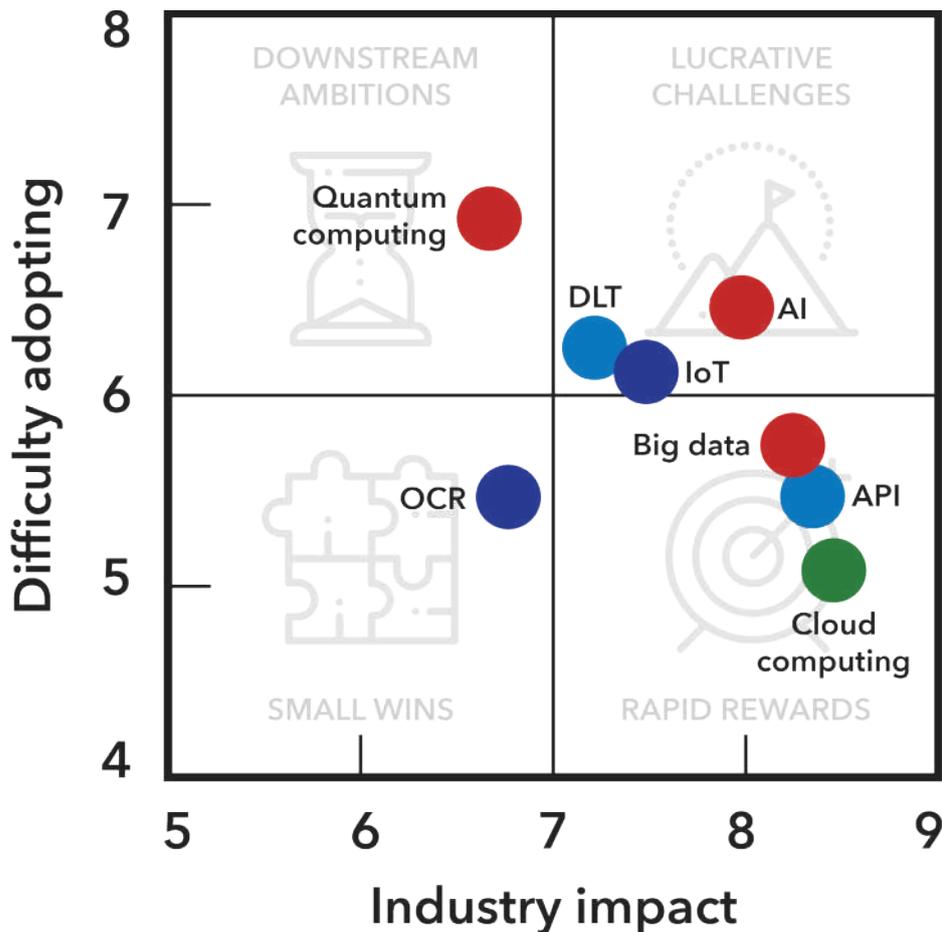
Rapid rewards

The technologies sitting at the intersection of high industry impact and low difficulty in adopting are seen as rapid rewards. Dedicating resources to implement these technologies should be a priority.

Lucrative challenges

The technologies sitting at the intersection of high industry impact and high difficulty in adopting are seen as lucrative challenges. They require considerable work on behalf of all stakeholders, but this work will have immense benefit in the future.

[35]Note: The axis scales for difficulty adopting and industry impact are 4-8 and 5-9, respectively, while the technologies were scored on a 0-10 scale. Depicting the scale in this way allows better visual segmentation into the four quadrants
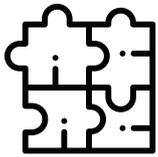
Small wins

The technologies sitting at the intersection of low industry impact and low difficulty in adopting are seen as small wins. Technologies in this quadrant can often be used as interim solutions, particularly by smaller local banks, until the more robust lucrative challenges can be effectively implemented.
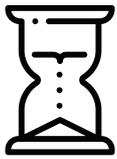
Downstream ambitions

The technologies sitting at the intersection of low industry impact and high difficulty in adopting are seen as downstream ambitions. These are technologies that may not be mature enough to demonstrate meaningful impact for the industry. The outcome of dedicating sources to implement these technologies is highly uncertain.

After plotting the aggregate data points in the matrix in Figure 2, further analysis was conducted to determine if there is any significant variation in these perceptions of impact and difficulty among the different self-identified stakeholder groups represented in the survey responses. Specifically, this analysis focused on differences between:

1. firms that use the different technologies to facilitate financing and firms that do not;

2. firms with a global presence and those with only a regional or local presence;

3. firms identifying as banks and those not identifying as banks; and

4. firms identifying as financiers and firms not identifying as financiers.

Figure 3: Average perceived industry impact and difficulty of implementing application programming interfaces (APIs), artificial intelligence(AI)/machine learning (ML) and Internet of Things (IoT)

Figure 3a: Average perceived industry impact of APIs
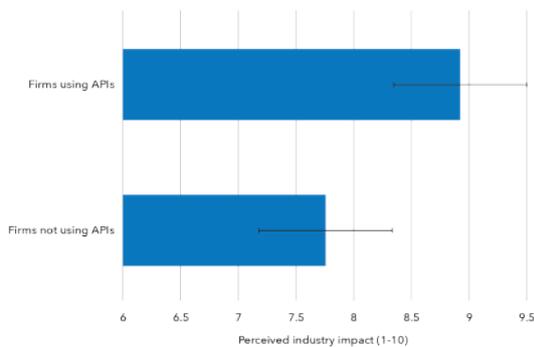
Figure 3b: Average perceived industry impact of AI/ML
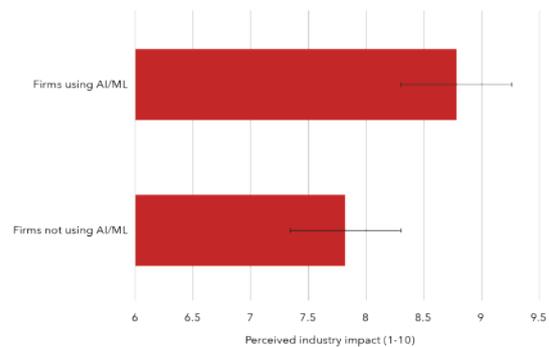
Figure 3c: Average perceived difficulty in implementing IoT
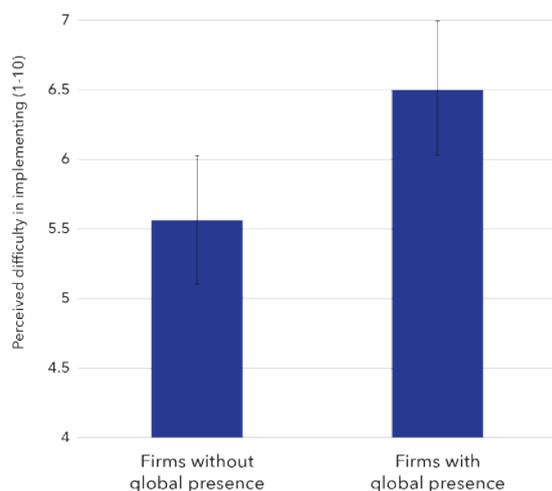
Figure 3d: Average perceived difficulty in implementing AI/ML
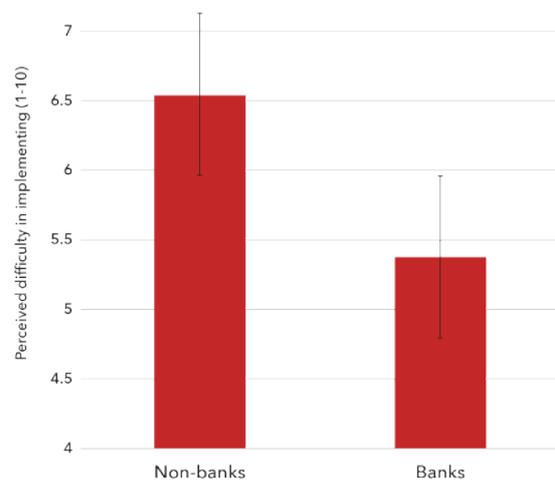
Source: Authors' survey of 105 industry professionals (see Appendix A). The lines indicate errors bars, showing the variability of this data

Most of the analyses did not unveil statistically significant differences amongst the groups (e.g. of the firms using cloud computing to facilitate financing and the firms not using cloud computing to facilitate financing, both groups perceived cloud computing as having, on average, an equal impact on the industry). There were, however, four instances where statistically significant differences were found, as demonstrated in Figure 3.

As shown in Figure 3a, 54 firms using application programming interfaces (APIs) view APIs as having a greater impact (p=0.0011)[36] than the 51 firms not using APIs. Firms using APIs may have more insights into the power and the capabilities that API connections provide, skewing their perceptions in a positive manner. In addition, it is possible that firms with a preconceived positive sentiment towards APIs (i.e. perceiving a strong impact) are also the firms most likely to be using them.

Figure 3b suggests that firms using AI or machine learning (ML) (n=23) view AI/ML as having a greater impact (p=0.0407) than firms not using AI/ML (n=82). This difference could be attributed to several possibilities. One is that firms using AI/ML have an inside understanding of the true capabilities of the technology for the industry and thus consider that AI/ML has a strong impact on their industry. Another possibility is that the correlation runs in the opposing direction and that firms viewing AI/ML as having a strong impact are the firms most likely to have implemented the technology in their workflows.

As depicted in Figure 3c, firms with a global presence (n=51) view IoT as more difficult to implement (p=0.0227) than firms without a global presence (n=54). This difference could be attributed to the idea that global firms have a larger-scale perception of what is required to interconnect the broader financial ecosystem, making the task seem more monumental. Firms with a global presence were no more or less likely to be using IoT, and firms using IoT did not view it as more difficult to implement than those not using it.

As can be seen in Figure 3d, banks (n=19) view AI/ML as being less difficult to implement (p=0.0090) than non-banks (n=86). Several possible explanations could underpin this difference. Banks already possess immense amounts of data, thus eliminating, from their perspective, the added difficulty of needing to acquire data in order for AI to be useful. Another reason could be that banks are simply more skilled in this area, making implementation appear like a straightforward endeavour.

[36]p represents the 'p-value'. In null hypothesis significance testing, the p-value is the probability of obtaining test results at least as extreme as the results actually observed, under the assumption that the null hypothesis is correct. In this instance, p=0.0011 means that there is a 0.11 per cent chance that the means of these two groups are actually equal. For the purposes of this analysis, any p-value less than 0.05 is considered significant.

3.3 | DIGITAL TECHNOLOGIES IN TRADE

The eight technologies emphasized here can be thought of as existing within the framework of a technology stack. Each layer can be used to facilitate and enhance the layer(s) above. The stack is depicted below. The following sections will explore the layers and technologies in this stack beginning from the foundation and working upwards. Within each, potential benefits, use cases, and means to address any challenges will be examined in more detail.

