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UNBLOCKING THE BOTTLENECKS AND MAKING THE GLOBAL SUPPLY CHAIN TRANSPARENT: HOW BLOCKCHAIN TECHNOLOGY CAN UPDATE GLOBAL TRADE

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SUMMARY

Blockchain technology is still in its infancy, but already it has begun to revolutionize global trade. Its lure is irresistible because of the simplicity with which it can replace the standard methods of documentation, smooth out logistics, increase transparency, speed up transactions, and ameliorate the planning and tracking of trade.

Blockchain essentially provides the supply chain with an unalterable ledger of verified transactions, and thus enables trust every step of the way through the trade process. Every stakeholder involved in that process – from producer to warehouse worker to shipper to financial institution to recipient at the final destination – can trust that the information contained in that indelible ledger is accurate. Fraud will no longer be an issue, middlemen can be eliminated, shipments tracked, quality control maintained to highest standards and consumers can make decisions based on more than the price. Blockchain dramatically reduces the amount of paperwork involved, along with the myriad of agents typically involved in the process, all of this resulting in soaring efficiencies.

Making the most of this new technology, however, requires solid policy. Most people have only a vague idea of what blockchain is. There needs to be a basic understanding of what blockchain can and can't do, and how it works in the economy and in trade. Once they become familiar with the technology, policy-

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makers must move on to thinking about what technological issues could be mitigated, solved or improved.

Governments need to explore blockchain's potential through its use in public-sector projects that demonstrate its workings, its potential and its inevitable limitations. Although blockchain is not nearly as evolved now as the internet was in 2005, co-operation among all stakeholders on issues like taxonomy or policy guides on basic principles is crucial. Those stakeholders include government, industry, academia and civil society. All this must be done while keeping in mind the global nature of blockchain and that blockchain regulations need to be made in synch with regulations on other issues are adjacent to the technology, such as electronic signatures. However, work can be done in the global arena through international initiatives and organizations such as the ISO.

Canada has an important role to play in developing international blockchain policy and furthering use of the technology. Estimates are that Canada will be among the top investors in blockchain, with a projected annual growth rate of nearly 90 per cent in just the next three years alone. Canadian policy-makers can take on a significant role in these early days by providing a hub for stakeholders and resources.

Already, industry has begun experimenting on a wide scale with Blockchain. Walmart, for example, has created a blockchain food safety alliance that tracks, traces and monitors product safety from farm to grocery aisle.

Blockchain has tremendous potential for relieving the pressure points and bottlenecks in trade supply chains. Its low investment costs are another asset that will help contribute to its widespread use in the next decade. Trade isn't the only place for blockchain; health care, data protection and voting security are all areas where blockchain can prove useful. With proper cooperation, governance and policies in place to regulate it, blockchain will soon become an accepted (unnoticed) part of many aspects of everyday life.

INTRODUCTION

When you think about all the steps that must take place, and all the co-operation required to bring a kiwi fruit to your local supermarket, it's hard not to marvel. The same goes for all the transactions needed globally, tying together more than 800 suppliers across more than 30 countries needed to produce the iPhone.[1] We take all this for granted, but the scope and complexity of the planning, processes, logistics and transactions needed to get the trading chain to work from farm to fork are simply staggering.

Blockchain technology was designed to permit two parties to conduct an online transaction without having to rely on a middleman to act as a third-party intermediary (Gabinson 2016).

International trade is a long chain of transactions, all requiring trust in order to enable execution. Often, the players don't know each other, have no physical interaction and the process has built-in lag times between delivery and payment. Currently, middlemen bridge these gaps, but this means interacting with numerous agents specialized in enabling different parts of the trade chain (e.g., having 10 parties covering the process of trade financing alone). While these proxies manage to build sufficient bridges where needed, they are not the perfect solution to the problem. Having to deal with various intermediaries is costly, inefficient and keeps information about the product in silos with each middleman.

In addition to its costliness, the lack of oversight in the current system gives rise to significant amounts of fraud and theft. The American National Cargo Security Council estimates that the global financial impact of cargo loss exceeds $50 billion annually (Hayes 2004), which highlights the positive effects of having more transparency and accountability built into the system.

A thriving community of trading firms is especially important for open economies like Canada. In value-added terms, exports accounted for a quarter of Canadian GDP[2] in 2014 (OECD 2017). This number is lower than the OECD average (31 per cent), and highlights the scope for improved growth through increased trade. The prospect of lowering the costs of trade will not only increase the volume of trade, but also level the playing field for small and medium-sized enterprises (SMEs). By enabling consumers to make more informed decisions, blockchain can empower the value-based trade that Canada aims to achieve with its more progressive trade agenda, such as the Comprehensive Economic and Trade Agreement (CETA) recently concluded with the EU. The agreement contains provisions on labour rights, environmental protection and sustainable development. The official communication regarding CETA states that it "upholds and promotes the values that Canada shares with the EU."[3]

> *"Trade is in Canada's DNA and it's vital to our economic prosperity."*
> The Hon. François-Philippe Champagne, Minister of International Trade, 2018 [4]

Much like the advent of containerization or the information and communications technology (ICT) revolution, the development of blockchain is a private-sector initiative offering huge potential for trade, growth and jobs. Realizing blockchain's potential, however, hinges on involvement by all stakeholders, including policy-makers.

