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Note 45 | **September 2017**

Beyond Fintech: Leveraging Blockchain for More Sustainable and Inclusive Supply Chains

One of the most noticeable and important developments of the advance of free trade over the last half century has been the emergence of global value chains. These production and supply networks cross multiple borders and connect advanced and emerging economies. They are vehicles that can deliver on many of the promises of globalization. Yet operating them is complex and costly. Global trade since the great recession has slowed, in part because of a lack of transparency and interoperability within these networks. Blockchain, a technology with unique abilities to record, track, monitor, and exchange assets without need of an intermediary, may be the solution to many of the logistical and cost issues that plague the growth and operation of global value chains, especially in the case of food, agribusiness, and pharmaceuticals. It also has potential to address issues of inclusion.

Public Disclosure Authorized

Globalization has made supply chains significantly more complex, involving multiple players from around the world and a great deal of coordination. This increases the cost of operating these global networks—with goods and services channeled across emerging and advanced economies. Imagine the complexity of a product sourced in Ethiopia or Indonesia, assembled in China, and sold in the United States.

The cost of operating supply chains makes up two-thirds of the final cost of traded goods. Seven percent of the global value of trade is absorbed in documentation costs alone, according to the Global Alliance for Trade Facilitation.[1] Faced with a dynamic and volatile environment, companies are increasingly turning to technological innovation to make their supply chains more cost-effective, resilient, and responsive to potential market disruptions.

Between the late 1980s and early 2000s, the emergence of global value chains—which were to become the main vehicle of international trade—was enabled in large part by advances in information technology that drastically reduced the cost of coordinating production stages carried out in different countries.[2] Today international trade is facing a global slowdown[3] and industries have signaled several critical challenges to global value chains, including: (i) a lack of transparency due to inconsistent or not readily available data; (ii) a high proportion of paperwork; (iii) a lack of interoperability; and (iv) limited information on the product's journey in the chain.[4]

Experts have called for trade facilitation measures, including a simplification in the movement of goods along global supply chains, in order to reduce companies' governance costs, increase speed, and reduce uncertainty.[5] [6]

While digitization of supply chains is already underway with technologies such as cloud computing, artificial intelligence, and the Internet of Things—which allows physical objects to communicate—blockchain appears to be the missing element in the mix.

Beyond providing innovative financial services, blockchain—a digital distributed ledger—can provide a platform that offers contracting parties the ability to verify that every link in a supply chain network is authentic, without need of an intermediary such as a clearing house or banking institution.
Blockchain can be used to record, track, monitor, and transact assets, both physical or digital, in a cost efficient and transparent manner.

By doing so, the technology can act as a 'plug and play' trust mechanism that enables other emerging technologies to achieve scale. These include artificial intelligence, machine learning, drones, and 3D printing, among others. In addition, the combination of Internet of Things, smart contracts and blockchain could provide a new model to reengineer supply chain logistics and the business models they support, and by doing so render them more efficient and transparent—and ultimately more inclusive. Hence, Blockchain promises to:

- Provide faster and more affordable payment and finance options
- Leverage distributed-ledger capabilities to remove third-party intermediaries, streamlining processes and promoting increased security across the value chain in multiple industries, with a focus on lowering the barriers to entry for small and micro-enterprises
- Provide solutions for increasing transparency across supply chains.