Figure 4: The trade financing technology stack

Layer	Technologies		
Analytical	Big Data Analytics	AI	Quantum Computing
Connectivity	API		DLT
Data Input	OCR		IoT
Infrastructure	Cloud Computing		
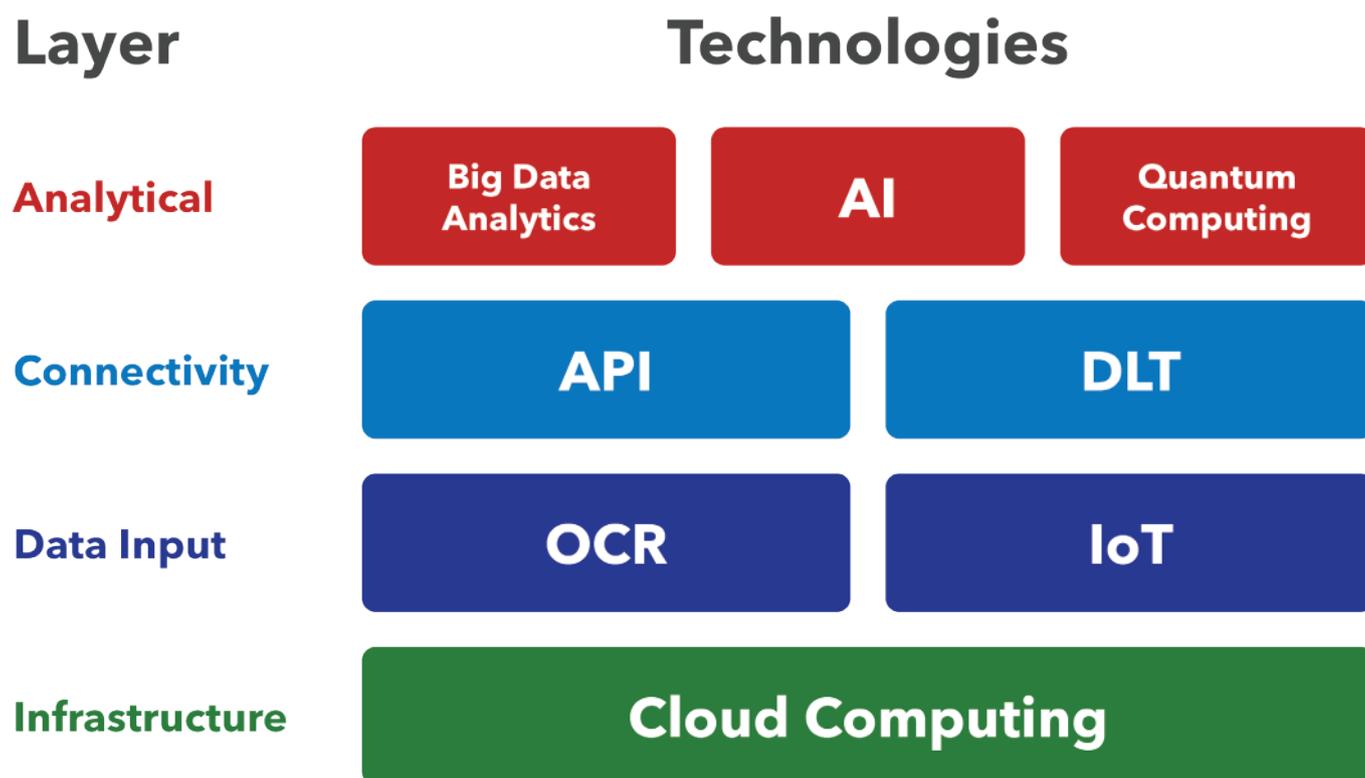
Note: Figure 4 attempts to illustrate the interplay between the different technologies. The authors have chosen to display these categories from a business perspective – with emphasis on what each technology is used for – rather than from a purely technological perspective. For instance, from a purely technological perspective, DLT is a trusted database. However, from a business perspective, it is used to connect parties directly, on a person-to-person (P2P) basis, in a trusted environment. As such, it has been categorized as part of the connectivity layer.

3.3.1

INFRASTRUCTURE TECHNOLOGIES

INFRASTRUCTURE TECHNOLOGIES

Infrastructure technologies enable other technologies and software systems to interact with external data sources. They generally refer to an organization's technological environment.

Figure 4a: The trade financing technology stack: cloud computing
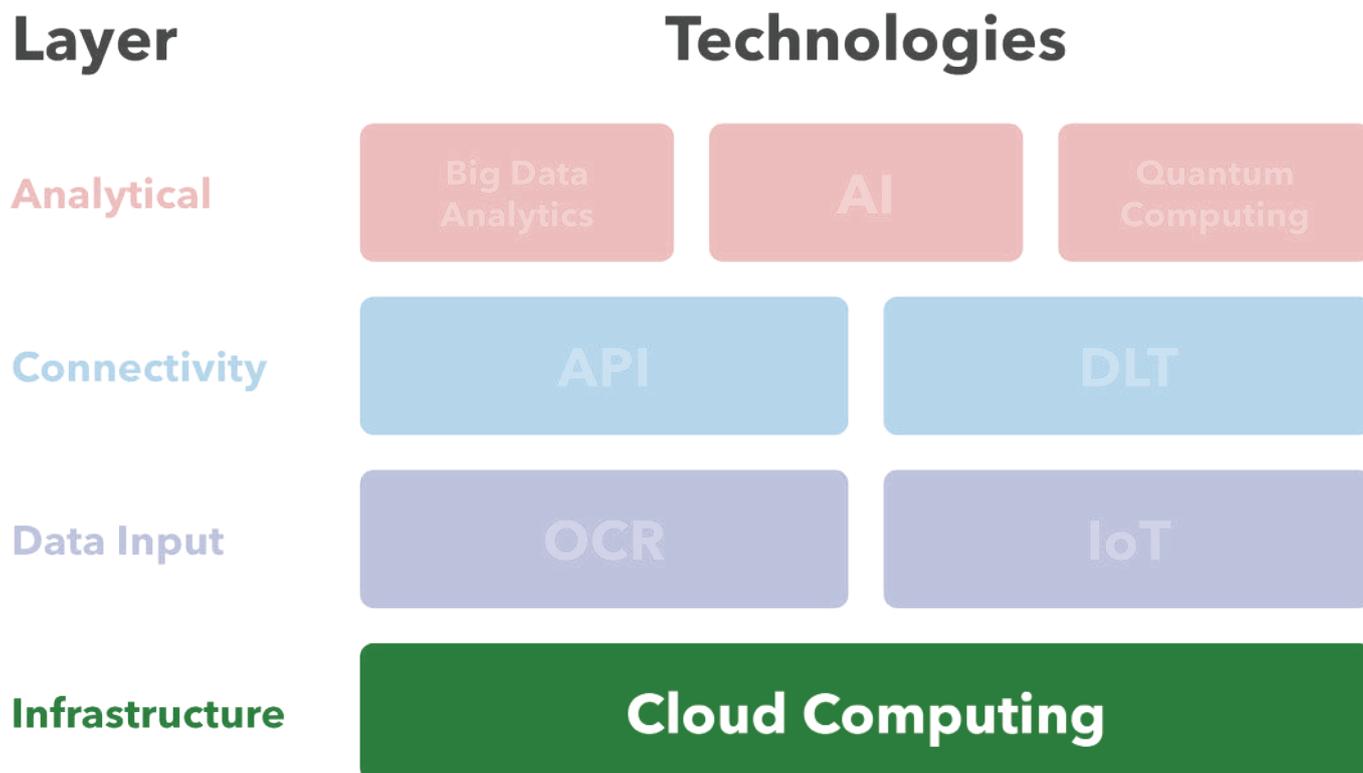
CLOUD COMPUTING

RAPID
REWARD

According to Microsoft,[37] "cloud computing is the delivery of computing services – including servers, storage, databases, networking, software, analytics and intelligence – over the Internet ("the cloud") to offer faster innovation, flexible resources and economies of scale". This on-demand approach enables the use of computing power without direct active management by the user.

POTENTIAL BENEFITS FOR MSMES

Despite being a generally mature technology in most other industries, cloud computing is still just beginning to emerge in trade finance. Nevertheless, it has the potential to provide several key benefits. First, it lowers the cost of using technology by reducing the upfront costs of setting up infrastructure. A report from Pennsylvania State University[38] shows that a full-fledged cloud migration can help reduce processing costs by upwards of 90 percent,[39] cost savings that would hopefully trickle down the value chain and result in lower costs for trade finance in general. As highlighted in Section 2.1.4, lower costs for trade finance transactions can facilitate financing for MSMEs.

MSMEs can derive additional benefits by adopting cloud computing technologies. The lower costs of scalable "pay-as-you-go" models allow smaller structures to leverage robust security and infrastructural elements, established by powerful hosting providers, while themselves remaining agile. This approach of "processing power as a service" [*24 Consultant], "is easily scalable to meet the needs of different company sizes" [*16 Fintech], eliminating costly investments to scale up. From a general business perspective, this has created opportunities for MSMEs to easily build and deploy applications to facilitate e-commerce, which has been a matter of survival for many MSMEs in the context of the COVID-19 pandemic. As the trade financing ecosystem slowly becomes more digitally versed, such applications will be able to provide additional data streams to potential financiers, increasing visibility and reducing the challenges associated with assessing MSME risk profiles, as discussed in Section 2.1.1.

Another fundamental benefit of cloud computing for the international trade industry is that it "can be accessed by the user from anywhere. This is required due to the global nature of the trade business and the fact that end-users are spread across many countries" [*15 Fintech]. Without the location-agnostic setup of cloud infrastructure, globally distributed workforces would be sparsely connected at best.

USE CASES

Cloud computing is used by many companies to provide enhanced customer service and allow for business continuity processes. With COVID-19 forcing companies to adopt remote working, big banks are increasingly

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[37]https://azure.microsoft.com/en-ca/overview/what-is-cloud-computing/.

[38]http://www.cse.psu.edu/research/publications/tech-reports/2011/cse-11-002.pdf.

[39]It is important to note that this study was published in 2011 and makes no specific reference to trade or trade financing. That said, the findings of the study are still relevant to the current publication.

[40]https://www.db.com/news/detail/20201204-deutsche-bank-and-google-cloud-sign-pioneering-cloud-and-innovation-partnership?language_id=1.

looking to the Cloud to accelerate a digital shift. In July 2020, Amazon Web Services struck a new deal with HSBC, while Google announced partnerships with Goldman Sachs and Deutsche Bank.[40] Some fintech companies are also actively using cloud computing to provide enhanced financial services to MSMEs. Pollinate,[41] for example is a Cloud-based fintech platform designed to connect data feeds from existing bank and third-party systems to give small companies a single place to manage their business. In October 2020, the National Australia Bank partnered with Pollinate to transform their merchant acquiring offering for MSMEs across Australia and to help MSMEs better manage and grow their businesses by giving them access to digital tools and payments solutions historically only available to larger businesses.[42] Pollinate is currently in discussions with leading banks in South Africa, Canada and other regions.

ADDRESSING CLOUD COMPUTING CHALLENGES

In terms of the adoption of cloud computing in MSME financing, two challenges need to be addressed. First, regional banks need to take a forward-looking stance and factor MSME needs into their decisions to adopt cloud computing in lieu of their existing infrastructural technology systems; and second, ambiguous and outdated regulations need to be updated to enable the use of cloud technology and secure data in trade. "There is still a need to adapt regulation where cloud-based solutions are not allowed for some financial institutions" [31 Fintech], an issue that some institutions interviewed report as having faced relatively frequently in the past, in particular in relation to the public use of cloud computing.
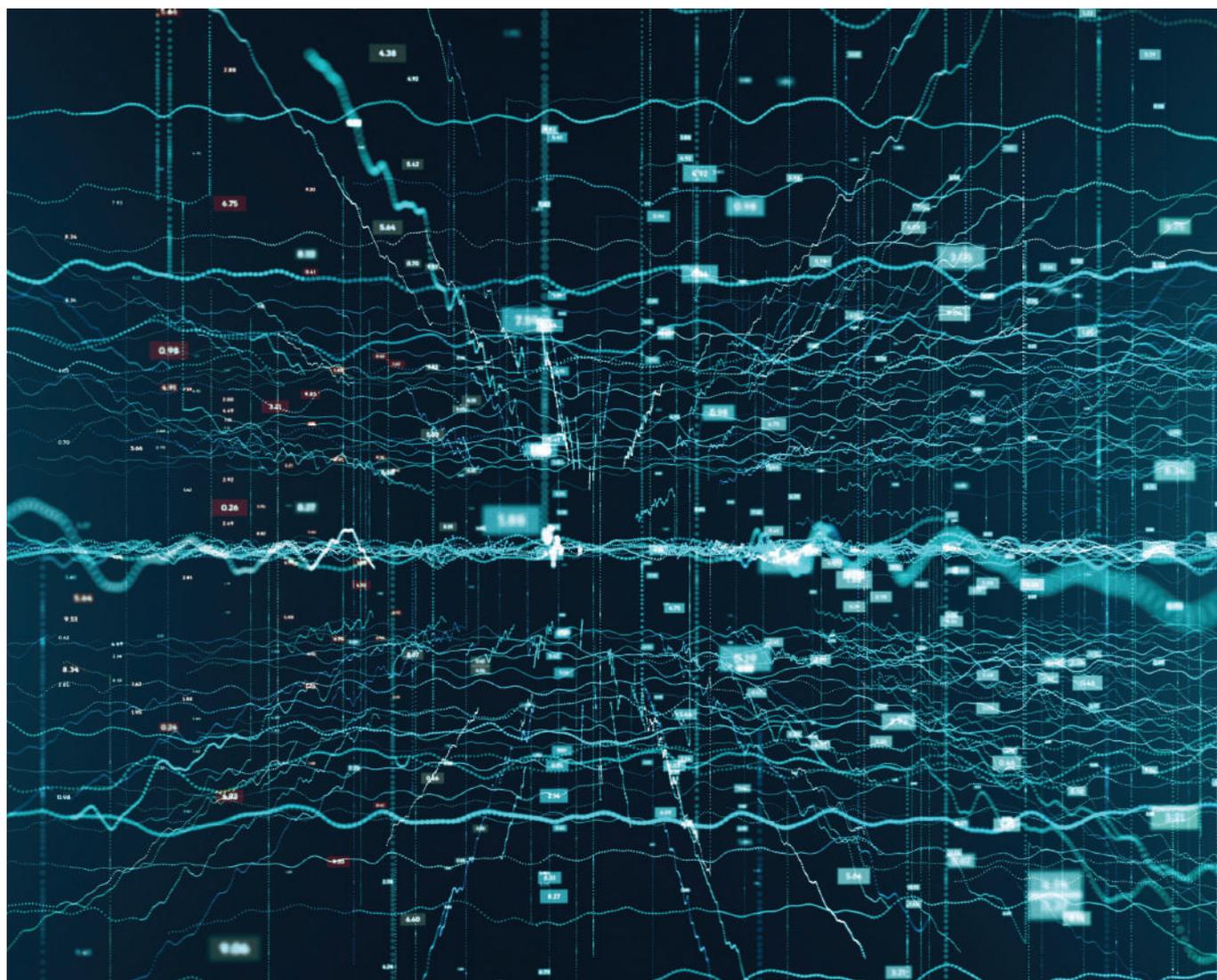
As cloud computing technologies are already generally available, leveraging them to assist with MSME financing is primarily a matter of bank-level adoption. The largest challenge for adoption lies in evaluating the internal financial viability of cloud technology. Banks "will need to compare the benefits of their currently deployed model with that of cloud solutions" [*1 Bank]. If the benefits do not outweigh the costs of implementation, banks will be hesitant to deviate from their current model, especially in regions of the world where cloud adoption is very much dictated by the core banking providers. This is particularly true given that the non-cloud systems from which banks will be transitioning will have come laden with large upfront investments. Increasing the availability of cloud-enabled tools through updated regulations is a good first step towards mitigating this transitory friction, but it is unlikely to be enough. A more forward-looking stance by the small regional banks most serving MSMEs would help all parties to reap the benefits of digitalization.