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1 According to Comparecamp.com (2014).

2 This corresponds to a gross export share of 34 per cent of GDP.

3 https://www.international.gc.ca/trade-commerce/trade-agreements-accords-commerciaux/agr-acc/ceta-aecg/index.aspx?lang=eng

4 Minister's Message on the State of Trade Report (2018).

WHAT IS BLOCKCHAIN TECHNOLOGY AND HOW DOES IT STAND TO IMPACT TRADE?

What is blockchain technology?

Blockchain technology describes a novel digital concept for storing data. The main idea is to simultaneously decentralize and secure trust between parties wishing to perform a transaction. The conceptual ledger system holds information about transactions in a register that is transparent and accessible. Once the information has been entered into a "block", it cannot be altered, only added to. Currently, many transactions involve middlemen who keep ledgers (e.g., pre-internet banks holding the actual paper deeds to stocks and using digital ledgers for bank balances) and/or acting as proxies for trust and information (such as a realtor in a real estate transaction).

In technical terms, blockchain – or in its more generic denomination, distributed ledger technology – is a distributed consensus mechanism with an underlying security protocol.

The original information is distributed and held by more than one party. These holders of information are called nodes (computers connected to the network). As soon as new information is available, it is time-stamped and sent out simultaneously to all nodes in the system. Each node then automatically replies to confirm that the new information has been received; hence the term "consensus mechanism". All transactions are handled according to a security protocol, which means they are added through cryptography. This ensures that they are meddle-proof once all nodes have reported that they have handled the information that was set up chronologically as one block in the process. Once the block is closed it is immutable and cannot be deleted. A new block is then generated to keep records of the next part of the transaction in the ledger.

The system also contains actors who add information along the process. The actors could be inspectors verifying that the shipment has been inspected and adheres to regulation. An actor could also be the importer's bank setting up a letter of credit, the carrier issuing a bill of lading (receipt of cargo for shipment) or even Internet of Things (IoT) sensors (e.g., measuring temperature or humidity inside shipping containers transporting perishables, or GPS co-ordinates tracking movement). Some actors have the authority to add information, others have viewing privilege. Blockchain is set up so that all have access only to the part of the process that pertains to them.

Although originally developed for transactions of the cryptocurrency bitcoin, blockchain can be used wherever people want to keep track of records. This includes everything from protecting endangered species to national security, waste management and tracking fine art and diamonds (Zago 2018).

HOW CAN BLOCKCHAIN TECHNOLOGY BE INCORPORATED IN TRADE TRANSACTIONS?

Trade is driven by economic incentives to reap the benefits of comparative advantage.

Trust, transparency and accountability are friends and the costs of distance and uncertainty are foes (Chaney 2013).

The trade chain is a long and complicated series of transactions, many of which take place without physical interaction between the transacting parties. Traded goods travel long geographical distances and across language and cultural barriers. Time is crucial for trade. First, there is an

inherent cash flow issue in these transactions. For example, a line of credit needs to cover the long time between harvest and consumption of fruits and vegetables. The longer it takes, the more expensive the credit. Second, once the agricultural products have been harvested, they are perishable and any delays risk ruining the goods and the revenue. This is increasingly true also for producers of fashion items, where a delivery delay can render the clothing passé, and thus not viable to sell.

Blockchain will decrease the costs of trade, which will empower globalization, trade, and optimize the global value chains that the ICT revolution has made possible. Moreover, through a number of channels, such as the way documentation can be handled and the trading process can be monitored, the technology also enables a new layer of trust, transparency and accountability (McDaniel and Norberg 2019).

Blockchain technology has the potential to revolutionize, reinvent or disrupt international trade. This is occurring just as we have begun to understand the impact that internet-led digitalization has had on trade and the economy. By lowering communications costs, ICT has brought about digitalization, global value chains, electronic platforms, 3D printing and much more. It has created many new opportunities for firms that previously were unable to enter the global market. The internet lowered the threshold for entering that market, shortened geographical distances and decreased the costs of participating in trade. As a result, smaller actors, such as consumers and SMEs, can now trade in markets that previously were inaccessible.

To enable this trade, new institutions emerged, improving trust through the use of ICT payment systems (such as PayPal, Alipay and Klarna). Blockchain technology can substitute for many of these systems, automating the roles of many parts of the administrative chain and making transactions smoother, more efficient, secure and transparent. Combining blockchain with other types of new technology such as the IoT, artificial intelligence (AI) and smart contracts, opens up enormous possibilities for allowing other applications to work in the same direction.