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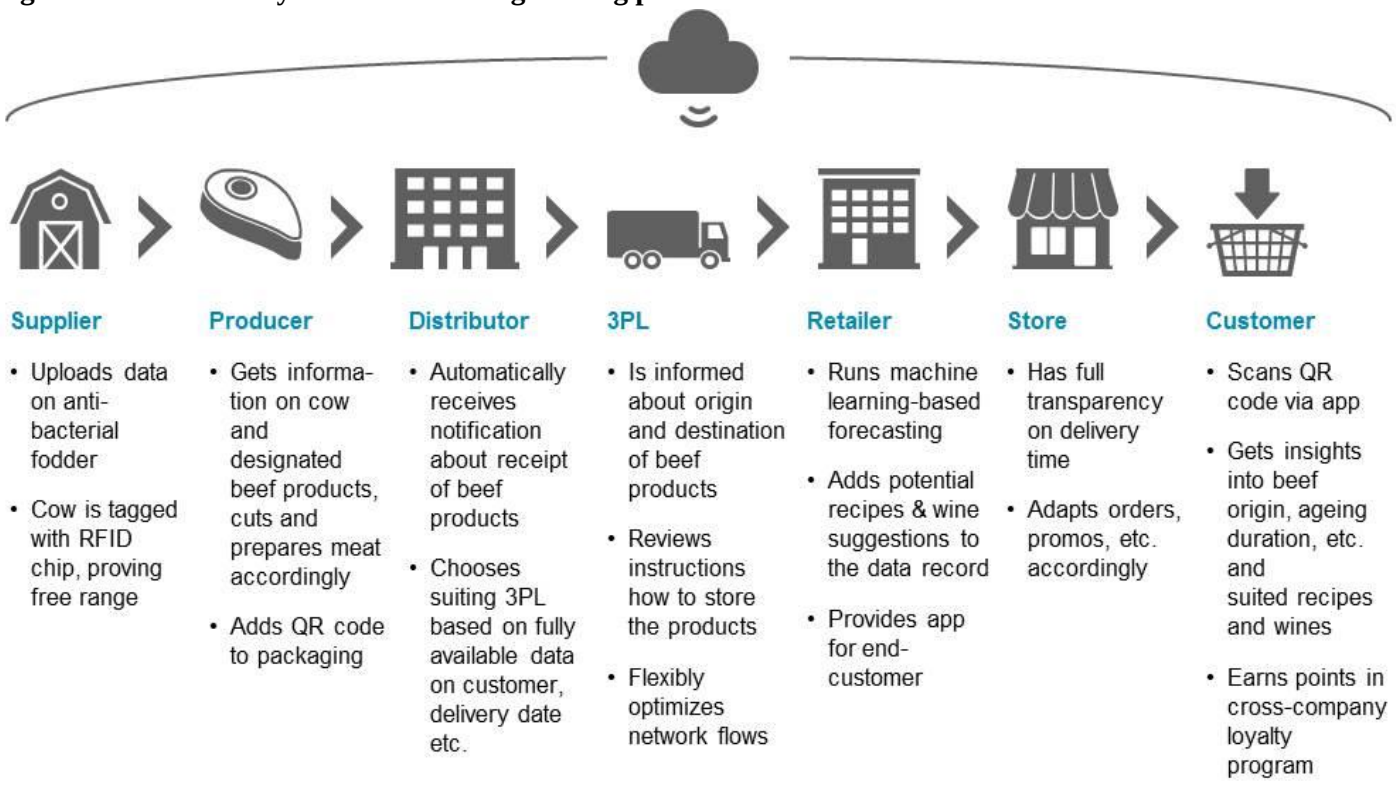
EMCompass Notes 43 and 44 highlight the positive impact that blockchain could have on the financial services industry, with a special look at trade finance and payments systems. Meanwhile, this paper examines blockchain's ability to integrate data flows and processes and to provide efficiency and transparency across digital supply chain networks and to allow for the inclusion of previously underrepresented economic groups. The paper further examines two sectors with significant economic and social impact on emerging economies, food and agribusiness, and pharmaceuticals, and also discusses the inclusion of women in global supply chains.

Food and agribusiness: Cost-efficiency and transparency of the supply chain. Global food and beverage manufacturers, retailers, and service companies want to reduce supply chain costs while also reducing their carbon footprint, meeting consumer demands to sustain the environmental quality of farmland, improve and maintain high quality food standards, promote health and safety, and maintain the economic viability of farming and farmers' wages. With roughly 40 percent of the global workforce,[7] agriculture is one of the leading job providers worldwide and a critical sector for boosting economic growth in developing economies. For emerging markets and their industry leaders with global market ambitions and footprint, adherence to sustainable supply chain practices will become more and more important in the years to come.[8] In this quest for efficiency and transparency, blockchain offers the ability to:

1. Integrate and manage supply chain transactions and processes in real-time; and
2. Identify and audit the provenance of goods in every link of the chain.

