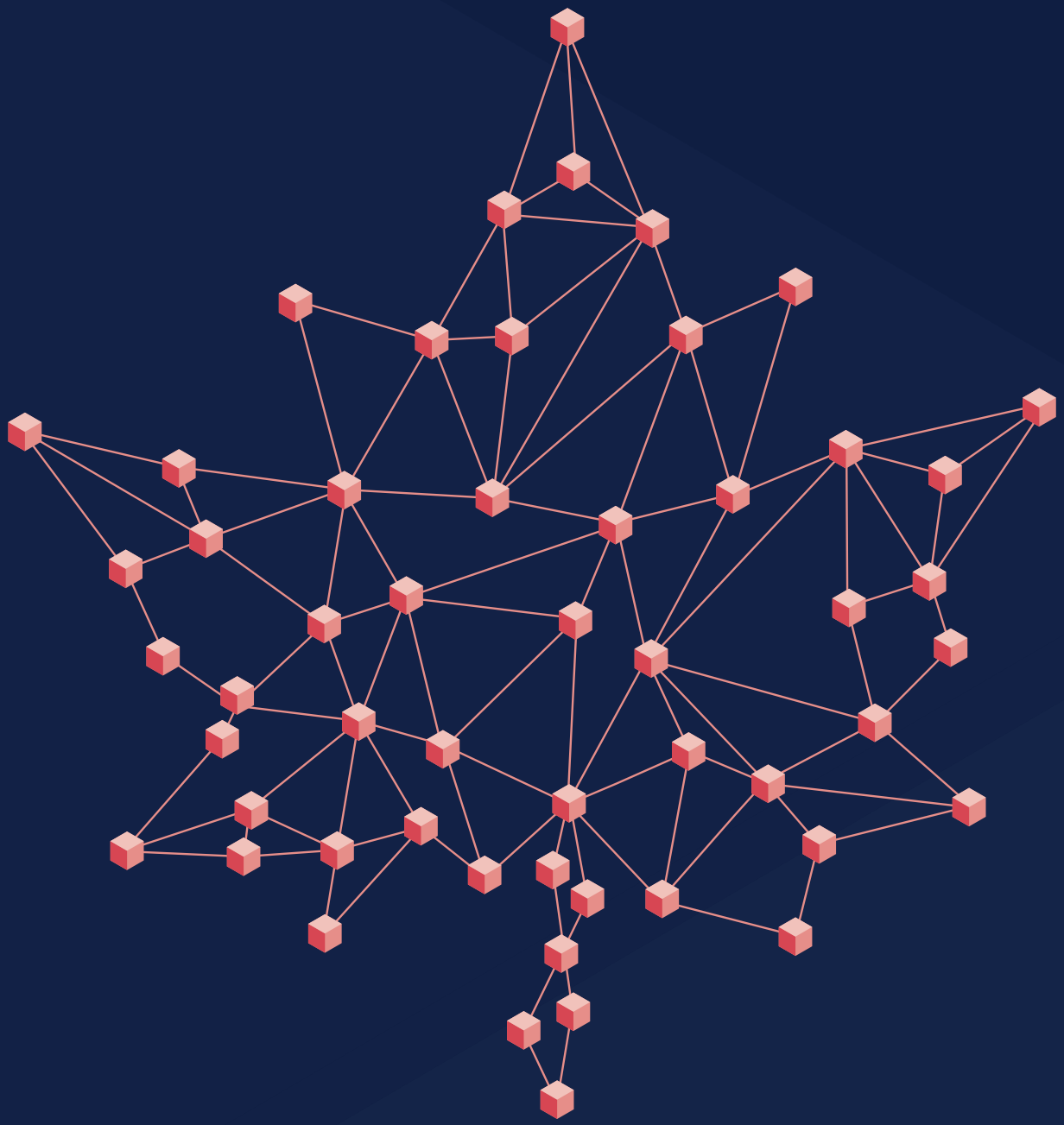
CHAIN REACTION

INVESTMENT IN CANADA'S BLOCKCHAIN ECOSYSTEM



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PREFACE

ICTC is a national centre of expertise on the digital economy. With over 25 years of experience in research and program development related to technology, ICTC has the vision of strengthening Canada's digital advantage in the global economy. Through forward-looking research, evidence-based policy advice, and creative capacity-building programs, ICTC fosters innovative and globally competitive Canadian industries, empowered by a talented and diverse workforce.