"The Holy Trinity": Blockchain, AI, IoT
and Their Super Power Application: Smart Contracts

Artificial intelligence (AI) denotes machine-simulated intelligence. Based on the assumption that human intelligence can be defined in such exact terms that a machine can mimic it, AI is applied to learning, reasoning and perceiving information. Using information based on mathematics, computer science, linguistics, psychology and other sciences, AI can perform many tasks, ranging from playing chess and driving cars to running search engines and targeting advertising. AI describes machines, systems or applications that are capable of performing tasks which previously only humans could perform (Aaronson 2018). Recently, there have been quite a few cases where AI has out-performed human intelligence, such as doing legal work (WEF 2018) and detecting cancer (Tucker 2018). Although founded as an academic discipline in 1956, AI has become central to IT only since recent advances in the availability of computing power and the ability to process large amounts of data.

Internet of Things (IoT) is the connection of standard items, like computers or smartphones to the internet. This also includes other everyday traditionally non-smart objects such as home appliances. A modified Coke machine at Carnegie Mellon University* in 1982, which enabled reports on inventory and whether drinks were cold, was the first internet-connected device. As costs, size and power requirements for computing power have fallen, it became viable to embed network connections into other physical devices, e.g., vehicles, refrigerators and watches. These objects can then connect and exchange data, making it possible to control and monitor them remotely.

According to Wikipedia, a smart contract is "a computer protocol intended to digitally facilitate, verify, or enforce the negotiation or performance of a contract. Smart contracts allow the performance of credible transactions without third parties. These transactions are trackable and irreversible."

Smart contracts tie together the underlying technologies in blockchain, AI and IoT. In practice, a smart contract is a protocol that does not require human interaction to track and verify the process along the way. The contract itself is set up with an if/then algorithm for the criteria that need to be met in order to execute the next phase. Thus, the current phase of the production is evidence that the criteria for all prior phases have been upheld. The contract can be set up so that the whole process is transparent and trackable, making it a prerequisite for subcontractors to fulfil not only the parts of the delivery per se, but ensuring it has the necessary paperwork and inspections that need to be met and displayed before executing the contract.

For trade-related purposes, a smart contract can verify, for example, that a product meets prerequisites for regulations and standards, such as being environmentally friendly, sustainable, and adhering to labour standards, rules of origin, etc.

* https://www.cs.cmu.edu/~coke/history_long.txt

Trade's administrative costs are significant. According to shipping giant Maersk (The Economist 2018), a shipment of avocados from Mombasa to Rotterdam in 2014 entailed more than 200 communications involving 30 parties. Until the ICT revolution, all documentation of trade goods in transit was done on paper. The advent of ICT and the digitalization of documents greatly facilitated the process. Papers no longer went missing and documents could be duplicated. The lowering of communication costs unleashed and empowered the concept of global value chains. Parts of the trade chain have taken it further, working to introduce digital supply chains (DSCs)[5] (Patnayakuni 2002) to increase co-operation and productivity to gain competitiveness.

Despite these advances, other parts of the trade chain are stubbornly stuck in their old ways and have yet to reap the technology's benefits. The shipping industry is the most notorious example of this. Maersk and IBM – who previously co-operated around a number of blockchain projects on shipping and logistics – have teamed up to initiate TradeLens,[6] an open platform for wider

[5] Digital supply chains are, as suggested by the term, extension of global supply chains, with greater levels of co-operation on a digital level. Here, MNEs take on the role as hub organizations for leading the digital integration and work along with their main suppliers to optimize operations all along the chain, rather than just sourcing from suppliers and optimizing within their own domain.

[6] www.tradelens.com

blockchain co-operation along the global supply chains. TradeLens aims to serves as a catalyst to digitizing documentation as well as connecting actors (such as port and terminal operators, customs authorities, freight forwarders, transportation and logistics companies, etc.) to form "a more efficient, predictable and secure exchange of information in order to foster greater collaboration and trust across the global supply chain."

Another issue is that documents along the trade chain are still highly compartmentalized, with each actor focusing on a specific part of the process. Hence, the importer needs to communicate directly with each one and make sure each has access to the necessary documentation.[7] With blockchain, the documentation can follow the product, ensuring that one part of the protocol is followed before it is sent on to the next part.

Time is money – especially for perishables. As an example, the Food and Agriculture Organization of the United Nations (FAO) estimates that between 30 and 40 per cent of food is lost or perishes before it reaches the market. In an attempt to make the border crossing procedure more efficient, the World Trade Organization (WTO) negotiated the trade facilitation agreement (TFA) which entered into force in 2017. The agreement contains provisions to expedite the movement, release and clearance of goods in trade by "cutting red tape at the borders". The full implementation of the agreement is estimated to be significant, reducing global trade costs by 14 per cent (WTO 215b). According to the estimates produced by the Organisation for Economic Co-operation and Development (OECD), the lower trade costs would lead to an increase of global exports by around US$1 trillion yearly (OECD 2015).

While the implementation of the TFA is useful for increasing the productivity of border crossing procedures, blockchain can take goods along the whole chain, from producer to consumer. The TFA initiative includes measures such as digitizing paperwork and streamlining procedures. These are commendable first initiatives, of which blockchain can be seen as an extension, albeit with more potential, where information can follow the good from initial production to the final consumer.