Figure 1: The efficiency dividend—Re-engineering processes



Source: End to End Blockchain-Enabled Supply Chain, Oliver Wyman

EMCompass Notes 39 and 43 examine how blockchain can provide more cost-efficient trade finance solutions, one of the levers to innovate the financial aspects of supply chain management. In the context of agriculture, this Note underlines how it can diminish risk and boost efficiency for all stakeholders in the supply chain through real-time settlement of physical commodities in a secured environment.

Automated blockchain supply chain finance and know-your-customer systems can reduce the need for agents, brokers, and reduce physical documentation.

For growers and suppliers, blockchain could shortcut cumbersome procedures and facilitate faster and more secure payments.

For example, payment terms in the Australian grains industry range from two to five weeks, and these terms pose counterparty or credit risk to growers.[9] The elimination of this risk means growers can be secure in their cash flow, liberate working capital, and better manage their businesses. For buyers, there are both back-office and liquidity benefits. A blockchain-enabled workflow automation (via smart contracts and integration with key machinery and data collection points) and auto-reconciliation for inventory can reduce cost and risk to buyers. Additionally, the distributed ledger model could also improve access for regulators and authorities with respect to collecting taxes and customs duties.

A number of blockchain-based projects are now coming to life. A European Union consortium of seven banks called the Digital Trade Chain is collaborating with IBM to develop a supply chain management and trade finance platform using blockchain technology. The goal is to make cross-border commerce easier for European small and medium enterprises (SMEs).[10]

Similarly, U.S.-based SkuChain aims to connect financiers in advanced economies with clients in emerging and developing economies, despite their lack of history of trade or data with these emerging market firms. The venture proposes 'a collaborative commerce platform,' combining payments, including a letter of credit or wire transfer; finance (operating loans or short-term trade loans); and visibility (integration with back office systems such as Systems Applications and Products in Data Processing or an Enterprise Resource Planning system.[11]

Another U.S. startup, Hijro, develops a blockchain-based financial operating network for global commerce, featuring real-time business-to-business payments, supply chain financing, and a peer-to-peer working capital marketplace that provides banking partners and non-bank lenders alike—including alternative finance providers, asset-based lenders, and hedge funds—with an alternative platform for lending to actors along the global supply chain.

Meanwhile, Memphis-based Seam—partly owned by trading giants Cargill, Olam, and Louis Dreyfus—is working with IBM to "lead an industry-wide collaboration initiative" to create a supply chain and cotton trading ecosystem based on blockchain. The company claims to have smart contracts that can reduce the time needed to settle a trade from the standard three days to just a few minutes.[12] And China Systems is working with the Emirates Islamic Bank to develop a blockchain solution that allows them to share information on a distributed ledger with Islamic banks on sharia-compliant halal goods.[13]

Blockchain promises to make the supply chain leaner, simpler, and more cost-effective—not just providing financing but integrating know-your-customer, inventory management, and traditional legacy systems to work seamlessly with existing supply-chain technology. This element provides an enforcement mechanism. It can identify where the goods came from and who was paid for them. This can help avert fraud, such as the Qingdao scandal in 2014, where volumes of copper, alumina, steel, and other metals where used as collateral for multiple loans. With blockchain, all actors along the supply chain are visible and accountable.

The transparency dividend: Enforcing sustainability and safety standards

Research by the Organisation for Economic Co-operation and Development indicates that "green trade" is rising in political and economic importance, "with a global market of $1 trillion a year for environmental goods[14] and services close."[15] At the same time, the Sustainability Consortium's 2016 Impact Report found that the majority of consumer goods manufacturers lack visibility into the sustainability performance of their supply chains. The 'greening' of global supply chains requires traceability and transparency. The former is necessary to track hazardous products and materials, allocate responsibilities, and monitor environmental compliance. The latter is a precondition for achieving credibility, legitimacy, and fairness, and to avoid "green-washing" or shifting polluting activities to developing countries."[16]