Since cloud computing has matured in various adjacent industries, many of the traditional technological, operational and educational challenges have already been overcome where adequate infrastructure has been established (see Box 1). However, some "regulatory challenges exist regarding data localization requirements" [*13 Fintech]. These regulatory requirements have a tendency to contain ambiguous phrasing, making it difficult to parse their exact meaning, which raises impediments to cloud computing adoption.

The key to addressing this challenge is regulatory reform. To that end, "it would be ideal if regulators would focus on the security of data instead of its physical location" [*8 Fintech]. The OECD[43] observes that it is also important to raise awareness about digital risks and enhance digital skills, as the continuous remote access that cloud computing enables implies cyber-risks that extend to the personal devices of employees. Fortunately, in many regions of the world, regulatory bodies are well on their way to addressing these risks and welcoming cloud technologies, even into highly regulated environments like banking. However, it is important to remember that "technologies such as cloud computing are not constants and may change in the future. Therefore, the real key is inclusive data and legal standards for any type of digital solution" [*11 Fintech]. The next steps for the total implementation of cloud computing involve easing the regulatory burden to encourage frictionless bank-level adoption.

BOX 1: THE DIGITAL DIVIDE

In some areas of the world, cloud technology is hampered by a lack of stable internet speeds. Without adequate connectivity, many of the benefits that cloud technology and other cloud-based applications bring are rendered moot.

This digital divide is dual-faceted, pertaining both to access to the internet and to the bandwidth of the connection. Substantial digital divides persist between and within countries. Only around half of the world's population can access and use the internet, and many of those who are not connected live in least-developed countries, landlocked developing countries and small-island developing states.[44]

There are significant gaps and barriers in several policy areas (ranging from ICT infrastructure and payment solutions to skills and legal frameworks) that need to be overcome to enable people and businesses to engage fully in the digital economy.[45]

[44]https://www.itu.int/en/mediacentre/backgrounders/Pages/digital-inclusion-of-all.aspx.
[45]https://unctad.org/system/files/official-document/dtlinf2020d1_en.pdf.

3.3.2

DATA INPUT
TECHNOLOGIES

DATA INPUT TECHNOLOGIES

Data input technologies are those that are able to provide data to a system. This can consist of digitally native data or the conversion of non-digital data into a digitized format.

Figure 4b: The trade financing technology stack: data input

Layer	Technologies		
Analytical	Big Data Analytics	AI	Quantum Computing
Connectivity	API		DLT
Data Input	OCR		IoT
Infrastructure	Cloud Computing		
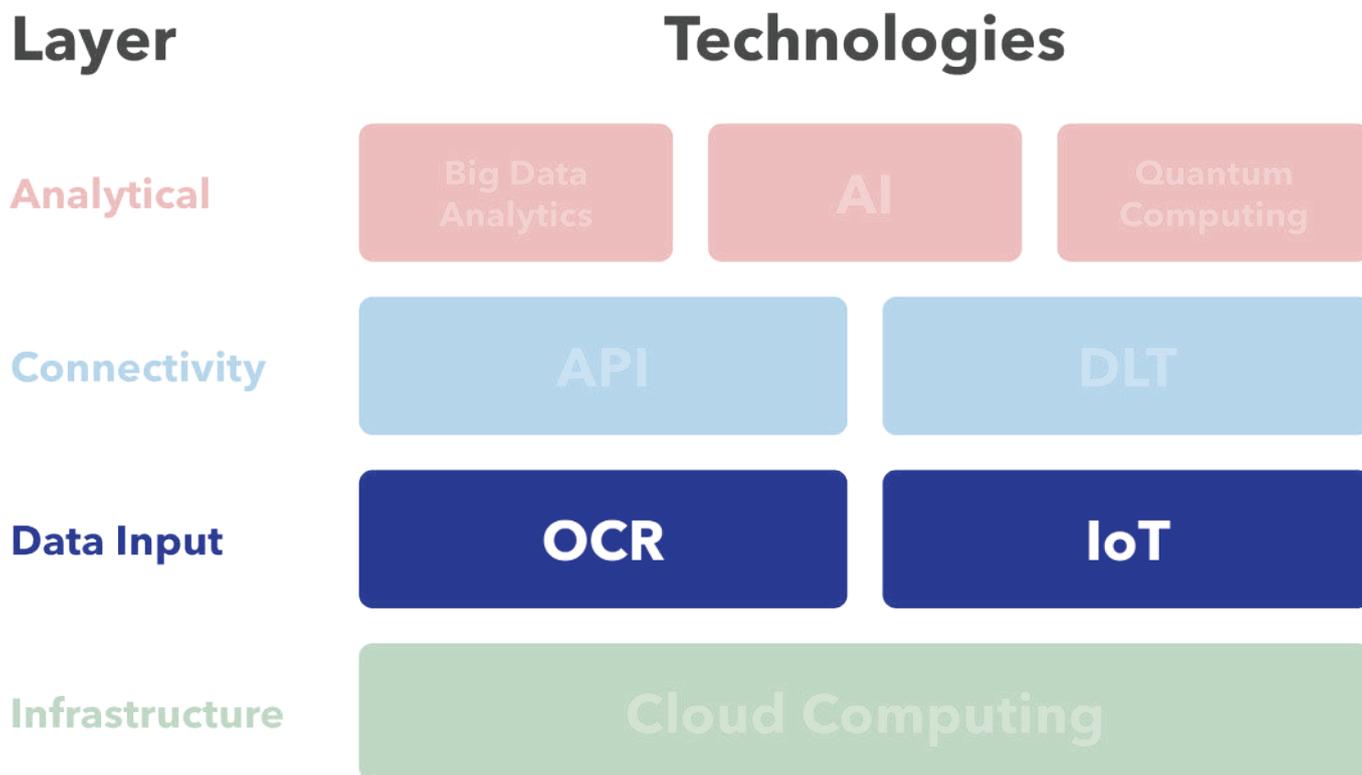
OPTICAL CHARACTER RECOGNITION (OCR)
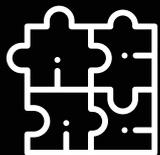
**SMALL
WIN**

OCR is a technology that converts scanned or printed text images, such as handwritten or printed documents, into machine-encoded text that can be processed further. OCR is a common method of digitizing printed texts so that they can be electronically edited, searched for and used in other digital processes.

POTENTIAL BENEFITS FOR MSMES

OCR technology allows paper documents to be scanned and converted into digital formats. As it seems clear that "paper in global trade will not go away quickly" [*8 Fintech], OCR provides a means for interacting with "clients who can't or won't deliver the data in a structured format" [*9 Fintech], and this allows "the user to easily find any kind of document" [*15 Fintech] simply by typing the details into a search bar, rather than searching through boxes of unorganized documents. "In an industry with 4 billion pages in circulation and millions of hours spent on examining these pages, OCR technology is acting like a bridge between technology and processes that can only be done by hand" [*17 Fintech]. For most MSMEs, the benefits of OCR will be experienced indirectly through lowered costs due to less manual input.

USE CASES

According to the ICC Global Survey 2020, 28 per cent of banks are using OCR for data extraction and creating searchable documents, including big banks active in trade finance, such as HSBC and Standard Chartered. OCR is also being used by various fintech companies active in the trade digitalization space, often in conjunction with other digital technologies, in particular AI and ML.

Traydstream, for example, is a cloud-based solution that digitizes documentary trade (letters of credit, documentary collections and open account financing) into a machine-readable format, using ML to automate the scrutinizing, clause-matching and rules- and compliance-checking processes.[46]

Nabu is another fintech company that uses OCR, natural language understanding and deep learning to digitize the manual processes of trade finance.[47]

ADDRESSING OCR CHALLENGES

Unlike most of the other technologies discussed in this publication, it is the technology itself that seems to be the greatest challenge for OCR. "The technology is not perfect, … the best you can get is 85-90 per cent effective" [*8 Fintech]. Furthermore, these accuracy challenges are only exacerbated for "non-Latin or non-romance languages" [*11 Fintech], meaning that "all documents require assistance by human intervention" [*10 Fintech]. This need to continue allocating human resources to the task of document review drastically reduces

[46]https://traydstream.com/.
[47]https://nabu.io/.

the expected benefits of the technology, and this may affect the likelihood of its corporate adoption, given that "integrating [these solutions] into existing processes of banks and corporates … can be expensive" [*8 Fintech]. These concerns are exacerbated by a seeming lack of motivated talent in the field. "Most people working in computer vision lately are focusing on health and medical imagery, making it difficult to build great teams with brilliant minds [for trade applications]" [*17 Fintech].

OCR is serving as a temporary bridge between the paper world of yesteryear and a digital future.