Trade financing is a cumbersome and complex process. There is a fundamental time lapse built into the process of international trade, which makes it less suitable for paying cash in advance. While exporters prefer to get paid as they are shipping off the goods, importers want to receive the merchandise before paying, in order to inspect the goods first. Transporting takes time and the quality of the goods may be compromised in the process. Trade financing, which is often described as "the lubricant of trade" has developed as a solution to these issues. Here, a finance or insurance agent (often both) provides credit, payment guarantees or insurance to facilitate the process and acts as a bridge for the time and risks involved in the transaction. According to the WTO (2016), up to 80 per cent of world trade is currently financed by credit or credit insurance; yet the WTO defines the lack of trade finance as a "significant non-tariff barrier to trade". This barrier hits smaller firms harder than larger ones, since on a global scale, over half of trade finance requests by SMEs are rejected (compared to a rejection rate of seven per cent for larger multinational firms).

Using blockchain technology, the importer's bank can set up a smart contract and create a letter of credit to guarantee exporters a payment before they produce or harvest. The producer will then know that the money has been deposited. The local bank can issue a credit to the producer with the guarantee from the exporter as collateral. Not only will lowering the risks and costs this way

[7] As examples of the red tape targeted in the TFA, the WTO points to the documentation requirements for goods which often lack transparency, leading to required paperwork being duplicated in many places along the way. Moreover, WTO identifies the lack of co-operation between traders and official agencies, and low usage of information technology to empower automatic data submission as issues that the implementation of the TFA can target.

benefit those firms currently using the services, but the increased transparency lowers the risks and costs for the issuing agents, making it more lucrative for new firms wishing to enter the financing market and increasing available liquidity for trading firms (Global Trade Review, 2016).

The other part of the trade financing process is trade insurance, which is used to manage the risk of any part of the goods getting ruined along the way. Traditionally, middlemen specializing in mitigating risk along the chain have handled this insurance. Some actors insure against risks during transportation from farm to warehouse, while others do so from warehouse to container. Still another actor focuses on risks while the goods are on board the ship, and so on. Thus, covering the risks requires quite a few actors and proxies. To minimize the risk of theft and fraud, containers were sealed upon exit and not opened until arrival; this is known as being transported in "black boxes". The shipping process can incorporate more transparency by using blockchain technology for inspection documentation, having IoT monitors send automated updates on the temperature and humidity within the container, and using GPS co-ordinates, cameras and alerts if the containers have been opened.

BLOCKCHAIN AND TRADE POLICY

Blockchain improves the agreements that are already in place

While governments negotiate, sign and implement preferential trade agreements, the economic gains are not automatically delivered once that work is done. Governments don't trade; firms do. The benefits of the trade agreements are not realized until firms make good use of the opportunities available from the preferential deals. Until recently, surprisingly little was known about the extent to which firms traded under the preferential, more liberalized rules, such as lower tariffs, resulting from Free Trade Agreement (FTA) negotiations. This is measured by preferential utilization rates (PURs) which are defined as the share of trade that takes place under preferences as a share of the total value of trade that is preference-eligible (Swedish Board of Trade 2018).

Customs data on tariff usage have only recently been made available on a wider scale. Early research shows that the use of EU preferential rates is relatively high, on average 75 per cent. Research also shows that PURs are positively correlated to the value of the shipment (Keck and Lendle 2012) and trading firm size – the bigger the firm or shipment, the higher the PURs (Nilsson 2016). However, trading firms are not automatically eligible for an FTA's preferential rates. Substantial administrative requirements are needed to qualify for those rates. To restrict trade deflection, firms need to prove that the goods adhere to the rules-of-origin (RoO) regulations.[8]

Providing proof for the RoO is often difficult and time-consuming. Evidence of the national origin of the product being shipped must be provided and firms also need to provide evidence of the production of inputs. The costs incurred are significant. Moreover, the negotiated rules differ across FTAs (e.g., RoO for NAFTA are different from those in CETA (Georges 2017)). In NAFTA's case, Anson et al. (2005) estimated the average costs for proving adherence to the RoO to an *ad valorem* equivalent of around six per cent. This cost is harder for smaller firms to bear. Putting RoO-related information on the blockchain would significantly lower the costs and administrative burden, as well as generally help increase the accessibility of information. The increased traceability that the

[8] Rules of origin are the criteria needed to determine a product's national source. https://www.wto.org/english/tratop_e/roi_e/roi_info_e.htm

technology creates can make the process faster, cheaper and easier, thus levelling the playing field for smaller firms entering the international market.

SMEs are the backbone of the economy and essential to growth and jobs. According to the government of Canada's key small business statistics, Canadian SMEs employed 10 million people, or 90 per cent of private-sector workers, in 2015. Meanwhile, SMEs account for just 25 per cent of exports. This matters, since much empirical research (Bradford and Jensen 1999) shows that the increased competition that exporting firms face causes them to out-perform non-exporters in employment, productivity and capital intensity, thus providing better, more secure jobs with higher wages. Levelling the playing field and increasing the participation of SMEs in the international arena are key to unlocking growth.