In food and agriculture, transparent supply chains are vital to ensuring quality and conformity to the expected standards of production (bio, fair-trade, circular economy), meeting environmental standards and combatting fraud, as well as monitoring supplier inclusion mandates. A 2016 survey on the investment priorities of industry leaders, conducted by the consultancy the Boston Consulting Group and AgFunder, an investment marketplace for the agriculture industry, found that supply chain and logistics was a top-five priority for 40 percent of their respondents, with food security and traceability cited most often as a priority.[17] Food safety is a major concern for consumers, and companies are feeling the impact after some notable incidents such as the Chipotle norovirus and salmonella outbreaks in 2015 that caused its profits to plummet by 44 percent.[18]

In contrast to inefficient labelling systems that are easily manipulated, blockchain provides businesses and consumers with a system that cannot be tampered with. It can provide much more reliable information on where food originated, the date it was created, and how it was produced. Blockchain quickly traces contaminated products to their source and ensures safe removal from store shelves.

Some of the largest players in the industry are taking notice and are experimenting with blockchain to provide proof of concept, using the technology to improve visibility into their supply chains. IBM and a group of leading food companies, including Dole, Driscoll, Golden State Foods, Kroger, McCormick and Company, Nestlé, Tyson Foods and Walmart, formed a consortium in 2017 to test IBM's blockchain solution, which aims "to identify and prioritize new areas where blockchain can benefit food ecosystems."[19] This follows a successful pilot that IBM launched with Walmart earlier in 2017. Through this

program Walmart discovered that, while it normally takes more than six days to trace a package of mangoes from the supermarket back to the farm where they were grown, blockchain can reduce this time to seconds.[20] Blockchain not only identified the farm where the mangoes were harvested but also the exact path they took on the way to the retail shelves. IBM's blockchain solutions are also being adopted by Everledger, a firm that is pushing transparency into the diamond supply chain network, with the aim of addressing a market fraught with forced labor and violence across Africa.[21]

In Asia, Chinese retailing giant Alibaba is launching a similar initiative in partnership with PricewaterhouseCoopers, Blackmores, and the Australia Post to fight counterfeit food products being sold across China. Similarly, China's second-largest e-commerce platform, JD.com, is working with Kerchin, a Mongolian-based beef manufacturer, to use blockchain to track the production and delivery of frozen beef.

A number of innovative startups around the world are also entering the space. UK based Provenance launched a successful pilot program in Indonesia using blockchain-enabled smart-tagging to track tuna fishing in Indonesia. German startup Slock.it aims to provide the benefits of the transparency, security, and auditability to real-world objects by integrating blockchain nodes in connected objects. US-based RipeIO's algorithms crunch data to calculate sustainability scores, as well as scores for spoilage and safety levels.[22] California's Filament is working to develop 'smart farming' solutions with a decentralized network allowing Internet of Things sensors to communicate with each other. By encrypting down to the hardware level and leveraging blockchain technology, Filament's decentralized network allows any device to connect, interact, and transact independently of a central authority.[23] And Bext360, a coffee-supply platform, uses blockchain, artificial intelligence, and the Internet of Things to support fair trade for coffee growers in developing nations.

Addressing a public health challenge: Blockchain and the pharmaceuticals supply chain

Over the past two decades, the pharmaceutical industry's supply chain networks have become globally diversified and complex, resulting in several new actors being introduced into the value chain—from development, manufacturing, and packaging to delivery. The industry has been under phenomenal pressure to fight counterfeit products and to check abuse in its supply chain. Medicines constantly change hands and undergo multiple transactions between production and end-user patient, with each transaction increasing the risk of falsified and substandard products infiltrating the supply chain.[24] The growing number of e-commerce platforms creates more channels for fake medicines to enter the market.

A 2014 report by American Health & Drugs Benefits estimated that counterfeit drugs provide approximately $75 billion in annual revenue to illegal operators (U.S. Department of Commerce estimates are $75-200 billion[25]), and have caused more than 100,000 deaths worldwide. The profit loss to pharmaceutical companies is estimated at $18 billion annually.[26]

For developing countries, the problem is dire. The World Health Organization estimates that 50 percent of drugs consumed in developing countries are counterfeit, the majority of them anti-malarial medicines and antibiotics. These fake drugs can harm patients while failing to treat the disease, and may create a resistance to the original product. The problem of counterfeit drugs is exacerbated by the opacity of the global pharmaceutical industry's supply chain. Existing solutions to detect fake drugs, including radio frequency identification tags, have been largely ineffective due to the disaggregated nature of the industry supply chain and the high cost of adoption.