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GLOSSARY OF TERMS

Bitcoin The first decentralized cryptocurrency, introduced in 2008 by Satoshi Nakamoto, whose identity remains unknown. Transactions are administrated online, pseudo-anonymously, and are securely stored on the public ledger, blockchain. Bitcoin is the first among a growing industry of cryptocurrency and decentralized finance innovations that use blockchain technology.

Blockchain A type of distributed (decentralized) ledger, designed to record digital transactions, consisting of immutable records.

Cryptocurrency A digital asset that can be used as a unit of account, a store of value, and a unit of exchange without the need for a central bank or administrative authority. Cryptocurrencies use cryptographic functions to secure transactions, control the creation of new units, and transfer of ownership of units bypassing the need for middlemen or third parties.

Cryptographic hash function An algorithm that turns any size of data into a unique fixed-size output and therefore is impossible to invert. Transactions are secure by "fingerprinting" the data that is transacted (compressing data transmitted into a shorter bit string or "fingerprint").

Decentralized Application (DApp) A computer application that runs on a computing system that is distributed across many servers (such as Ethereum or Bitcoin).

Decentralized Finance (DeFi) Often referred to as building financial products with "money Legos", DeFi is the movement to provide financial products and services without the need for intermediaries, through DApps built on a trustless and public blockchain.

Distributed Ledger Technology (DLT) A technology facilitating a database of transactions that is hosted across a wide variety of servers and locations rather than being controlled and maintained by one centralized authority. Records are only stored once consensus has been met by parties. All files on a distributed ledger are timestamped and given cryptographic signatures and are tamper resistant.

Ethereum An open source, public or private blockchain-based platform for DApps featuring smart contract functionality. Ethereum was co-created by Canadian programmer Vitalik Buterin. Currently, Ether, the cryptocurrency generated by the Ethereum platform, is second only to Bitcoin in global market capitalization.

Foreign Direct Investment (FDI) A category of cross-border investment in which an investor resident in one economy establishes a lasting interest in, or a significant degree of influence over, an enterprise resident in another economy.

Hash Function A process that converts one value into another. Hash functions are most often used to generate a value, which can only be decoded by sourcing its value from a hash table. Cryptographic hash functions cannot be reverse engineered. Hash functions can be used for a variety of reasons including database lookups, digital signatures, etc.

Mining A process through which new blocks are added to a blockchain. When one node presents a transaction, it is reviewed by other node(s), and it waits in a pool with other transactions to be published in one "block" onto a blockchain. Mining nodes are compensated with new cryptocurrency for their time and work for validating and publishing new blocks.

Nodes People or computers participating in the blockchain are known as "nodes" operating within a peer-to-peer (P2P) or decentralized network rather than a centralized server.

Smart contract A class of object-oriented programming that executes the terms of a procedure by compiling its clauses into computer code, thereby sidestepping the need for a trusted third party to oversee it. Ethereum has the greatest volume of decentralized applications for smart contracts.

Stablecoin A digital asset with similar features to a cryptocurrency (such as cryptographic protection, P2P exchange, and use of smart contracts) that differs by being pegged to a currency with a relatively stable price (e.g., the US dollar).

Sybil or 51% attack An attack on a blockchain made possible when a group of nodes control over 50% of the voting power in a blockchain: either through creating numerous false identities ("Sybil") or by holding over 50% of the network's mining power, computing power, or hash rate.

Trustless system A system where participants do not need to know or trust each other—or a third party—for it to function properly (i.e. consensus is achieved without the need for trust between parties).