As tariffs have decreased, non-tariff barriers (NTBs) have become an increasingly important impediment to trade. As a result, trade negotiators have added these issues to the agenda. Technical barriers to trade, often referred to as regulations, were included in the CETA negotiated between Canada and the EU (CETA Text Article 21), where discussions focused on ways to increase regulatory co-operation, coherence and so forth. Gathering information on the regulatory requirements and voluntary standards needed to sell a product in an international market can be costly, especially for SMEs. Blockchain can make it cheaper and less cumbersome for firms to both adhere to, and document that, the traded good/service is up to standards and regulations. Currently, there are some promising initiatives set out to make the information more readily accessible, such as the digitalization program Xalgo4Trade here in Canada, which is an open-source initiative for the "internet of rules" (Atkinson 2018).

A QR code sticker can also make more information about a product accessible, thus making it easier for producers to profile themselves to consumers and stand out from the competition. The French supermarket Carrefour has initiated a project in which all information on its house brand of chicken will be available via a QR code sticker on the container. In an effort to make the process totally transparent, the blockchain is set up so that every actor in the supply chain (breeder, processor, butcher, etc.) enters their own information independently on the blockchain. Since the data are decentralized, Carrefour cannot intervene in the flow of information. In just a few seconds with the help of a smartphone, a consumer can see whether a particular animal has received antibiotics and what it has been fed. Initiatives such as this will help consumers make more informed choices and empower producers who wish to compete by means other than price.

Supply chain scandals mean consumers are increasingly demanding to know more about the provenance of the things they buy (Francisco and Swanson 2018). Some of these recent scandals included the horsemeat found in Findus' lasagne, or the fact that manufacturing for Zara, Walmart and Sears took place in Bangladesh factories that workers later burned down. In the longer run, this will empower smaller or more diverse firms to enter the market and give consumers more variety to choose from with regard to ethical considerations, environmental impacts, etc.

Blockchain also works very well to support the underlying characteristics of modern trade agreements

Blockchain technology is particularly suited for the criteria of modern, progressive trade policy. Traditionally, trade negotiations focused on lowering tariff barriers. Newer types of trade agreements not only focus on non-tariff barriers to trade such as regulatory issues, but also include more qualitative aims. Forward-looking trade agreements (such as CETA, applied on

Sept. 21, 2017), also aim to take responsibility for value-based trade, with language on transparency, accountability, sustainability, human rights, labour rights and so on.

> *"Progressive trade means doing everything possible to ensure that all segments of society, both in Canada and abroad, can take advantage of the economic opportunities flowing from trade and investment – with a particular focus on women, Indigenous peoples, youth, and small and medium-sized businesses"*
>
> The Hon. François-Philippe Champagne, Minister of International Trade[9]

Blockchain makes it easier to monitor and trace to what extent both the product and the production process adhere to the progressive values set out in the agreement. Instead of the information being held as a certificate with the individual actor along the supply chain, it can be made accessible through the product itself with the QR code on, say, a sticker on a fruit.

BLOCKCHAIN AND POLICY GOING FORWARD

The vision of how far along blockchain has come differs widely, depending on whom you ask and what measure you use to determine progress. In the past two years, much effort and resources have been directed to advancing the use of blockchain. Key inception points have been identified and pilot projects have been successfully deployed to the trade chain. In medical terms, we're at the point where you could confidently say that the lab results are looking good. Perhaps even more importantly, these efforts have also clarified which user cases do not stand to benefit from blockchain.[10] As often happens with technological advancements, expectations tend to gather at the extremes, divided between hype (e.g., the solution to frictionless EU-U.K. trade post-Brexit[11]) and hostility (the most over-hyped and least useful technology in human history (Roubini 2018)). Figuring out where blockchain can and should be applied is a valuable part of advancing the adoption and development of the technology.

To continue the medical metaphor, the next step for developers would be to use blockchain on a larger scale of patients and assess the effects in a clinical trial. The following step will be to assess the pressure points and see how it works within a more diverse ecosystem. To reach the next level of development, blockchain will need to evolve with regard to both supply (e.g., user friendliness) and demand, (willingness to adopt the technology). There is much talk about the interoperability needed to really get the technology off the ground; developers must figure out how to get it to scale up and work across different platforms, industries and borders. Independent initiatives such as the Blockchain Interoperability Alliance (BIA)[12] and the International Organization for Standardization (ISO)[13] are important venues for discussing and developing such co-operation.

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9 Speech made July 7, 2017, at the release of Canada's State of Play: Trade and Investment Update, 2017 report. http://www.international.gc.ca/economist-economiste/performance/state-point/state_2017_point/index.aspx?lang=eng

10 Gartner predicted that 90 per cent of enterprise blockchain projects launched in 2015 would fail within 18 to 24 months (Panetta 2017). Misunderstanding blockchain or ignoring its purpose ranked number one on their list of top 10 mistakes in enterprise blockchain projects.