Blockchain could intervene to provide greater transparency, help detect fake drugs and, ultimately, reduce tracing costs by:

- Tracking and tracing pharmaceutical raw materials and finished products, from manufacturer to end-user, in a distributed ledger that is tamper-proof
- Requiring participants to verify the authenticity of data
- Integrating anti-counterfeit devices into the 'Internet of Things' to authenticate genuine drugs and detects fakes.
- Serving as an open-source platform for drug standards to enhance information-sharing across unrelated databases, and among different actors in the drug supply chain.

Blockchain's distributed ledger technology presents an innovative alternative to existing systems: It can provide a record of all transactions, including location, data, quality, and price; it is visible to all involved entities, in real time; and it minimizes record tampering.

Several initiatives are currently underway to develop blockchain-based solutions that can provide more visibility into the pharmaceutical industry's supply chain. Rubix, a spinoff of Deloitte, is working in Canada with pharmaceutical companies to build applications for drug safety, drug channels, and public safety. And U.S. based startup iSolve has developed BlockRx, a private-blockchain solution for the life-sciences industry that provides traceability in drug supply chains.

BlockRx's goal is to connect systems that do not readily communicate, establish data provenance that satisfies regulatory and business requirements, and create a network of trading partners that are incentivized to facilitate the transfer of information within a secured environment. Blockverify, a UK startup, has developed anti-counterfeit solutions that may make the verification of a drug's authenticity as easy as scanning a bar code with a mobile phone. Each product will have its own identity on the blockchain to record changes of ownership, and will be accessible to everyone.

Similarly, Chronicled, a California company, builds open protocols and hardware and software solutions that incorporate blockchain's cryptographic technology with the Internet of Things, to ensure that transactions and actors cannot be falsified. It recently launched CryptoSeal, a platform that provides tamper-proof adhesive seal strips containing a Near-Field Communication chip to seal and track shipments of drugs. Meanwhile, French startup Blockpharma has developed a private blockchain application that creates a bridge between existing programs and the blockchain consortium. The laboratories release medicine boxes with bar codes that can be traced throughout the supply chain via a smartphone.

A case for inclusion: Women in the global value chain

Women represent a significant portion of workers in many value chains. However, informal roles and comparatively low access to credit and identification are an obstacle to women's access to jobs and assets, as well as to the creation of productive, sustainable markets. Blockchain technologies can help address some of these challenges. In terms of business ownership, there are approximately 10 million women-owned small and medium enterprises (SMEs) around the globe, representing around 30 percent of all SMEs in emerging markets. Seventy percent of these women-owned enterprises are unbanked or underbanked, which represents a finance gap of roughly $300 billion per year.[27] Access to financial services such as credit, savings, and insurance are considered one of the major barriers to growth for women-owned businesses.

Laws and cultural norms that restrict women from opening a bank account are common causes of exclusion.[28] Women comprise just over 40 percent of the agricultural labor force in the developing world, a figure that ranges from about 20 percent in the Americas to almost 50 percent in Africa and Asia.[29] At a global level, one fourth of all economically active women were engaged in agriculture in 2015.[30] Supporting women's roles in agricultural value chains can increase productivity, profitability, and sustainability for actors along the chain.

Blockchain offers the potential to address some of the barriers to women's financial inclusion and economic empowerment, both as individuals and as business owners. It could provide a cost efficient digital identity (see EMCompass Note 42, 43), which can help overcome women's comparatively low access to formal identification[31] and offer an entry to formal roles and remuneration in supply chains. It could also help women establish ownership of disputed land titles. Finally, it could promote financial inclusion by helping women establish credit scores through alternative credit data sources, bypassing traditional intermediaries and banks.

Finally, blockchain's auditability and traceability can provide a tool for the monitoring and enforcement of supplier inclusion and gender empowerment initiatives that are currently difficult to monitor and enforce.