To overcome this challenge, it would logically be necessary to improve the technology; however, OCR is unique. It is in a strange situation where its success will lay the groundwork for its own obsolescence. OCR is serving as a temporary bridge between the paper world of yesteryear and a digital future. It will create "more adoption of new technologies by banks to improve their operational processing" [*18 Fintech], allowing them to convert paper records to digital ones. This will further empower trade chain ecosystems to "start with [digital] data at the source, which renders OCR useless" [*8 Fintech]. Ultimately, a digital trade utopia has no need for OCR.
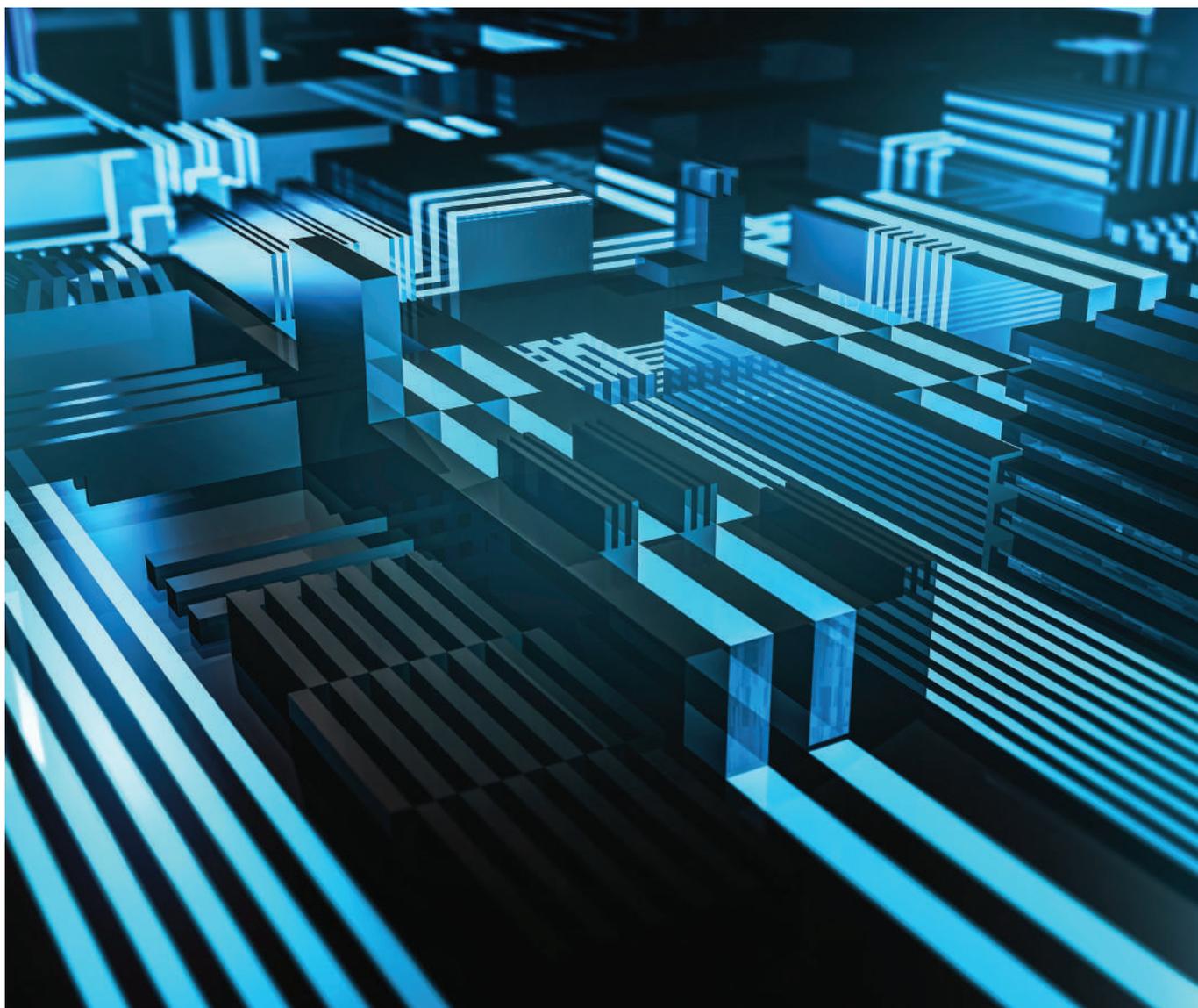
INTERNET OF THINGS (IOT)

**LUCRATIVE
CHALLENGE**

IoT refers to the network of billions of physical "things" worldwide that are now connected to the internet and that collect and share data. These "things" are embedded with sensors, software and other technologies that allow them to collect and exchange data with other connected entities and systems.

POTENTIAL BENEFITS FOR MSMES

The main benefit that IoT brings for MSME financing is that it adds transparency to and enables information to be communicated from and about each section of the physical supply chain, thanks to the data generated by a plethora of sensors and other devices; this "will provide a higher sense of security for financial institutions to finance, which will benefit MSMEs" [*7 Fintech]. This added sense of security mainly stems from two features. First, IoT devices can operate as oracles[48] for DLT-powered smart contracts,[49] providing a powerful data input solution. Thus, events, reported by such IoT oracles, can be used as triggers to release portions of funds, mitigating the dissonance between sellers who want payment before shipment and buyers who want shipment before payment. Second is the ability to "track goods while they are on a vessel or even in transit" [*7 Fintech], meaning that "the goods evaluation process will no longer require a physical presence" [*12 Fintech]. Sensors placed in containers can transmit vital information like temperature or CO_2 levels, providing all parties with a sense of security between the shipping and the receipt of goods. Ultimately, "more visibility into the trade lifecycle, will lead to better fraud prevention and greater participation from investors" [*21 Fintech].

USE CASES

As noted above, IoT is increasingly used to provide end-to-end visibility into the physical supply chain. Arviem,[50] for example, a service provider for real-time cargo monitoring based in Switzerland, uses IoT technology to help clients with asset tracking, track-and-trace and supply chain visibility. Arviem has developed innovative supply chain finance services for goods in transit, leveraging IoT to monitor the location and condition of intermodal containers in real time. essDOCS,[51] a well-established company that provides paperless trade solutions, recently partnered with Swisscom[52] and Linxens[53] to develop their dTrack solution, which uses IoT technology to digitally track physical cargo and paper trade documents, distributing the document source data across the supply chain. This is done by making use of tamper-proof near-field communication chips attached to paper outputs, allowing dTrack to scan data and geo-tags across the supply chain. This IoT-based solution is used as a means to integrate the use of paper documents into trade finance by being able to digitally track them.

[48]Blockchains cannot access data outside their network, and therefore an oracle is a data feed – provided by a third-party service provider – designed for use in smart contracts on a blockchain, which provides external data and triggers smart contract execution when pre-defined conditions are met. Such conditions could be any data, such as the temperature in which the goods are maintained, payment completion, price fluctuations, etc. Oracles are the only way for smart contracts to interact with data outside of the blockchain environment and are, therefore, crucially important.

[49]Smart contracts are computer programmes that self-execute when certain conditions are met.

[50]https://arviem.com/.

[51]https://www.essdocs.com/.

[52]https://www.swisscom.ch/en/residential.html.

[53]https://www.linxens.com/.

ADDRESSING IoT CHALLENGES

For IoT, the largest challenges are related to using and understanding the data. Networks of IoT sensors can generate vast arrays of data. While this has the potential to be extremely valuable and provide useful insights, these insights cannot be put to practical use without robust analytics. To overcome this, firms need to be mindful of the internal procedural work that must be completed to ensure that staff, in conjunction with AI processes, are able to interpret and work with the new data effectively. These major internal challenges are clear next steps for IoT.

Another data issue relates both to data ownership and its legal admissibility in case of litigation. For example, it is unclear whether temperature data transmitted from an IoT sensor that depicts a spike in temperature above an agreed standard for a short period of time while, say, the vessel is crossing the equator, would constitute legal grounds for withholding payment on an otherwise unimpacted shipment [*8 Fintech]. Overcoming this legal ambiguity requires regulatory work as well as the establishment of a common understanding and common approach to structuring and using data. These concerns, however, are not unique to IoT. Those seeking this change need to look beyond IoT-specific regulation and strive for a reform that will enable digitalization across the entire trade ecosystem.

Beyond these external challenges, there are also challenges related to the potentially high costs of IoT networks. For many higher-priced goods, the additional cost of using an IoT device may be inconsequential, however "for low-cost goods the cost of IoT can be prohibitive" [*26 Consultant]. Even in situations where the cost is not an immediate concern, there must still be enough perceived benefit to justify the expenditure. This is why "ensuring tamper-proof devices is critical. Any form of tampering, malicious or unintentional, would render the IoT data worthless" [*11 Fintech].

There are three primary security issues that arise with regard to IoT:

1. intercepting and altering the data broadcast by the IoT device;

2. tricking an IoT device into recording reporting data that are not true (for example, removing cargo from a crate and simultaneously replacing it with a boulder); and

3. hacking into the IoT device to gain access to the connected system.

Addressing these challenges will help drive down costs relative to the perceived benefits of implementing IoT. Ensuring high levels of security is important, as are economies of scale, and the exploration of other connectivity-enabling technologies like 5G. The need for connectivity enablement exists since enhanced IoT requires ubiquitous networking[54] which, in turn, implies the ability to connect everywhere (see Box 2 on the digital divide).

At the end of the day, establishing "clear roles and responsibilities for the supply chain participants and enabling the use of IoT data with ancillary participants like customs, ports, and freight forwarders" [*4 Bank] will be critical. This is true regardless of whether future regulation and standardization will consider IoT to be an autonomous technology or simply an enabler or function of other autonomous technologies.

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[54]Ubiquitous networking is the distribution of communications infrastructure and wireless technologies throughout the environment to enable continuous connectivity.

3.3.3

CONNECTIVITY TECHNOLOGIES

CONNECTIVITY TECHNOLOGIES

Connectivity technologies are technologies that allow various systems and/or actors to connect, facilitating the exchange of data. API and DLT allow firms, networks, technologies, and applications to communicate with one another, sharing data and enhancing the services available to all parties involved.[55]

Figure 4c: The trade financing technology stack: connectivity

Layer	Technologies		
Analytical	Big Data Analytics	AI	Quantum Computing
Connectivity	**API**	**DLT**	
Data Input	OCR	IoT	
Infrastructure	Cloud Computing		
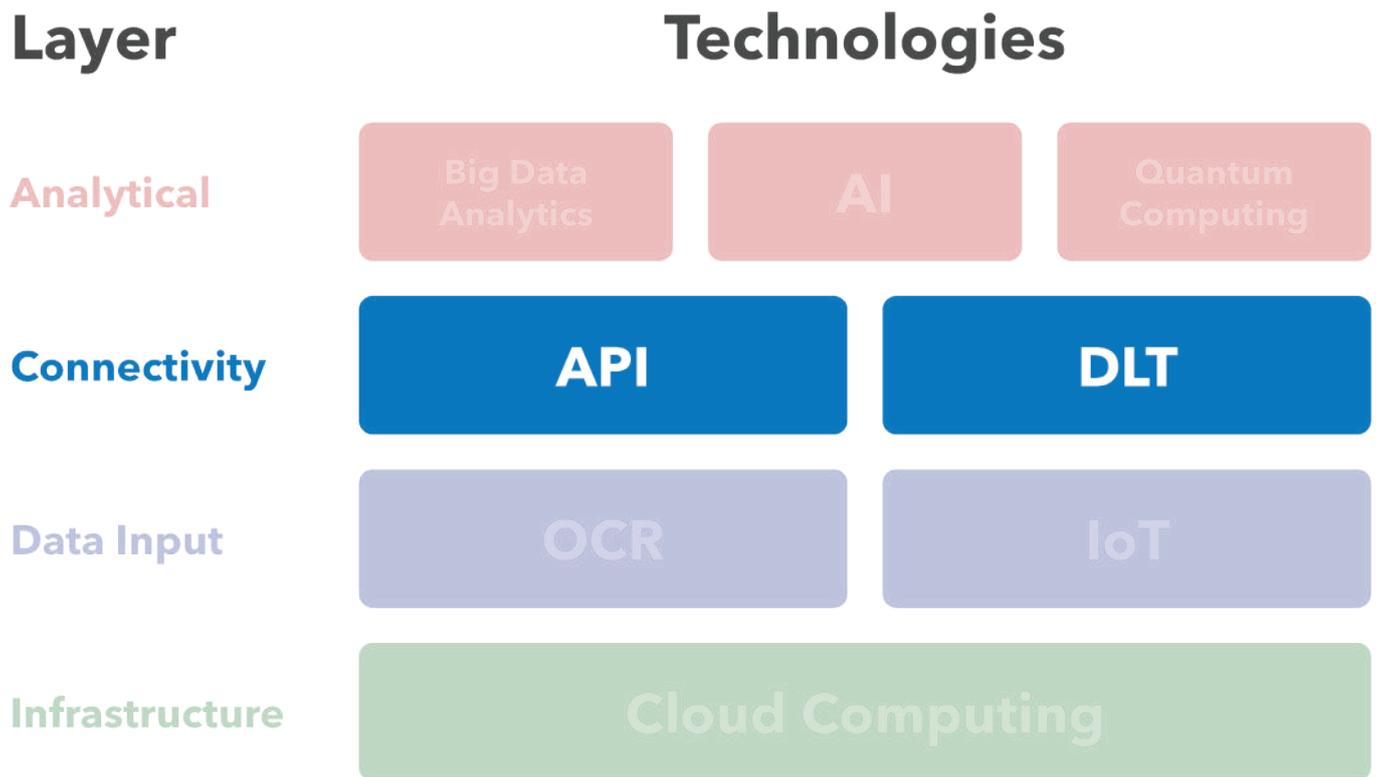
[55]As previously mentioned, the categories were chosen from a business perspective rather than a pure technological perspective to facilitate analysis. From a purely technological perspective, DLT is a trusted database. However, from a business perspective it is used to connect parties directly, on a person-to-person (P2P) basis, in a trusted environment. As such, it has been categorized as part of the connectivity layer.

APPLICATION PROGRAMMING INTERFACE (API)

RAPID REWARD

Application programming interface is a software intermediary that effectively allows two applications to interact with each other. APIs define the types of calls or requests that can be made from one application to another, how to make them, the data formats to be used, and the conventions to be followed.

Having been in practical existence since the early 2000s,[56] APIs are widely used and well established in many industries. They are used to connect existing business processes that can aid treasury management, such as enterprise resource planning (ERP) systems. APIs are indispensable tools for allowing various applications and software to interconnect and communicate, making it possible to realize the full value of other technologies across different data sources. API development has been touted as a fundamental driver of development work for the internet as a whole.