11 As argued by British Chancellor Philip Hammond, *The Irish Times,* Oct. 1, 2018. https://www.irishtimes.com/news/world/europe/hammond-technology-may-be-solution-to-frictionless-border-trade-1.3647599

12 https://icon.foundation/contents/icon/bia?lang=en

13 The ISO is working on developing 10 standards for blockchain and distributed ledger technologies, covering issues such as taxonomy and ontology, architecture, privacy and personally identifiable information. https://www.iso.org/committee/6266604/x/catalogue/p/0/u/1/w/0/d/0

A crucial point for policy-makers is to get regulation to work across other issues that are fundamental to executing the blockchain process. While some issues, such as e-signatures, are being recognized and dealt with on a policy level, they have yet to be fully implemented in practice. Pilot programs (such as the Swedish initiative to put land ownership on block chain) EU Blockchain Observatory and Forum 2018a), which cannot go live because "a contract to sell property in Sweden needs by law to be on paper" highlights the importance of thinking and working on the broader issues involved with updating the new technology and realizing its potential.

WHAT CAN/SHOULD POLICY-MAKERS DO?

Since the technological process so far has been taking place in the private, rather than the public, arena it would be easy to conclude there is not much of a specific to-do list for policy-makers. As with the advent of containerization, blockchain is a private-sector development that poses huge implications for trade. In terms of its nature, however, blockchain is much more similar to the internet, as a global resource technology which crucially depends on the engagement of all stakeholders to reach its full potential. The issues the technology needs to solve to reach the next level of development, such as scaling up, interoperability and adoption, could all benefit from public support and input.

A careful eye should be cast on the need for regulating the application and how blockchain works with other types of regulations

Blockchain is a global resource, an underlying infrastructure on which endless applications can be built. Blockchain per se doesn't need to be regulated and the technology's universal reach suggests that governance should be confined neither to national borders nor to certain sectors of society. Rather, blockchain should be governed the way the internet is governed –through global governance networks based on a multi-stakeholder approach.

We cannot leave governance of such complex global innovations solely either to governments or to the private sector: political and commercial interests have proven insufficient to ensure that this new resource serves society. Rather, and more than ever, we need multi-stakeholders to collaborate as equals and provide global leadership. We need all three pillars of modern civilization – the private sector, the public sector and civil society – to participate in stewardship of this new global resource (Tapscott and Tapscott 2018).

Nevertheless, policy-makers need to keep an eye on whether and how to regulate the applications of this technology. This was made apparent by the risks of the rapid, unregulated expansion of crypto assets and the reported incidents of thefts, hacking and scams. The regulatory afterthought has given rise to divergent regulatory approaches across the globe. On one end of the spectrum, Estonia has introduced digital citizenship on blockchain, while on the other end, Algeria has moved toward a total ban on cryptocurrencies. Across the U.S., state regulations vary. For example, Arizona wants to pass legislation regarding citizens paying their tax bills in bitcoin, and New York requires a bit-licence to conduct virtual currency business activity. [14] Meanwhile, China has extended the Great Firewall to include cryptocurrencies, banning some cryptocurrency-focused accounts from chat as well as initial coin offerings (ICOs)[15] and has restricted cryptocurrency transactions. In an

[14] https://www.dfs.ny.gov/legal/regulations/adoptions/dfsp200t.pdf

[15] https://www.loc.gov/law/help/cryptocurrency/china.php

effort to keep track of the regulatory issues surrounding blockchains and digital cash, Bitlegal.io was recently set up.

Regulating an emerging technology is complicated, because of timing and the level of regulation to apply. Too much regulation risks stifling development, and too little risks inhibiting the willingness to adopt. Like the fairy tale of Goldilocks and the three bears, this is about getting things just right.

Moreover, since technological development outpaces policy-making, proposed regulation might be coming in too late, spurring policy-makers to try to retrofit the new adaptations to the new regulation as it is developed. Learning from the implementation of the internet, many countries have opted for the less-is-more approach, which early research demonstrates to be beneficial.

"The smart regulatory hands-off approach adopted in the EU and the U.S. to a large extent bodes well for future innovative contributions of blockchains in the financial services and related sectors and toward enhanced financial inclusiveness" (Yeoh 2017). Trying to strike the right balance, while learning and minimizing the risks, some governments have turned to the use of regulatory sandboxes in which, for a limited time, authorized businesses can test their products and services in the real market on a trial basis, while keeping communication open among developers, regulators and firms. Recently, the British Financial Conduct Authority (FCA) concluded a new version of its sandbox experiment to promote competition in the interest of consumers, tying together regulators worldwide with firms operating in financial services.[16]

As the technology makes its way into more diverse systems, it is imperative to ensure that it is interoperable with current national regulations. The authors of the EU Parliament (2017a) refer to this as "anticipatory policy-making", which implies comparing and contrasting the use and effect of blockchain to the current regulations. Their report (EU Parliament 2017b) points out that the European directive on non-financial reporting could have consequences for blockchain applications for supply chains, and needs to be examined.

In the case of international trade, it is not merely important that the technology be interoperable across different types of blockchains and national regulations. For the chain to work from farm to fork, the incorporated systems also need to be cohesive with regulations across all the countries the product passes through. Thus, there must be international collaboration on the regulations currently in place or planned for and how they may impact the changes blockchain will create in international supply chains. In this regard, some initiatives are up and running. Established in May 2017, the ISO has a technical committee for developing standards for blockchain and distributed ledger technologies. The committee is working on developing 10 ISO standards[17] covering crucial issues such as terminology, security, interoperability, governance and smart contracts. The Standards Council of Canada is one of the 37 participating members.