ABSTRACT

This study examines opportunities for foreign direct investment (FDI) generation and attraction in Canada in the context of blockchain. The blockchain ecosystem in Canada is investigated and compared to other key areas globally. Insights are provided by industry experts on the value of blockchain in general and across specific sectors. Industry experts also provide feedback and viewpoints about Canada as a destination for blockchain FDI, helping to identify and articulate Canada's value position for blockchain and its ability to attract investment. This study finds that blockchain is considered a field of growing interest, although it currently struggles with adoption and large-scale implementation. Canada is perceived as having a maturing blockchain ecosystem, with industry experts noting strong educational institutions and a skilled talent base as attractive features. However, key barriers include regulatory uncertainty, a relatively small tech ecosystem, faltering private or public investment, and a conservative business climate.

The COVID-19 pandemic has shifted both global priorities and investment opportunities. While this research touches briefly on the impact of COVID-19 for blockchain, the findings are limited for the time being. Further research is required to truly grasp and understand the impacts of COVID-19 on the overall economy, emerging technologies like blockchain, and Canadian opportunities for investment attraction.

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EXECUTIVE SUMMARY

An exciting and emerging technology based on the concepts of transparency and immutability, blockchain has the potential to augment many sectors by changing and optimizing processes in areas such as supply chain management, financial services, public administration, and others.

With the initial cryptocurrency (and thereby initial blockchain) hype having settled, businesses are beginning to realize the value of blockchain across various industries. Currently, some of the most common and applicable use cases of blockchain technology take advantage of the efficiency, transparency, and accountability that blockchain solutions can provide. However, existing barriers like the conflation of blockchain with cryptocurrency, difficulty accessing funding, and unclear regulatory realities exist, which prevents Canada's ecosystem from growing and scaling at speed. On the investment front, this reality poses challenges that curtail ecosystem development and could potentially lead to an "innovation drain"—both in terms of talent and startup departure—from Canada to other parts of the world.

Industry experts interviewed in this study viewed Canada favourably, recognizing it as home to several blockchain experts and a highly skilled talent base. Many alluded to Toronto as a key hub for promising blockchain organizations, and educational institutions like George Brown College were highlighted as essential in continuing to develop and grow key blockchain skills in Canada. Interviewees tend to view Canada as a favourable destination for investment generally-speaking but were lukewarm on the notion of blockchain-based investment—here, many expressed concern about conservative business culture, lagging private and public sector investment, and slow movement on the regulation front as key obstacles preventing FDI.

While these barriers exist for the time being, interviewees were optimistic about Canada's potential to overcome them. By addressing these issues and continuing to support and grow its competitive advantage in the production of skilled talent and innovative IP, Canada can eventually create a vibrant blockchain ecosystem that attracts investment from around the world.

INTRODUCTION

Record keeping has been central to human civilization for millennia. The very emergence of the first writing system seems to have been, at least in part, tied to streamlining the recording and tracking of transactions.[1] Ledgers and contracts underpin the legal, political, and economic systems that facilitate interactions between households, firms, and governments. However, the technology of record keeping has not kept pace with broader technological change. In its current state, record keeping can cause delays, waste, overcharging, corruption, fraud, and security risks that amount to billions in lost revenue. Blockchain's central promise is to resolve many of these issues.

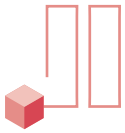
Blockchain's novel innovations and its key features of decentralization, immutability, security, transparency, auditability, and efficiency, offer a wide array of value propositions to businesses in a range of industries. The initial main use cases, at least in the enterprise setting, focus on unlocking value through waste reduction. However, blockchain technology has the potential to go far beyond these aims and reinvent whole value chains, especially when combined with other advanced technologies such as artificial intelligence (AI) and the internet of things (IoT).

ICTC's recent report *Building Canadian Consensus: Our Maturing Blockchain Ecosystem,* is a comprehensive look at Canada's blockchain ecosystem, tracing its journey from a small community of cryptocurrency enthusiasts to a promising subsector of the Canadian tech industry. Blockchain employed over 1600 professionals across the country in late 2019. *Building Canadian Consensus* offers an introduction to blockchain technology, analyzes the breakdown of the blockchain workforce by sector, type and size of company, and outlines emerging trends for Canada's maturing blockchain industry.