POTENTIAL BENEFITS FOR MSMES

In the trade space, the increased development of APIs in recent years has enabled the creation of increasingly customer-centric solutions that solve several significant problems. This can be done by providing customers with instantaneous and transparent access to information about their own orders, transactions, and shipments to which they may not previously have had access. In short, by automating the transfer of data, "APIs make platforms more efficient" [*29 Bank].

ADDRESSING API CHALLENGES

Despite being widespread in many industries, APIs come with their own set of challenges, which may affect the efficiency of the solutions being developed to facilitate MSME financing. First is the fact that the costs of developing API connections to external applications are not necessarily a part of firm-level budgets for other software development. This means that the resources to develop these connections need to come from additional budget allocations, which can be difficult to attain. Practitioners in the field have reported difficulties in securing funds to develop APIs as part of their DLT projects to make MSME financing more efficient [*29 Bank]. Second is the need to have many different APIs: different platforms send different data, creating a need for as many APIs as there are platforms. In addition, any time there is a change in the data structure, the API needs to be changed as well. This issue could be mitigated by the development of standardized data models – a need that is not unique to APIs. The development of standardized data models is, in many respects, a precondition to support the efficient use of digital technologies in trade (see also the next sub-section on DLT). Finally, another challenge faced by practitioners in the field is the fact that it is difficult "to convince the customer to share the data automatically to provide relevant services" [*29 Bank]. Thought should be given to the development of a common framework on how to leverage data at all stages of the trade technology stack to better assess financing risks and give comfort to customers.

[56]See https://blog.postman.com/intro-to-apis-history-of-apis/

DISTRIBUTED LEDGER TECHNOLOGY (DLT)

LUCRATIVE CHALLENGE

A distributed ledger is a decentralized, distributed record of transactions in which the transactions are stored in a manner that all parties to the network can trust, although the specific mechanism used to facilitate that trust varies from platform to platform. DLT ensures immediate transparency in terms of a transaction's status for the specific parties involved in that transaction. Because transactions added to the ledger are linked to one another, time-stamped and tamper-resistant, DLT allows easy traceability and prevents double-spending problems such as the ones that have recently shaken the commodities world in Asia.[57] Not only does DLT provide a secure and robust environment in which other layers and entities in the ledger can connect and in which various stakeholders can interact directly, on a peer-to-peer basis, without intermediaries, it also allows for traceability. For these reasons, it is believed that "what Enterprise Resource Planning (ERP) did for the single enterprise, blockchain can do for the whole supply chain".[58]

POTENTIAL BENEFITS FOR MSMES

DLT has tremendous potential to facilitate the digitalization of trade finance and brings several key benefits to the parties involved, from the tokenization of assets[59] (including collaterals[60]) to the possibility of transferring digital assets, preventing double-spending and forgery, rendering payments and other processes automatic, reducing paper waste, and introducing a new approach to identity management. DLT can empower individuals and companies around the globe to make transactions more efficiently, economically and quickly, while retaining a high level of security. It has the potential to digitalize trade and trade finance processes; it could be to trade and trade finance transactions what the internet has been to communication.[61]

With such widespread benefits, it is no surprise that such a vast number of DLT platforms and projects have emerged in trade. According to the TFG and WTO co-publication *DLT in Trade: where do we stand?*,[62] there are at least 44 DLT projects currently active.

When it comes specifically to MSME financing, DLT brings a holy trinity of value: trust, transparency and traceability. These benefits can make it easier for MSMEs to build a digital credit history and for banks to assess MSME creditworthiness. Some DLT projects, such as the European-based we.trade,[63] are focused specifically on serving MSME firms, amplifying the benefits of DLT for smaller firms that will be able to access solutions tailored more specifically to their needs. The increased transparency provided by DLT can also make it easier for Tier 2 suppliers and lower[64] which are often small businesses, to access finance. Common supply chain finance

[57]https://www.treasuryandrisk.com/2020/07/09/trade-finance-under-scrutiny-in-singapore/?slreturn=20201101121703.

[58]https://www.linkedin.com/pulse/what-erp-did-single-enterprise-blockchain-can-do-whole-paul-brody/.

[59]The tokenization of assets refers to the process of issuing a blockchain token that digitally represents a real tradeable asset.

[60]The term collateral refers to an asset that a lender accepts as security for a loan.

[61]https://www.wto.org/english/res_e/booksp_e/blockchainrev18_e.pdf.

[62]https://www.wto.org/english/res_e/publications_e/blockchainanddlt_e.htm.

[63]https://we-trade.com

[64]A Tier 2 supplier is a second-level supplier, i.e. the supplier of a Tier 1 company. A Tier 1 company provides parts and materials directly to a manufacturer of goods.

solutions are usually only available to established Tier 1 suppliers, which are able to convince their big corporate buyers of their trustworthiness. By enhancing visibility into deeper-tier suppliers, DLT can make their access to finance easier. Various companies like Linklogis[65] and Skuchain[66] are leveraging DLT to this effect.

Another potential benefit of DLT for MSMEs is its ability to allow traditional processes or sources of finance to be bypassed. DLT allows companies and individuals around the globe to make transactions on a direct, peer-to-peer basis, without the need to go through traditional banks. In doing so, DLT allows MSMEs that do not have access to bank financing to access the international trade market through other means. The platform FastTrackTrade,[67] for example, leverages DLT to enable MSMEs to build a credit history and access the services of various fintech companies, thereby bypassing banks (see further below).

Anecdotal evidence also suggests that the use of cryptocurrencies and stablecoins (i.e. cryptocurrencies that try to peg their market value to an external reference, such as the US dollar, or to the price of a commodity, such as gold) by traders from the developing world to settle international trade transactions is increasing (see Box 2). Indeed, even large global banks and consortia in the developed world, such as Fnality International,[68] are creating their own stablecoins. A recent interpretative letter issued by a US federal banking regulator allowing US financial institutions to use stablecoins for payment activities is likely to accelerate the move.[69] Last but not least, some projects have emerged that use digital assets to settle global payments and bypass the traditional correspondent banking system, such as Ripple.[70]

Last but not least, as noted earlier (see Section 2.1.1), the establishment of a global digital identity system can be a powerful tool to help MSMEs access finance. By making it possible for entities to manage their identities themselves (by using self-sovereign identities, or SSIs – i.e. the capacity to own and control one's digital identity without the intervention of administrative authorities), as well as to manage related verifiable credentials and their usage throughout global supply chains, DLT presents interesting opportunities to break existing identity siloes and improve the verification of companies' credentials (see Box 3). In doing so, DLT makes it easier for MSMEs to build an identity and to reduce the costs related to supplier verification processes which can weigh heavily on small businesses.[71]

Various DLT-based identity solutions are already in production across the world, such as the Sovrin Network,[72] a public-permissioned DLT platform designed as a global public utility exclusively designed to support SSI and verifiable claims, Civic[73] and uPOrt.[74] Other projects, like KYC-Chain,[75] are developing DLT-enabled digital identities specifically for companies with a view to enhancing verification of customers' identities and streamlining the KYC onboarding process. Ensuring interoperability between these different systems is essential to enable the development of a global digital identity system. It is critical that the various solutions developed integrate globally accepted standards such as the decentralized identifier (DID)[76] developed by the World Wide Web Consortium (W3C).[77]

[65] https://www.linklogis.com/.

[66] https://www.skuchain.com.

[67] https://www.fasttracktrade.co/.

[68] https://www.fnality.org/ - Fnality International is a financial technology firm founded in 2019 by a consortium of financial institutions to create a network of distributed financial market infrastructures using blockchain and DLT in order to deliver the means to make "on-chain" payments (i.e. payments enabled by the blockchain and DLT infrastructure) to wholesale banking markets.

[69] https://www.marketwatch.com/story/crypto-prices-jump-after-u-s-regulator-says-banks-can-use-stablecoin-connect-to-blockchains-11609811050rketWatch

[70] See https://ripple.com/ripplenet/#. The low efficiency of the current correspondent banking system has led startups, such as Ripple, to develop alternative payment systems based on DLT. RippleNet allows financial institutions to exchange, in real time and at little or no cost, currencies, cryptocurrencies, commodities and other tokens of value directly, without relying on the traditional intermediaries of the international financial system.

[71] https://www.unescap.org/sites/default/files/86%20Final-Team%20Hanna%20Norberg-Sweden.pdf.

[72] https://sovrin.org/.

[73] https://www.civic.com/company/.

[74] https://www.uport.me/.

[75] https://kyc-chain.com/.

[76] https://www.w3.org/TR/did-core/.

[77] The W3C is the main international standards organization for the World Wide Web. See https://www.w3.org/.

The most frequent use of DLT is in platforms, the members of which conduct transactions using a common rulebook. On such platforms, the distributed ledger is a "holder of the truth" for all messages and transactions between members. This not only provides transparency and security for its members but also gives the platform's members clear data definitions and a defined transaction process. "Ricardian contracts" (see Box 4) even allow legal contracts to be interpreted digitally. The use of DLT allows various costs that can weigh heavily on trade transactions and indirectly impact the smaller players, from coordination costs to processing and verification costs,[78] to be slashed.

BOX 2: USING CRYPTOCURRENCIES AND STABLECOINS TO SETTLE INTERNATIONAL TRADE TRANSACTIONS

When cryptocurrencies were originally conceptualized in the wake of the 2008 financial crisis, they seemed able to address many of the shortcomings and inefficiencies of the cross-border payments system. Remittances and fiat currency[79] devaluation have driven cryptocurrency use in developing countries, in particular in Africa.[80] Unfortunately, many of these original crypto-assets, like Bitcoin, suffer from severe price volatility.

Enter stablecoins. A stablecoin has many of the same features as a cryptocurrency, but it stabilizes its price by linking its value to a certain pool of tangible assets. Stablecoins are particularly popular in East Asia as a result of the Chinese government's decision in 2017 to ban exchanges of yuan for cryptocurrency. According to the "Chainalysis 2020 Geography of Cryptocurrency Report",[81] the most popular stablecoin is the controversial Tether,[82] which is claimed to be "tethered" to the value of national currencies like the US dollar, the euro and the offshore Chinese yuan.[83] Tether makes up 93 per cent of all stablecoin value transferred by addresses in East Asia. The report provides anecdotal evidence that a significant share of cryptocurrency and stablecoin transactions between Eastern Asia and Africa, and to a lesser extent Russia, are for business purposes.

While stablecoins could help to address the value volatility issues that plague traditional crypto-assets in international trade, they are not without their own challenges. The G7 Working Group on Stablecoins identifies several challenges facing stablecoins,[84] including legal certainty, sound governance, data privacy and tax compliance. Stablecoins that reach a global scale also offer challenges with regard to monetary policy, financial stability and fair competition.

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[78]See Catalini, C., and Gans, J. (2017), "Some Simple Economics of the Blockchain", MIT Sloan Research Paper No. 5191-16, 21 September 2017. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2874598. See also Ganne, E. (2018), Can Blockchain Revolutionize International Trade?, WTO: Geneva, 2018. Retrieved from https://www.wto.org/english/res_e/booksp_e/blockchainrev18_e.pdf.

[79]A fiat currency is a national currency that is not pegged to the price of a commodity such as gold or silver. The value of fiat money is largely based on the public's faith in the currency's issuer, which is normally that country's government or central bank. (Source: https://www.ig.com/en-ch/glossary-trading-terms/fiat-currency-definition.)

[80]https://go.chainalysis.com/2020-geography-of-crypto-report.html.

[81]https://go.chainalysis.com/2020-geography-of-crypto-report.html.

[82]https://tether.to.

[83]https://www.bloomberg.com/news/articles/2020-04-01/biggest-winner-in-crypto-crash-is-most-controversial-coin.

[84]https://www.tresor.economie.gouv.fr/Articles/5f8c26f2-a2cd-4685-ba82-fa9e4d4e5d67/files/d10fb97f-a9a6-472b-842a-8b279e8863c4.

BOX 3: SELF SOVEREIGN IDENTITY AND DECENTRALIZED IDENTIFIERS

According to the Institute of Electrical and Electronics Engineers (IEE),[85] SSI is a concept in the landscape of identity management according to which: "the user, and only the user, is to have full control over their identity data". This is in contrast with the world of today, in which identity is managed by a cluttered collection of centralized independent bodies.

Decentralized identifiers (DIDs) can be used to enable SSIs. The W3C working draft[86] on the topic states that "Decentralized identifiers (DIDs) are a new type of identifier that enables verifiable, decentralized digital identity. A DID identifies any subject (e.g., a person, organization, thing, data model, abstract entity, etc.) that the controller of the DID decides that it identifies".