Recommendations for Canadian Policy-Makers

The role of policy-makers at this point should be to focus on understanding the technology, its workings in the economy and in trade – where there are economic potential benefits – and to the extent possible, engage and enable co-operation. Moreover, the focus should be on anticipatory policy-making. Endorsing the technology from a government position, as the EU has, lends legitimacy to projects and sheds light on possibilities, opening the eyes of the public, SMEs,

[16] https://www.fca.org.uk/news/press-releases/fca-reveals-fourth-round-successful-firms-its-regulatory-sandbox

[17] https://www.iso.org/committee/6266604.html

educators and students. Canadian policy-makers looking to support the development of blockchain and its economic effects should educate themselves and the public on what blockchain is, and perhaps even more importantly, on what it is not.

Despite the hype around cryptocurrencies like bitcoin and Ethereum, the interest and knowledge around blockchain are quite limited. A first task for policy-makers would be to gather and provide a basic understanding of what blockchain is. As frequently voiced in my interviews with the blockchain industry, and summarized in the blog by Palfreyman (2017), explaining blockchain is often still at the level of describing what it is not (bitcoin mostly, but also not a distributed database replacement). Having a basic understanding of the technology, what its novelty entails and what issues could be solved or improved, as well as how all these things are connected, would be a very useful foundation for policy-makers. Beyond that, they should aspire to build some deeper in-house expertise to monitor the broader goings-on and the issues that might need attention. As Urban and Pineda (2018) suggest, this would also decrease the reliance on outside consultants.

There is currently a shortage of academic resources devoted to blockchain. First, this is a constraint on the development of blockchain for industry. Despite much collaboration, silofication still plagues the industry, something at which the Massachusetts Institute of Technology (MIT) has taken aim. "MIT and the academic layer can be a place where we can do assessments, do research and be able to talk about things like scalability without any bias or special interests," says Joichi Ito, director of the MIT Media Lab.[18] Along the same lines, Stanford University has recently opened a Center for Blockchain Research. From the industry side, Ripple has set up a $50 million fund for its University Blockchain Research Initiative (UBRI), partnering with 17 academic institutions globally,[19] seeking to collaborate on R&D, creating curriculums and stimulating ideas and dialogue. The University of Waterloo represents Canada in this partnership. Although the bigger, more prestigious (mostly American) universities are starting to cater to student demands and offering courses on blockchain, the shortage of blockchain developers is one of the biggest hindrances to the development of the technology (Luu 2018).

Second, the shortage of academic resources devoted to blockchain is creating a shortage of information for policy-makers. Since blockchain is both a very recent development and poised to affect many aspects of society, it is imperative to get a broad understanding from a wide range of sciences on the effects and expectations, which requires a much bigger commitment and co-operation with academia. For Canadian policy-makers in trade specifically, it is important to gain insight into blockchain's effects on trade. There must be impact assessments on blockchain similar to the work that Brynjolfson et al. (2018) did in their paper, estimating the effect AI has had on translation of e-commerce platforms and the resulting effects on transactions and trade.

-Explore the technology and learn what it can and (cannot/should not do); try it out on one's own projects.

The large number of failed projects is an important part of the learning process for blockchain developers. However, the learning-by-doing approach is an equally important part of the process for users and policy-makers. Engaging in public-sector projects incorporating blockchain is an essential part of understanding its workings, potential and limitations. This will provide a natural way to collaborate with other parts of the ecosystem, such as developers and other stakeholders, so that they can work together on anticipating, mitigating and learning from mistakes.

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18 Tapscott and Tapscott (2018).

19 https://ripple.com/insights/ripple-introduces-the-university-blockchain-research-initiative/

Co-operating with local suppliers is also good for business. In their report, Urban and Pineda (2018) point out that one of the most commonly voiced complaints from Canadian blockchain entrepreneurs is the lack of large institutional reference customers like government, which are needed for procuring larger scale projects.

-Engage on a wide range across the ecosystem, get involved in the setup of a multi-stakeholder blockchain governance; communicate in a wider sphere, across and within sectors, locally and globally.

An important lesson from internet governance is that a multi-stakeholder approach is imperative to making the most of a technological platform that stands to fundamentally change how society operates. The internet is a public and global good that is constantly changing and evolving, and governance must mirror that. Blockchain is still a black box for most stakeholders and, therefore, a holistic and co-ordinated effort will be necessary (Kim and Kang, 2018).

While blockchain has not yet reached either that scale or scope, the underlying nature is similar and much could be gained at this stage by engaging across the ecosystem, starting with issues such as developing a common taxonomy, sharing lessons and discussing basic policy issues.

Mirroring the World Summit on the Information Society's (WSIS) (2005) definition of internet governance as *"*the development and application by governments, the private sector and civil society in their respective roles, of shared principles, norms, rules, decision-making procedures and programs that shape the evolution and the use of the internet", the governance of blockchain needs to be based on a novel approach encompassing the interests of all parties, and the public sector is an integral part of making that happen. Although blockchain is not nearly as evolved now as the internet was in 2005, it is not too early to co-operate on issues like taxonomy or on outlines for policy guides on basic principles.