Investors and credit agencies are now paying greater attention to non-financial performance issues, including human rights and gender equality. Development-finance institutions such as IFC require their clients to adopt performance standards on environmental and social sustainability issues, which include a commitment to inclusion.[32] A series of similar standards has been established by private sector institutional investors. And consumers are also paying more attention to environmental and social standards. As a result, companies are increasingly aware of the importance of these issues to their brands and reputations.

While blockchain technology alone is not sufficient to address the cultural and structural issues underlying the challenge of gender equality, it does present a strong toolkit to tackle significant facets of the issue. The potential benefits of even marginal change can be significant for both the private sector and entire economies.

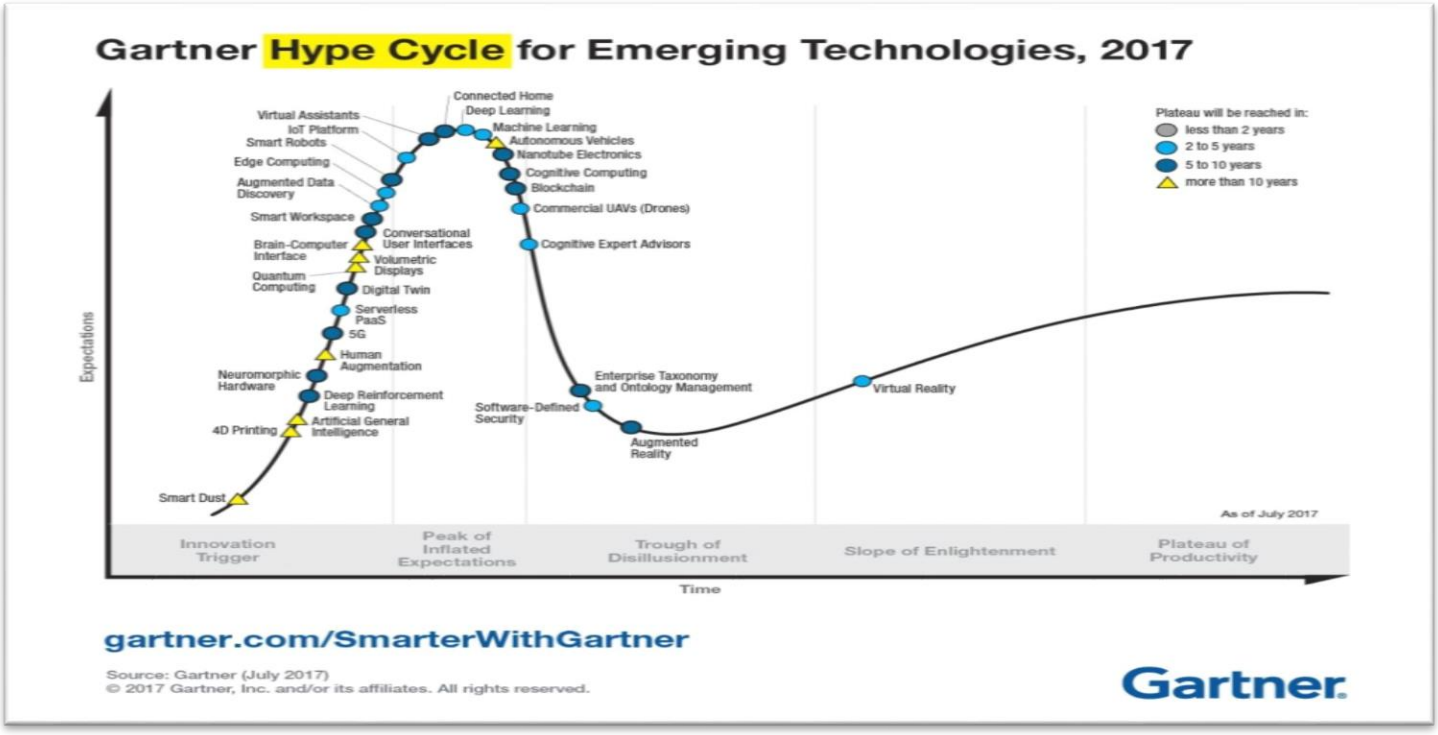
Challenges

As discussed in previous EMCompass Notes, blockchain needs to overcome multiple challenges in order to become a mainstream technology. One key challenge is linked to the development and governance of the technology.[33] Without a set of standards that can ensure the interoperability of systems across industry and supply chains, it will be difficult for the technology to achieve scale. Coexistence with legacy systems, as well as that of private and public blockchains in supply chains, will need to be negotiated. The blockchain development community also needs to provide a roadmap for continued blockchain innovation, particularly in rendering smart contracts more agile and ensuring scalability and security. Full network benefits will not be realized without widespread adoption by industry, an issue that renders blockchain's takeoff more difficult.

This will take time, as blockchain is a relatively new concept and the number of people able to use it are few. While companies in advanced economies will attract the best talent in the global workforce, those in developing countries may require more time to catch up. A lack of sufficient digital skills will be an obstacle to adoption, especially for SMEs and micro-enterprises that do not have the financial means to attract talent. Large players that act as hubs would have to require their supply chain partners to align accordingly. Failing to do so may lead to their eventual exclusion from the supply chain. In the case of SMEs, the digital skills gap may intensify their marginalization from the digital supply chain instead of advancing their inclusion.

Moreover, with the growing number of regulators concerned about potential risks, the regulatory framework for the technology is uncertain and unpredictable. Supply chains are currently governed by a highly complex, overlapping nexus of legal and regulatory jurisdictions. In a recent industry survey, 56 percent of participants identified regulatory uncertainty as a major barrier to adopting the technology, followed by a lack of alignment among stakeholders, and of technological maturity.[34]