Currently, an individual may be called upon to display a driver's licence, passport or identity card as a proof of identity. However, the extent to which this identity is trusted is directly linked to the level of trust that can be placed in the central authority that issued the identification. By making creative use of DLT, DIDs are able to circumvent these issues by creating a verifiable identity in a decentralized manner. This enables the owner of the data to control their own data while still making it verifiable, and also solves some of the data protection concerns raised by regulations like the EU General Data Protection Regulation (GDPR) of 2018.

BOX 4: RICARDIAN CONTRACTS

According to R3, an enterprise software firm,[87] Ricardian contracts, also referred to as "advanced document technology", allow a legal contract to be interpreted digitally without losing the value of the original legal prose. They are unique legal agreements or documents that can be read by computer programmes as well as humans at the same time. Ricardian contracts can interweave computer language and human language, which can make transaction costs much lower, contribute to faster resolution of disputes, and allow agreements to be executed more efficiently. The use of cryptography helps to keep the risk of fraud to a minimum.

While they are similar to traditional smart contracts, Ricardian contracts introduce a human-readable form to the machine-readable agreement. In this sense, Ricardian contracts are legally enforceable, unlike their smart counterparts. Their technical setup also allows for added flexibility, as the intentions as well as actions of clauses can be clearly articulated within the prose of the contract.

[85]https://ieeexplore.ieee.org/document/8776589.
[86]https://www.w3.org/TR/did-core/.
[87]https://www.r3.com/blog/what-is-a-ricardian-contract/

As work in the trade finance DLT sphere has continued to progress, another unforeseen benefit has also emerged: DLT has the capacity to incentivize an internal industry push to address the challenges of standardization. Different DLT platforms have different data standards and communication protocols, which limits their ability to talk to each other. This "digital island" problem has brought to the fore the need to develop a set of globally accepted standards spanning the entire supply chain. Increased pressure to develop trade standards, if executed, would provide immense benefits to all traders, including the smaller traders, and would support the wider adoption of nearly all of the digital technologies discussed in this publication.

USE CASES

1. Several prominent DLT-based trade finance consortia simplify the trade finance process and inject streamlined efficiencies into the industry. Contour (formerly Voltron)[88] focuses on addressing challenges related to letters of credit, Marco Polo[89] focuses on working capital finance and payables finance, and we.trade targets a host of trade financing tools geared specifically to MSMEs.

2. LinkLogis,[90] a supply chain financing service provider based in China, and Standard Chartered work together to provide DLT-based deep-tier supply chain financing. Skuchain[91] is another DLT-based commerce cloud platform that works with multiple large international commercial banks to offer deep-tier supply chain financing.

3. Envoy[92] and FastTrack Trade[93] are digital marketplaces that use DLT to connect alternative financing lenders to buyers and sellers and digitize trade documents securely for trusted track records (purchase orders/invoices/payments).

4. Halotrade[94] and Provenance[95] designed and demonstrated innovative applications of DLT in the open-source Project Trado, convened by Cambridge University in 2019, which enables new business models, such as data for financial benefits swaps for smallholder tea farmers in East Africa.

5. Crowdz[96] is a fintech company working to simplify business-to-business (B2B) payments with a platform that makes sending, paying and selling invoices much easier for MSMEs. They accomplish this by utilizing Ethereum-based[97] smart contracts to record invoices and supporting documents on the blockchain. By also integrating with smaller accounting platforms, they help small businesses to manage their cash flows in a secure and immutable manner.

6. An alternative use of DLT proposed by the International Trade and Forfaiting Association (ITFA)[98] is to digitalize the exchange of trade document data using a combination of advanced document technology and DLT. By using this advanced document technology, which is provided by Enigio,[99] negotiable instruments and relevant data can be freely transferable, can be controlled by the legitimate owner, and can maintain singularity (i.e. prevent double-spending). Furthermore, creating these documents to be readable

[88] https://www.contour.network.
[89] https://www.marcopolo.finance.
[90] https://www.linklogis.com/.
[91] https://www.skuchain.com.
[92] https://envoydefi.com.
[93] https://www.fasttracktrade.co.
[94] https://halotrade.io.
[95] https://www.provenance.org/.
[96] https://www.crowdz.io.
[97] Ethereum is a community-built technology that underpins the cryptocurrency called ether – see https://ethereum.org/en/.
[98] https://itfa.org.
[99] https://www.enigio.com

by both man and machine allows data verification to be done with complete accuracy. These advanced document-negotiable instruments not only solve the interoperability challenge for DLT platforms, but also enable trade documents and data to be governed by existing international trade rulebooks and standards, such as the International Chamber of Commerce (ICC) Uniform Customs and Practice for Documentary Credits (UCP) or the 1930 Geneva Convention Providing a Uniform Law for Bills of Exchange and Promissory Notes. The ITFA proposal is open to all transactions in which the governing legislation is technology-neutral and accepts digital documents with electronic signatures.

Implementing advanced documents with the ITFA's dDoc (i.e. digital document) specifications would enable gradual digitalization, whereby paper trade and digital trade could be performed in parallel. A second advantage with this type of technology is that it can be readily integrated into any current information technology infrastructure used by banks and corporations, and it would bolster the interoperability for MSMEs that are not on platforms, which cannot be solved simply through creating a network of networks.

ADDRESSING DLT CHALLENGES

As noted above, there is a large number of projects and initiatives operating in the DLT trade finance space, resulting in a "digital island problem", i.e. multiple DLT platforms that do not "talk" to each other, or that only talk to a limited extent. It is important to keep in mind that "there is not going to be one network to rule them all. It is going to be a network of networks. Therefore interoperability will be key" [*13 Fintech].

The World Economic Forum[100] identifies business models, platforms and infrastructures as the three key layers to DLT interoperability. To ensure industry-wide value maximization, firms and groups developing DLT solutions need to ensure that their solutions are designed from a standpoint that puts interoperability first and that establishes connectivity across each of these three layers. Efforts also need to be made to develop global standards. Various organizations are working towards creating standards for DLT in trade, both general (e.g. the Digital Standards Initiative (DSI) of the International Chamber of Commerce (ICC) and the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT)) and specific (e.g. The Bankers Association for Finance and Trade (BAFT)'s distributed ledger payment commitment (DLPC))[101]. Ensuring that the standards being developed are widely accepted and span the entire supply chain will be of critical importance for the success of DLT projects in trade and trade finance.

"There is not going to be one network to rule them all. It is going to be a network of networks."

*-[*13 Fintech]*

The future trade finance infrastructure must be truly inclusive, with low barriers to entry for digitalization. It is of primary importance that information essential to transactions can be shared in a secure way, perhaps through digital documents. Within shipping, mining, banking, purchasing and other fields, there is a large number of industrial parties with different specialized platforms, each of which has its own rulebook. For these to communicate effectively, a standardized rulebook of rulebooks and a standard of standards are needed. The world is not static, and all transactions are unique, meaning that there will always be transactions requiring their own documentation even if most documents can be standardized. For this, developments in AI may come to be important.

[100]http://www3.weforum.org/docs/WEF_A_Framework_for_Blockchain_Interoperability_2020.pdf.
[101]https://www.wto.org/english/res_e/booksp_e/blockchainanddlt_e.pdf.

A handful of significant challenges in the realm of DLT for trade finance lie in the legal arena. First is the uncertainty surrounding the recognition of electronic signatures and electronic documents. Only around 60 countries have established laws and standards regarding electronic signatures and digital transactions.[102]

Second is the general absence of legal recognition of digital negotiable instruments.[103] To remedy this, the United Nations Commission On International Trade Law (UNCITRAL) has developed a Model Law of Electronic Transferable Records (MLETR),[104] which aims to enable the legal use of electronic transferable records both domestically and across borders. The UNCITRAL MLETR provides a legal framework for the electronic/digital transfer of documents and negotiable instruments in electronic/digital form, using DLT that would provide harmonization if adopted by key nations in trade and finance. Released in 2017, the UNCITRAL MLETR has to date been adopted by the Kingdom of Bahrain and Singapore. More recently, Abu Dhabi Global Market (ADGM) also enacted the Electronic Transactions Regulations 2021, based on UNCITRAL MLETR, confirming that electronic signatures are legally enforceable in ADGM.[105] Recognition of the legal validity and enforceability of electronic signatures and of documents such as electronic invoices is also being discussed in talks conducted by a group of WTO members in the context of the WTO Joint Statement Initiative on E-commerce.

Due to the antiquated laws and regulations of many countries, firms are forced to establish creative digital workarounds each time they seek to make a transaction in a new country. This adds immense complexity to the overall process and risks reducing, if not outright eliminating, the effectiveness of DLT until such outdated policies are addressed and revised. However, to overcome this problem, it will be important to find the "right balance between over-regulation and under-regulation. Most people are of the opinion that some regulation is necessary so there is a need to get the balance right" [*3 Bank]. The current pandemic has highlighted the need to revise legislation to allow and promote digital trade. Many countries are currently in the process of adopting a technology-neutral approach to their substantive law.

For MSMEs, another challenge is that the solutions created may not meet their specific needs. Due to the large upfront investment involved in creating functioning DLT networks, many of the products are naturally geared towards servicing big-ticket and high-volume customers, which offer the greatest potential return on investment. Since most of the "products offered are limited and seem to be tailor-made by the original request" [*28 Sector Expert], there is a risk that MSME-specific needs will be forgotten in the ensuing chaos. In order to overcome this, it will be critical that the handful of DLT-based initiatives currently focused on MSMEs, such as we.trade, remain committed to this market segment. Otherwise, MSMEs will be forced to contend with solutions that are not geared to their unique needs.

An additional consideration with regard to DLT as a connectivity technology is any legislation surrounding data protection and privacy. As DLT can be made tamperproof, there may be difficulty removing information placed on the system. Privacy laws, banking secrecy and corporate secrecy are all issues that may arise if data that are subject to regulation are published on a DLT-platform. To promote accessibility for corporates, DLT systems should establish connectivity and transparency only between the relevant parties. Last but not least, advances in quantum computing, while opening new opportunities (see Section 3.3.4), could also, in the long term, represent a threat to DLT, the resilience of which relies heavily on encryption and algorithms. Important efforts are underway to develop post-quantum algorithms.[106]

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[102]https://rightsignature.com/legality/electronic-signature-laws.html#:~:text=More%20than%2060%20countries%20have%20some%20form%20of%20 e%2Dsignature,the%20legality%20behind%20electronic%20signatures.

[103]See https://baft.org/docs/default-source/default-document-library/joint-dlt-report-2018-final-code-is-not-law.pdf.

[104]https://uncitral.un.org/en/texts/ecommerce/modellaw/electronic_transferable_records.

[105]https://www.adgm.com/media/announcements/adgm-enacts-electronic-transactions-framework.

[106]See for example https://fortune.com/2020/09/11/post-quantum-encryption-algorithm-nist/.

3.3.4
ANALYTICAL
TECHNOLOGIES

ANALYTICAL TECHNOLOGIES

Analytical technologies are those that take large amounts of collected data and convert those data into actionable insight.