This policy engagement needs to be done on a number of different levels. On the local level, it should bring industry, consumers, academia and other community members together, to learn and share on more concrete issues. Since blockchain space is not bound by national borders or regulation spheres, any policy decisions taken on a local level will impact the global ecosystem as well. Work must thus be done on the global arena through international organizations, such as via the initiatives created by the OECD and WEF.

-Consider endorsing blockchain to officially support Canada as a good breeding ground for the technology.

Policy-makers can do numerous things to empower their home field to receive blockchain investment and development. Canadian policy-makers have been forthcoming in anticipating and realizing many of these things, which have shown to be fruitful.

> "*Canada probably has one of the three biggest hubs for blockchain technology in the world. We've achieved this position by virtue of having a lot of young innovators that got into the industry three to four years ago, and also due in large part to the federal and provincial governments that have been very pragmatic in working with the industry.*"
>
> Jason Cassidy, CEO, Crypto Consultant.[20]

[20] Johne (2018).

Home to two of Ethereum's founders and several other people significant to the industry, Canada is doing well, as it is already a destination for blockchain private-sector-related investments. While the International Data Corporation (IDC) forecasts that the biggest investments will be in the U.S. and western Europe, Canada is expected to be among the top growing investors in blockchain, with an estimated annual growth rate of close to 90 per cent between 2018 and 2022 (IDC 2018).

Last spring, the EU took a more direct, policy-based approach to endorse blockchain, which might be an option for Canadian policy-makers to consider to increase growth. The EU, which has defined blockchain as "an important tool in fostering innovation and supporting the digital single market", launched the EU Blockchain Observatory and Forum in February 2018. The forum was deemed "one of the world's most comprehensive repositories of [blockchain] experience and expertise." The project's direct goal is to ensure that the EU plays a leading role in blockchain today and in the future. The project has a website where anyone can contribute to map out current blockchain developments in the EU and engage in discussions on how best to foster innovation.

In addition, the European Commission launched an allocation of €380 million worth of investments to be used for blockchain development by 2020. The Observatory and Forum declaration was followed up on April 10 with the introduction of the European Blockchain Partnership, which set out to be "a vehicle for cooperation amongst Member States to exchange experience and expertise in technical and regulatory fields and prepare for the launch of EU-wide [blockchain] applications across the Digital Single Market for the benefit of the public and private sectors."[21] By signing the declaration, member states agreed to "contribute to the creation of an enabling environment, in full compliance with EU laws and with clear governance models that will help services using [blockchain] flourish across Europe."

More practically, this initiative serves the dual purpose of making sure all willing member states are on the same page, while increasing the technology's credibility. The declaration mentions committing to officially recognize blockchain's potential to transform digital services, sharing experiences, best practices and key takeaways, and agreeing to work together to realize its potential for citizens, society and the economy.

SUMMARY/CONCLUSION

Blockchain's potential benefits dovetail nicely with the underlying process and transactions that make up the chain of international trade. By enabling a layer of trust and transparency, it stands to increase not just current levels of trade, but also firms' use of the current agreements, as well as to empower the objectives driving modern, progressive, value-based trade policy. Blockchain has the potential to increase productivity, economic growth and jobs, as well as help consumers make informed choices among the greater variety of products that will be able to enter the market.

The combination of high potential for reforming the traditional pressure points/bottlenecks of the trade chain and updating various parts that are notoriously stuck in their ways, combined with the low investment costs, suggests that blockchain holds great potential for trade. This is particularly important for open economies relying on trade for growth, such as Canada. While much talk, investments and project developments are going on, it is still important to remember that we are in blockchain's early days. My best guess is that it will be five years before we start seeing and reaping the benefits of its wider adoption. Fully developed, blockchain will be woven into the infrastructure so we probably won't even know it is there.

[21] European Commission (2018): "Declaration on Cooperation on a European Blockchain Partnership."

Canada is well-positioned to be a significant hub for investing in and developing blockchain. There is room for policy-makers to take on a bigger role by serving as a hub for stakeholder participation and encouraging academic resources, to enable the technology's potential to be realized.

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RESOURCES FOR POLICY-MAKERS LOOKING TO LEARN MORE ABOUT/GET MORE ENGAGED IN THE TECHNOLOGY.

Blockchain Canada is a not-for-profit organization that connects entrepreneurs, researchers, regulators and the public to help make Canada a global leader in blockchain technologies.[22]

Blockchain Canada was founded on the premise that blockchains have the potential to transform many aspects of Canada's financial, social and governance systems in ways that make them more decentralized, open and equitable.

The Blockchain Association (BAC), (formerly the Bitcoin Alliance of Canada) founded in 2013 is a not-for-profit, industry-funded association working with all levels of government and other stakeholders to support employment growth and career opportunities in blockchain technology, to promote and sustain community development, and to enhance consumer safety and industry competitiveness. BAC also provides its members with a full range of services and programs including education and training, benchmarking and best practices, networking, advocacy and industry information

[22] http://blockchaincanada.org/

About the Author

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