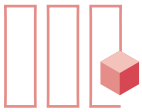
Building on ICTC's previous report by diving deeper into use cases for blockchain technology across sectors, this study assesses the relative strengths, weaknesses, and key themes tied to Canada's blockchain ecosystem in order to analyze our ability as a nation to attract blockchain-related foreign direct investment (FDI).

[1] *Tim Harford "How the world's first accountants counted on cuneiform", BBC News, June 12, 2017, https://www.bbc.com/news/business-39870485*

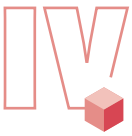
Section I provides an overview of blockchain technology and its features. Because blockchain is a novel and, in many ways, still developing technology, this overview is critical to understanding the possible value propositions, the drawbacks of the technology, and its use cases.



Section II paints a picture of the Canadian blockchain ecosystem, comparing it to notable blockchain developments in other jurisdictions such as the US and the European Union.

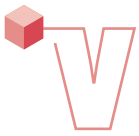


Section III presents key themes that emerged during the course of discussions with multiple blockchain industry experts across the globe. These themes cover both the use cases of blockchain as well as interviewee perceptions of Canadian blockchain.



Section IV discusses some of the current use cases of blockchain technology being trialled in seven sectors. These are advanced manufacturing, agriculture and ocean technology, business and finance, digital technology, life sciences, natural resources, and transportation and logistics.

Section V concludes by analyzing key informants' perceptions of Canada as a favourable destination for blockchain-related FDI.



A SWOT analysis, showcasing Canada's strengths, weaknesses, opportunities, and threats related to attracting blockchain FDI is also presented in **Appendix IV.** This analysis, including a combination of insights gained from key informant interviews along with other secondary research, can act as an instrument by which to assess and enhance blockchain FDI strategies.

WHAT IS BLOCKCHAIN?

A blockchain is a type of distributed ledger technology (DLT) that is continuously updated by participating users and verified by other users. It is hosted across numerous servers rather than having a single authoritative version held by a single user or data centre. All entries into a blockchain are permanently recorded—new entries may be written, including those reflecting a change to a previous record, but already-existing entries cannot be deleted.

The integrity of entries in the blockchain are maintained through three main primitives: cryptographic hash functions, digital signatures, and asymmetric encryption. Blockchain uses a particular cryptographic technique where each entry or "block" is encoded such that it points back to the previous block—this means that no old entry can be changed without compromising all the other blocks in the interlinked "chain." Using this process, blockchain is intended to be decentralized, transparent, autonomous, immutable, and, at times pseudonymous.[2] Although not necessarily intended, the output of blockchain tends to be open source. For more information on key concepts of blockchain technology, please see Appendix III.

Blockchains can be segmented into different types based on their respective permission models. A public blockchain is one where anyone can read the data on a blockchain (important information can be encrypted). It is further branched into two variants—permissionless and permissioned. A closed blockchain on the other hand requires authorization to read, write, and verify records in the blockchain. This type of blockchain is also forked into two variations. A consortium blockchain, also called a federated blockchain, is often selected by industry as it improves efficiency of communication and, with notable investments in R&D, can be scalable. The second type of closed blockchain is the private/permissioned enterprise blockchain, where only the network operator has permission to write to the blockchain or verify data, improving overall security. Figure 1 and Figure 2 provide overall summaries of blockchain types by their most common respective properties. Variations of the below are also possible: for example, while less frequent, enterprise applications can also use public blockchain networks; platforms like Ethereum can at times bounce between all four quadrants.