Figure 4d: The trade financing technology stack: the analytical layer
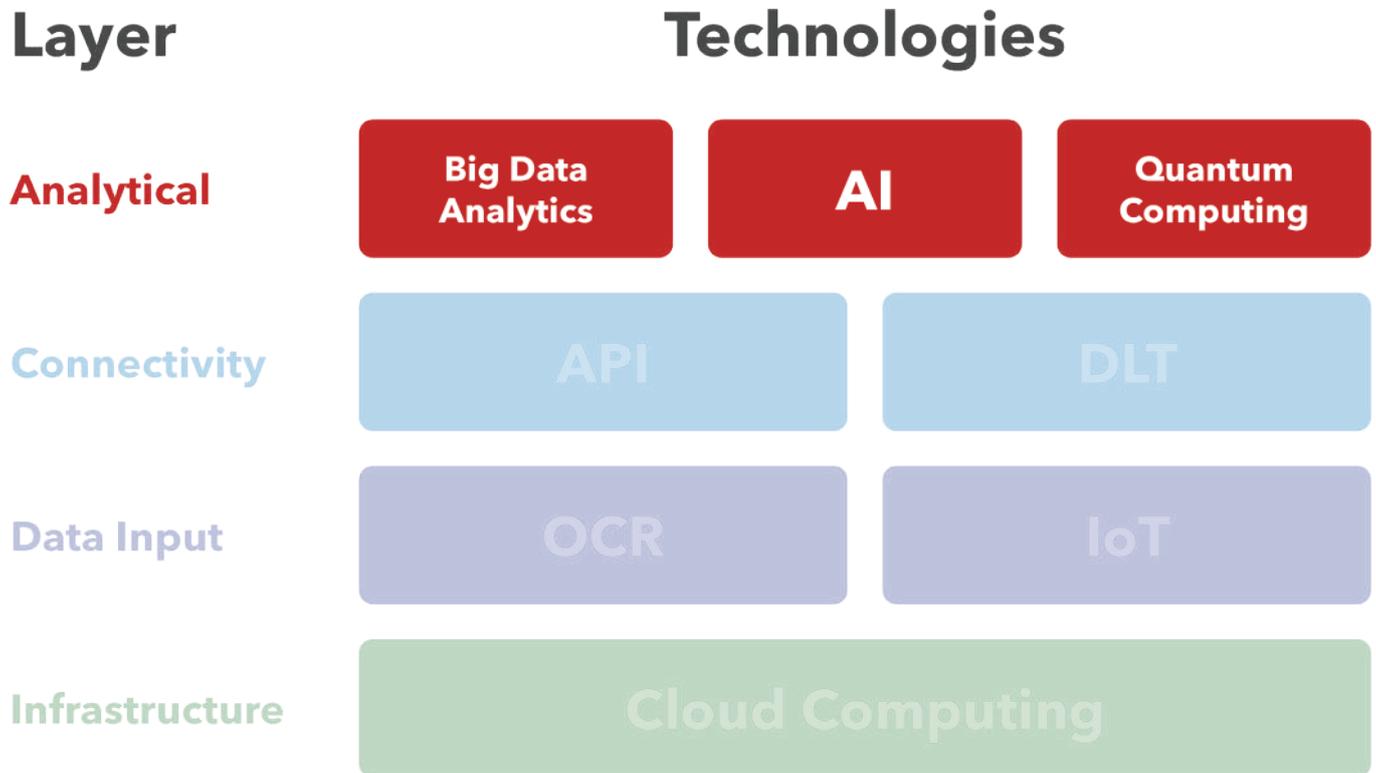
Once data are gathered, there is still the issue of making sense of it. Developing practical solutions requires that the people working on them have strong trade industry expertise and data analysis skills. Unfortunately, this skill combination is not always readily available. Furthermore, as a traditional industry, trade finance suffers from a reluctance to adopt new technologies or processes. There is always the likelihood that companies will stick with the old, ineffective ways with which they are comfortable, rather than trying something new and innovative. Education will be a crucial step to develop trust in analytical technology, in order to foster adoption and trickle benefits down to MSMEs.

The new technologies in question include big data analytics, AI and quantum computing.

Big data analytics are seen as a "rapid reward" and AI a "lucrative challenge" by industry experts. In contrast, quantum computing is considered a downstream ambition technology, i.e. a technology with low impact and which is currently difficult to adopt.

BIG DATA ANALYTICS

**RAPID
REWARD**

According to IBM,[107] "big data analytics is the use of advanced analytic techniques against very large, diverse data sets that include structured, semi-structured and unstructured data, from different sources, and in different sizes" to uncover hidden patterns, correlations and other insights.

POTENTIAL BENEFITS FOR MSMES

Data sit at the heart of nearly all business processes. As a result of this, analytical technologies are playing an increasing role in nearly every aspect of 21st-century commerce, including trade finance. Data input technologies, such as IoT and OCR, are producing unprecedented volumes of raw data, but these are often unstructured due to a widespread lack of standardization. Big data analytics provide a means to organize and analyse these data points, generating "a holistic view of customers across all products and markets" [*1 Bank]. This increased sense of transparency will "supplement and improve business decisions by providing critical insights into client usage of products and services" [*1].

Developing an increasingly digital-first approach to data will help "solve the pain point of information asymmetry between banks and MSME consumers" [*3]. This is because the connection capabilities of digital software will allow banks and MSME consumers to share information with each other in a mutually beneficial manner. Financial institutions will have the information required to determine an accurate risk profile for the MSME, and the MSME will have a greater likelihood of acquiring finance as it is able to divulge accurate financial information.

"With analytical technologies, small businesses can be given accurate credit scores which reflect their actual risk profile rather than their lack of credit history"

*-[*22 Fintech]*

While analytical technologies are often thought of as a useful tool when there is too much data, they can also help in instances where there is too little. Many MSMEs, particularly newer ones, lack a credit history. This can make it difficult, if not impossible, for banks to assess their creditworthiness and offer financing. Using predictive insight capabilities, enabled by analytical technologies, "small businesses can be given accurate credit scores which reflect their actual risk profile rather than their lack of credit history" [*22 Fintech].

The capacity to organize and analyse large amounts of data also makes it possible to leverage alternative non-traditional data, such as logistics data, e-commerce data, social media data and mobile payments, and other transactional data, to better assess the creditworthiness of small companies. Financial institutions, as well

[107]https://www.ibm.com/analytics/hadoop/big-data-analytics.

as alternative finance providers, can thereby obtain the credit information they require to determine a more accurate risk profile for the MSME. This will give MSMEs a greater likelihood of acquiring finance, as they acquire the ability to divulge accurate financial information to a wide range of potential lenders.

USE CASES

According to the ICC Global Survey, 23 per cent of banks use big data analytics in their operations. It is also used by many regulatory technology (or regtech) firms like Quantexa,[108] a data and analytics software company that provides financial data analytics services to companies. Quantexa uses big data analytics techniques to provide automated, cost-effective decision-making for KYC and AML compliance.

Become[109] is an example of a US-based online platform for small businesses to find and optimize funding solutions. The company uses big data analytics to help small businesses improve their "lendability" and provides a platform to match them with lenders.

Additional examples include MYbank[110] and China Systems.[111] MYbank is a Chinese digital bank established by a financial subsidiary of Alibaba (a China-based global wholesale trade platform) that makes use of big data analytics. MYbank utilizes the big data analytics service of Alibaba as well as Alibaba's subsidiaries Ant Group and Zhima Credit to evaluate borrowers in order to provide funds primarily to help farmers purchase agricultural machines and tools. The credit information comes from big data analytics of information such as online transactions, rented car return conditions, and court reports about default debts, if any of these exist. This is an entirely different model for risk profiling, which not only uses MSME data, but also other touchpoints such as transactions, to build a different credit profile [*31 Consultant].

Ant Group, also a member of the Alibaba Group, is another example of a company using big data analytics to facilitate MSME lending. The firm offers microloans to MSMEs using data from prior online transactions to evaluate potential borrowers. Ant Group relies on transactional history, such as bill-paying behaviour, rather than on collateral to make its lending decisions.

"This data could be used to construct risk profiles in a different way. The use of technology shouldn't only be for composing the currently used profile, but also to invent new ways to assess (and prove) MSME risk ."

*-[*31 Consultant]*

China Systems, a global software provider and trade solutions vendor, uses big data analytics to empower their analytics processes by sourcing data using open application programming interface (API) frameworks.

ADDRESSING BIG DATA ANALYTICS CHALLENGES

The challenges still confronting the adoption of big data analytics are centred predominantly around the procurement of quality data and the arrangement of human resources.

[108]https://www.quantexa.com
[109]https://www.become.co/.
[110]https://www.mybank.cn/index.htm.
[111]https://www.chinasystems.com.

As [*9] observes, "the real bottleneck is the data we are able to acquire." With vast swathes of trade finance transactions still occurring on paper, acquiring data in digital formats is a slightly more difficult process, requiring the support of other technological innovations like OCR. Even if data are digitized, collating them may still not be straightforward. Legal data collection can "only be done with customers who agree to participate" [*5]. Data privacy regulations in many jurisdictions impose strict rules on the collection of private data to protect consumer rights. Firms leveraging big data analytics and AI need to work within these bounds to maximize the availability of data, while ensuring that any use of the collected data does not do so in a way that would violate companies' and consumer's trust. In addition, the use of alternative data such as logistics data, e-commerce data, and mobile payments may raise questions as to the relevance of some types of data collected to assess risk. Approaches to leveraging alternative data to assess the creditworthiness of companies vary significantly. A globally coordinated approach on this matter may be warranted. However, gathering large amounts of high-quality data is only part of the equation; the people and the models involved are just as important.

Aligning the human resources, both within organizations and within the industry as a whole, is necessary to turn raw data into actionable knowledge. Data need to be transformed into a suitable form for analysis and to be analysed using appropriate models, and the resulting output needs to be understood by the end-user. This end-to-end process will require close cooperation between operational and information technology colleagues to ensure that the best data models are selected and implemented. People are at the heart of decisions concerning these models, and people are responsible for coordinating beyond the walls of a single organization. "Specialized big data analytics solutions that solve trade finance issues must be coordinated with broader solutions that can be applied to multiple businesses" [*23]. Ensuring that the right people are in the right places and having the right conversations is a crucial challenge for big data analytics in trade finance.

ARTIFICIAL INTELLIGENCE (AI)

LUCRATIVE CHALLENGE

While big data analytics compile useful data for humans to use in decision-making, AI is able to further process that data and produce an actual decision. According to the Encyclopedia Britannica,[112] artificial intelligence (AI) is:

"the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience."

AI is a broad term that is used to describe a series of subfields, such as machine learning, neural networks, deep learning and natural language processing (see Box 5).

Big data analytics and AI are closely linked. The development of big data analytics involves many AI theories and methods and therefore depends on AI, and the development of AI relies on big data analytics because it requires lots of data for the process of "learning". As a result, many of the benefits and challenges for MSMEs that big data analytics represent will also be represented by AI. To avoid repetition, the following sections will focus exclusively on benefits and challenges that are unique to AI.

POTENTIAL BENEFITS FOR MSMES

AI brings the power of data to the next stage compared to big data analytics. The ability of AI-powered programmes to parse and understand data has vast implications for financing processes. In addition, it has the capability to facilitate the creation of "new processes that were simply too complicated to be done with the human brain itself" [*17], including "predictive insights across trade functions" [*11]. The development of predictive insight capabilities has interesting applications, such as credit scoring.[113] A better outcome for credit scoring could help shift the focus towards good risk (see Section 2.1.5), potentially increasing MSME access to trade finance (which is low-risk by nature). At its core, AI has the power to go beyond the limited capabilities of human intelligence.

USE CASES

1. There are multiple examples of companies using AI and ML to improve their financing solutions to the benefit of all, in particular MSMEs.

2. For example, Efcom,[114] a factoring[115] software firm based in Germany, uses AI as a risk monitoring tool to determine if an invoice is fraudulent.

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[112]https://www.britannica.com/technology/artificial-intelligence.

[113]Credit scoring is a statistical analysis performed by lenders and financial institutions to determine a person's or a small, owner-operated business' creditworthiness. Credit scoring is used by lenders to help decide whether to extend or deny credit.

[114]https://www.efcom.de/en/.

[115]Factoring is a financial transaction and a type of debtor finance in which a business sells its accounts receivable (i.e., invoices) to a third party (called a factor) at a discount. Factoring is commonly referred to as accounts receivable factoring, invoice factoring, and sometimes accounts receivable financing.

3. QuantaVerse,[116] for its part, uses AI for entity resolution and relationship-mapping and to monitor transactions for suspicious activity, which are all-important for the onboarding of new customers and financial crime compliance.

4. Another firm that leverages AI to assist with client onboarding is Temenos.[117] Temenos also uses AI to help banks conduct eligibility checks and process loan applications.

5. RHB Banking Group has an AI-powered mobile app to help with compliance checking and personalized offerings.

6. Other companies, such as Flowcast,[118] a US-based AI firm, leverage machine learning methodologies to create predictive models that assess risk. Flowcast's models render explainable a business' creditworthiness, its risk of delinquency, its timeliness in making repayments, and the likelihood of dilution of its transactions.

7. Ant Group,[119] a member of the Alibaba Group, uses AI and data from mobile payment platform Alipay to run an extraordinary variety of businesses, including consumer lending, money market funds, and wealth management, health insurance and credit rating services. AI supplements Ant Group's business functions on many fronts, including fraud prevention and risk profiling.

8. Tradeteq[120] is another fintech company that uses big data analytics and AI for credit scoring to help MSMEs which are often deemed "too risky" by current credit rating models to access finance. Tradeteq provides AI-powered predictive credit analytics to assess the riskiness of clients, vendors and individual transactions, and to assess the potential for defaults in trade finance liabilities of private and unrated companies.

9. Finally, AI is also being used by companies like Taulia[121] for dynamic discounting and supply-chain financing.

BOX 5: SUB-CATEGORIES OF AI[122]

Machine learning (ML): A subset of AI techniques that uses experience to improve performance.

Neural networks: Virtual network structures that are designed, in their topology and behaviour, to resemble neuron cells and the connections of the latter within the biological brain.

