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.
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.

The authors would like to thank Thomas Frossard, Hans Huber and Joel Schrevens for their assistance with Figure 1.
Accelerating trade digitalization to support MSME financing
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, 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.

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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)

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 \( (p=0.0011) \) 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.
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.

*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

<table>
<thead>
<tr>
<th>Layer</th>
<th>Technologies</th>
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<tbody>
<tr>
<td>Analytical</td>
<td>Big Data Analytics</td>
</tr>
<tr>
<td>Connectivity</td>
<td>API</td>
</tr>
<tr>
<td>Data Input</td>
<td>OCR</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td><strong>Cloud Computing</strong></td>
</tr>
</tbody>
</table>
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/


\(^{39}\)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.

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. Some fintech companies are also actively using cloud computing to provide enhanced financial services to MSMEs. Pollinate, 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. 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.

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41https://www.pollinate.co.uk/
42https://www.fintechnews.org/pollinate-platform-expands-its-global-reach/
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]
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*

<table>
<thead>
<tr>
<th>Layer</th>
<th>Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical</td>
<td>Big Data Analytics, AI, Quantum Computing</td>
</tr>
<tr>
<td>Connectivity</td>
<td>API, DLT</td>
</tr>
<tr>
<td>Data Input</td>
<td>OCR, IoT</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Cloud Computing</td>
</tr>
</tbody>
</table>
OPTICAL CHARACTER RECOGNITION (OCR)

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.
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 for DLT-powered smart contracts, 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 CO2 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 Swisscom52 and Linxens53 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.

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48Blockchains 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.
49Smart contracts are computer programmes that self-execute when certain conditions are met.
50https://arviem.com/.
51https://www.essdocs.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 networking54 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.

54Ubiquitous networking is the distribution of communications infrastructure and wireless technologies throughout the environment to enable continuous connectivity.
3.3.3 CONNECTIVITY TECHNOLOGIES
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.

**Figure 4c:** The trade financing technology stack: connectivity

<table>
<thead>
<tr>
<th>Layer</th>
<th>Technologies</th>
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<tbody>
<tr>
<td>Analytical</td>
<td>Big Data Analytics</td>
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<tr>
<td>Connectivity</td>
<td>API</td>
</tr>
<tr>
<td>Data Input</td>
<td>OCR</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Cloud Computing</td>
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</tbody>
</table>
APPLICATION PROGRAMMING INTERFACE (API)

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, 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.

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

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\(^59\)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.
\(^63\)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\(^6\) and Skuchain\(^6\) 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\(^6\) 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\(^6\), 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.\(^6\) 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\(^7\).

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.\(^7\)

Various DLT-based identity solutions are already in production across the world, such as the Sovrin Network\(^2\), a public-permissioned DLT platform designed as a global public utility exclusively designed to support SSI and verifiable claims, Civic\(^3\) and uPort\(^4\). Other projects, like KYC-Chain\(^5\), 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)\(^6\) developed by the World Wide Web Consortium (W3C).\(^7\)

\(^{46}\)https://www.linklogis.com/.
\(^{48}\)https://www.fasttracktrade.co/.
\(^{49}\)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.
\(^{51}\)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.
\(^{53}\)https://sovrin.org/.
\(^{54}\)https://www.civic.com/company/.
\(^{55}\)https://www.uport.me/.
\(^{56}\)https://kyc-chain.com/.
\(^{57}\)https://www.w3.org/TR/did-core/.
\(^{58}\)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 currency79 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”51, 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.

79A 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.)
82https://tether.to.
84https://www.tresor.economie.gouv.fr/fr/Articles/5f8c26d2-a2cd-4685-ba82-fa9e4d4e5d67/files/d10f97f-a9ad-472b-842a-8b279e8863c4.
According to the Institute of Electrical and Electronics Engineers (IEEE), 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 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.

According to R3, an enterprise software firm, 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.
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.
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 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)). 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.

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

102https://rightsignature.com/legality/electronic-signature-laws.html#:~:text=More%20than%2060%20countries%20have%20some%20form%20of%20e%20Signature%3A%20More%20than%2060%20countries%20have%20some%20form%20of%20eSignature%3A.
3.3.4 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

<table>
<thead>
<tr>
<th>Layer</th>
<th>Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical</td>
<td>Big Data Analytics</td>
</tr>
<tr>
<td></td>
<td>AI</td>
</tr>
<tr>
<td></td>
<td>Quantum Computing</td>
</tr>
<tr>
<td>Connectivity</td>
<td>API</td>
</tr>
<tr>
<td></td>
<td>DLT</td>
</tr>
<tr>
<td>Data Input</td>
<td>OCR</td>
</tr>
<tr>
<td></td>
<td>IoT</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Cloud Computing</td>
</tr>
</tbody>
</table>

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.
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

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, 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 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 and China Systems. 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.

108https://www.quantexa.com
109https://www.become.co/
110https://www.mybank.cn/index.htm
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)

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, 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. 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, a factoring software firm based in Germany, uses AI as a risk monitoring tool to determine if an invoice is fraudulent.

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.
115Factoring 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, 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. 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, 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, 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 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 for dynamic discounting and supply-chain financing.

**BOX 5: SUB-CATEGORIES OF AI**

- **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/.
118 https://flowcast.ai.
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 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. [*24]

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.

123Some 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.
QUANTUM COMPUTING

According to the University of Waterloo’s Institute for Quantum Computing, 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” and that it “will mainly be required for heavy computing activities,” 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” 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.

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.