Figure 2. Blockchain Maturity Cycle



Source: Gartner

Conclusion

Blockchain technology is at a nascent stage of development, but there are signs that it is exiting the hype-cycle of inflated expectations and entering a more pragmatic phase of exploration (Figure 2). Educating key stakeholders, both in the private and public sectors, about the technology's benefits remains a big challenge. Supply chains are an ecosystem that prefers conservative innovation and is dominated by industrial players with complex business models that are not easy to reengineer.

However, companies cannot afford to sit out the evolution of blockchain. They must be realistic about their expectations and use pilot schemes to learn and adapt their strategies. The closer the use case is to a real business challenge, the better the chances of productive feedback will be. Companies will also need to weigh the risks of adopting the technology against the numerous opportunities it has to offer.

About the Author

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Acknowledgments

The author would like to thank the following colleagues for their review and suggestions: Aksinya Sorokina, Associate Operations Officer, Advisory Services – Financial Institutions Group, IFC; Alexa Roscoe, Consultant, Gender Secretariat, Cross Industry Solutions, IFC; and Thomas Rehermann, Senior Economist, Thought Leadership, Economics and Private Sector Development, IFC.

Additional EM Compass Notes about Blockchain

This note is the last in a series of five complementary EM Compass Notes by this author: The notes focus on: (1) a general overview of blockchain technology (Note 40), (2) an outlook for blockchain's implications for emerging markets (Note 41); (3) a general overview of the impact of blockchain on financial services (Note 43), (4) an emerging market regional analysis of blockchain developments in financial services (Note 44) and, (5) implications of the technology beyond financial technology (this note).

Please also refer to EM Compass Note 38, "Can Blockchain Technology Address De-Risking in Emerging Markets?" by Vijaya Ramachandran and Thomas Rehermann, for how blockchain can be used to mitigate de-risking by financial institutions, which affects recipients of remittances, businesses that need correspondent banking relationships.

[1] http://www.tradefacilitation.org/

[2] GVCs are Coasian constructs that exist only if the incremental benefit from improved complexity (GVC length) is higher than the increased transaction cost. This means that (i) the total accumulated trade cost along the GVC is bounded by the GVC performance in terms of efficiency but also that, (ii) for a given structure of efficiency gains, the length of the GVC is negatively correlated to trade costs. WTO, 2017. Accumulating Trade Costs and Competitiveness in Global Value Chains. https://www.wto.org/english/res_e/reser_e/ersd201702_e.pdf

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