Deep learning: A subset of ML that uses multi-layered neural networks to solve complex problems.

Natural language processing (NLP): A branch of AI that deals with the interaction between computers and humans using natural language, i.e. naturally evolved human language, as opposed to binary computer language.

ADDRESSING AI CHALLENGES

While the road ahead for AI is promising, it is not without its challenges. The efficiencies of AI are maximized when applied to digitally native documents. Unfortunately, "we are still facing regulatory challenges on the acceptance of digitally native documents" [*7]. In most instances, trade transactions necessitate the use of paper documents, which AI tools in isolation are unable to access. If AI is to realize its full potential, outdated

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[116]https://quantaverse.net/.
[117]https://www.temenos.com.
[118]https://flowcast.ai.
[119]https://www.antgroup.com/en.
[120]https://www.tradeteq.com.
[121]https://taulia.com.
[122]Artificial Intelligence Demystified, (2020). UN/CEFACT Group on Advanced Technologies.

regulatory requirements will need to be updated and advancements will need to be made in other supporting technologies, namely OCR. Unfortunately, as noted in Section 3.3.2, OCR currently requires human intervention to ensure accuracy. The key in this instance is to bypass the error-prone middleman, OCR, entirely. Updating regulations to accept the use of digital original trade documents would facilitate an environment in which the entire trade cycle is paperless and can benefit from the power of digitalization (see also Section 3.3.3).

Most current national regulations do not allow most AI solutions to be widely adopted. This stems from legal concerns, such as "the ambiguity of Uniform Customs and Practice for Documentary Credits (UCP) rules" [*7], which do not specify whether AI can be used in lieu of humans. As policymakers work to bring these regulations into the digital age, however, they must not do so using clauses that limit AI's usefulness. "It will be key that regulators do not require from machines too much compared to what they require from human beings, such as the explainability of underwriting decisions" [*20]. Overburdening of this nature would set AI adoption back considerably.

Likewise, too much regulatory change poses a particular challenge for AI and ML. "Machine learning is only as good as the input and supervision which can also be complicated by changing requirements and regulations" [*11]. Changes to regulations, such as those used in compliance, will effectively require the algorithm to learn a whole new set of rules – a time-consuming and costly process.

Another major step forward for AI in trade finance will be the further[123] standardization of trade documents and data formats. While AI models are able to decipher unstandardized forms better than previous computing technologies, "standardized forms would lead to a higher recognition ratio" [*5] and subsequently more accurate prediction models. Prediction model accuracy is a direct driver of the appetite for AI adoption.

Progress in education will help firms to make the decision to implement AI. Education on the usefulness of AI will allow banks to fully understand the benefits that using it to help small businesses will have for the sector. Explainable artificial intelligence ("XAI"), whereby the results of AI algorithms can be conveyed to and understood by humans, will provide further transparency.[124]

Another crucial challenge to be addressed is that of the lack of trust of the human teams within financial institutions with regard to algorithms. Many employees feel threatened by algorithmic tools and fear that by assisting the machine, they will train themselves out of a job. To overcome this, firms seeking to implement the technology need to educate their employees both on its benefits and its limitations. "Document checkers need to be trained to understand where the technology assists them, but also where it does not assist them, to prevent a mismatch of expectations. There is still a human checker involved, and this person needs to know what the machine is not able to pick up" [*7]. It is the people that will give AI its power and they need to be prepared. This will prevent a mismatch of expectations and help employees to understand that these algorithms exist to enable, not to replace.

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[123]Some standardization already exists. BAFT's Master Risk Participation Agreement, for example, is widely used by the industry, as is its distributed ledger payment commitment (DLPC) Technical and Business Best Practices. Also, SWIFT trade messages are formatted according to ISO standards.
[124]https://cloud.google.com/explainable-ai.

QUANTUM COMPUTING

**LUCRATIVE
CHALLENGE**

According to the University of Waterloo's Institute for Quantum Computing,[125] "Quantum computing is essentially harnessing and exploiting the amazing laws of quantum mechanics to process information. A traditional computer uses long strings of 'bits,' which encode either a zero or a one. A quantum computer, on the other hand, uses quantum bits, or qubits", which are both 0 and 1 at the same time. Quantum computers have the potential to process exponentially more data than classical computers. Quantum computing can be considered as both an infrastructure technology, because quantum hardware is required, and as an analytical technology.

POTENTIAL BENEFITS FOR MSMES

Compared to AI, quantum computing allows analysis of much vaster pools of data and is currently being explored as a means to improve the credit rating of companies seeking financing. However, most experts interviewed (see Appendix A) do not see any particularly strong use case for quantum computing in trade finance at the present time. This seems to stem predominantly from the notions that "the technology is still in its infancy" [*20 Fintech] and that it "will mainly be required for heavy computing activities" [*7 Fintech], while trade digitization is, likewise, still in its infancy. Beyond that "the concepts of quantum computing are difficult to grasp and … it is difficult at this stage to demonstrate the value" [*20 Fintech]. In general, "it is too early to say" [*9 Fintech] which applications this technology will have for the trade finance industry.

USE CASES

1. AI-powered fintech company Tradeteq recently began a collaboration with the Singapore Management University (SMU) with the support of the Monetary Authority of Singapore (MAS) to explore quantum-computing-based solutions for the industry. While quantum computing is still very much in its infancy, and the technology does not yet exist to build a large-scale quantum computer, SMU and Tradeteq believe their work may be the first to show a practical advantage for a financial application of the technology as quantum computing continues to improve.[126]

ADDRESSING QUANTUM COMPUTING CHALLENGES

Given the present state of affairs, the specific challenges for quantum computing have yet to be fully discovered. Initial research by firms in the field indicates that there is a strong infrastructural challenge, as any data must be turned into a quantum state before being used. This creates an infrastructure challenge due to the need for quantum hardware. The technology still needs time to mature and be better understood if it is to attract the capital needed to invest in hardware and if it is to attract and build the talent needed to operate it in order to optimize the supply chain and orient research activities.

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[125]https://uwaterloo.ca/institute-for-quantum-computing/quantum-computing-101.
[126]See https://www.gtreview.com/news/fintech/quantum-computing-the-next-tech-frontier-for-trade-finance/ for more information about this project.

4 | CONCLUSION

The key issue for MSME financing is risk assessment, and more specifically, how to better assess the risk potential of companies that lack a long credit history. Technological tools and data-driven solutions enable firms to approach this process from a new angle. They make it possible to harness a bigger pool of data to provide greater visibility into firms' operations and creditworthiness. Rather than a backward-looking approach to risk assessment, as in the past, data can now allow financiers to make risk assessments a real-time process.

Financial institutions can also do more to understand the risks associated with each type of transaction and to examine them from a different point of view through the use of alternative data sets to develop more granular credit scoring and risk assessment models. Technology offers clear promises, and considerable amounts of work are already being done.

Yet the trade finance gap has not been reduced. It is clear that the technology itself is not enough. A multi-pronged approach is needed to unleash the potential of digital technologies in order to facilitate MSME financing.

"The rationale should be to drive the change through a complete digital approach giving access to identity check, business checks, data track records and access to connected financial services (payment, transaction-based financing and insurance cover). This means to construct a transversal view across many silos that are currently organized manually in a physical economy."

*-[*27 Fintech]*

First, developing globally accepted standards to remedy the digital island problem will be key to empowering the digitalization of trade and trade finance and to allowing small businesses to benefit from it. It is crucial for key decision-makers to bear in mind that interoperability is not just a challenge between different technical platforms. Cross-industry interoperability enabling seamless exchanges of data based on standard data models is equally critical, and must always be maintained as a guiding goal. Rather than each trade silo – such as finance, logistics and insurance – creating its own standard, the trade process as a whole must be considered.

Second, a coordinated move away from individual perspectives on how to leverage what type of data should be initiated to allow banks and alternative financiers to better assess MSME risk potential and to lend more to these firms, within a common understanding and the respect of data privacy rules. Thought should be given to creating a common framework about how to leverage data at all stages of the trade technology stack to better assess financing risks and distinguish the good risks from the bad.

Third, creating an enabling regulatory framework that recognizes e-signatures and e-documents and is in line with the UNCITRAL MLETR is critical. Technology cannot thrive in a regulatory vacuum. More movement needs to be seen on that front, both at the national and international levels.

Fourth, identity is critical. There is a strong need for a trusted global digital identity system for companies. Work is well underway in this regard with the establishment of global identifiers and the development of standards such as the DID developed by the W3C, but adoption still remains limited. Ensuring interoperability and mutual recognition between the different approaches being used is needed to avoid nullifying the benefits that digital identities can bring and to facilitate MSME financing.

Fifth, accelerating digitalization to support MSME financing requires an acceleration of efforts to bridge the digital divide to allow all MSMEs, wherever they are, to benefit from the opportunities that digital technologies can offer. Investing in information and communications technology infrastructure, education and skills, among others, are essential in this respect. In addition, for MSMEs to take advantage of the new technologies being developed, there is a need to raise awareness about the opportunities and solutions offered.

Working independently, however, no stakeholder has the clout needed to successfully bring down the paper regime that has held power for centuries. Digitalizing trade requires coordinated action. Industry, governments, financial regulators and international organizations all have a key role to play in this regard. Policymakers, technologists, practitioners, bankers, and all other stakeholders must work together to devise, agree and then execute a roadmap that will catalyse action and lay the foundation for the digitalization of trade and for the digital technologies discussed in this publication to have a potentially transformative impact on MSME financing.

At the end of the day, introducing the industry of trade financing to its prospective paperless future self, will have generous implications for many spheres, including MSME financing. While the challenges that MSMEs face in acquiring funds will not end with this change alone, there is little doubt that they will be reduced. Reduced barriers to MSME financing helped the Apple Computers of 1976 to grow into the remarkable monolith that it is today. Let's empower all visionary leaders of small firms to turn their dreams into reality, and maybe one day to change the world.

APPENDIX A: METHODOLOGY

To investigate the state of the industry, the authors conducted a quantitative survey to practitioners from banks, fintech companies, multilateral development banks, industry associations, trade governance bodies, consultancies and trade policy experts. In total, 105 responses were received.

Respondents were asked to provide a score of between 1 and 10 for what they believe the impact of each technology will be on the industry and how difficult it will be to implement that technology in the industry. In addition, demographic questions were asked in order to determine whether there were variations in the perceptions held by each of the groups. These questions included the type of organization (bank, fintech companies, etc.), geographic presence, and whether the groups actively use any of the technologies in question to facilitate MSME financing.

The quantitative survey was supplemented by a series of qualitative interviews. In total, 34 interviews were conducted. Of these, 10 were from banks, 16 were from institutions classified as fintech companies, and 8 were from sector experts and consultants. The banks surveyed comprised multinational operations with a global reach. The authors acknowledge that large global banks are less likely to serve the MSME market, as discussed in Section 2.1.2. However, these are currently the firms most invested in exploring the world of digital technologies. This makes them poised, at the present moment, to understand the potential of the different technologies, the pain points they can address, and the challenges they face. The intention is to encourage further digitalization at all levels by profiling this particular subsector.

Each expert was first asked the question: "What do you see as the key challenges when it comes to MSME access to finance?" Subsequently, for each of the eight technologies highlighted in this publication, interviewees were asked to identify those with which their business is currently working, the pain points each technology helps to solve, the challenges they encounter while using them, and what needs to be done to enable these technologies within trade and supply chains.

APPENDIX B: CONTRIBUTORS

We would like to thank the following survey respondents and contributors for their contributions to this publication.

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The world business organization

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For many micro, small and medium-sized enterprises (MSMEs) around the world today, access to financing can mean the difference between prosperity and bankruptcy. Working to identify, understand, and ultimately overcome the challenges that MSMEs face in their quest for acquiring financing will help to ensure that the next great technological idea does not cease to exist before it has a chance to change the world.

This publication seeks to identify some of the most pressing of these challenges, understand them, and explore the potential application of digital technologies to mitigating their impact. To that end, the authors conducted interviews and surveys with experts in the field of MSME financing, including, in some cases, trade financing, to shed light on these issues and explore the ways in which technology can be used.

This publication begins by examining some of the challenges that have been identified as impacting MSME financing, as well as the role that the COVID-19 pandemic has had in moulding the landscape. Next, it moves on to examining key digital technologies, their potential benefit to the industry – in particular to MSME financing – a selection of case studies and of companies utilizing these technologies, the adoption challenges they face, and recommendations for overcoming these challenges. The technologies in question include cloud computing, optical character recognition, the Internet of Things, big data analytics, artificial intelligence, quantum computing, distributed ledger technology and application programming interfaces.