[2] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2020/03/canada-blockchain-ecosystem-2019-v2.pdf*

BLOCKCHAIN TYPES			READ	WRITE	COMMIT	EXAMPLE
	OPEN	PUBLIC PERMISSIONLESS	Open to anyone	Anyone	Anyone	Bitcoin Ethereum
		PUBLIC PERMISSIONED	Open to anyone	Authorized participants	All or subset of authorized participants	Supply chain ledger for retail brand viewable by public
	CLOSED	CONSORTIUM	Restricted to an authorized set of participants	Authorized participants	All or subset of authorized participants	Multiple banks operating a shared ledger
		PRIVATE PERMISSIONED ENTERPRISE	Fully private or restricted to a limited set of authorized nodes	Network operator only	Network operator only	External bank ledger shared between parent company subsidaries

Figure 1. Types of blockchain by permission model.[3]

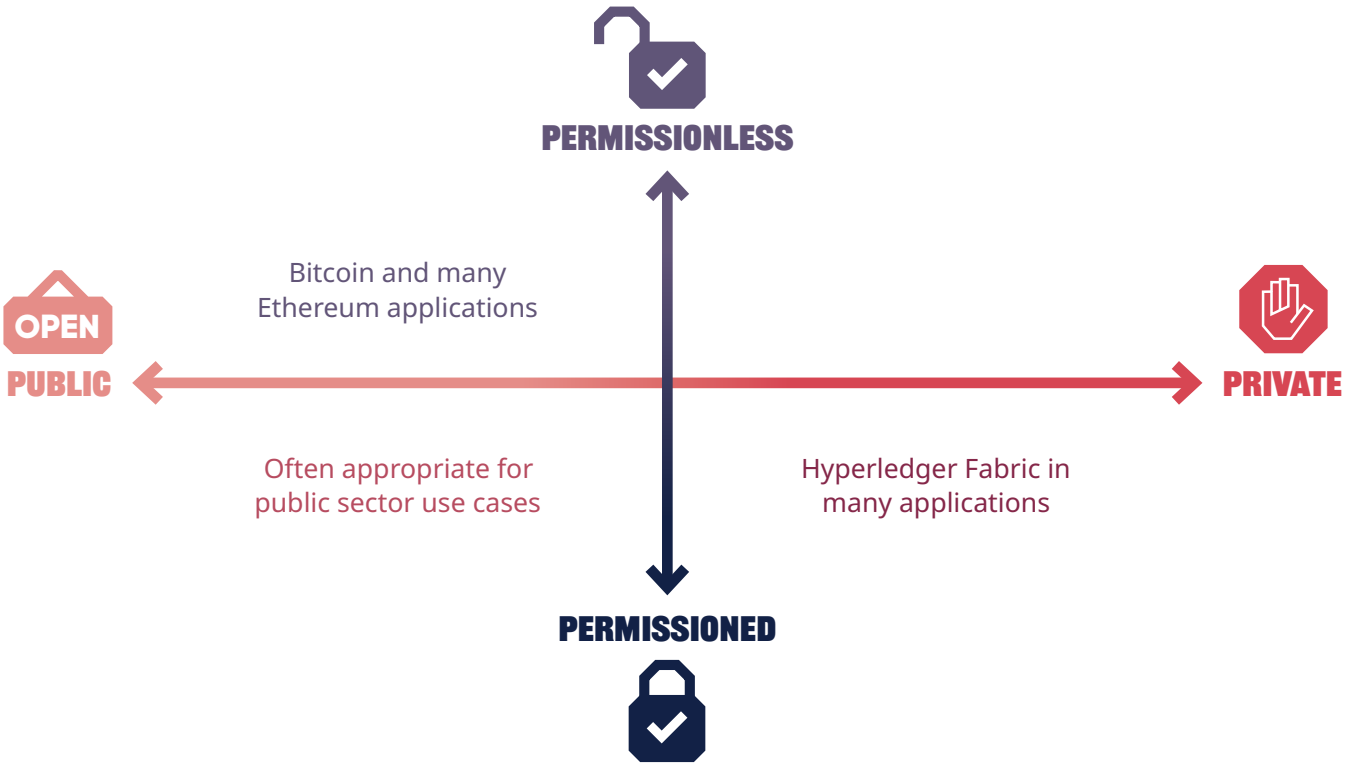


Figure 2. Permissioned and permissionless blockchains: Platforms and protocols.[4]

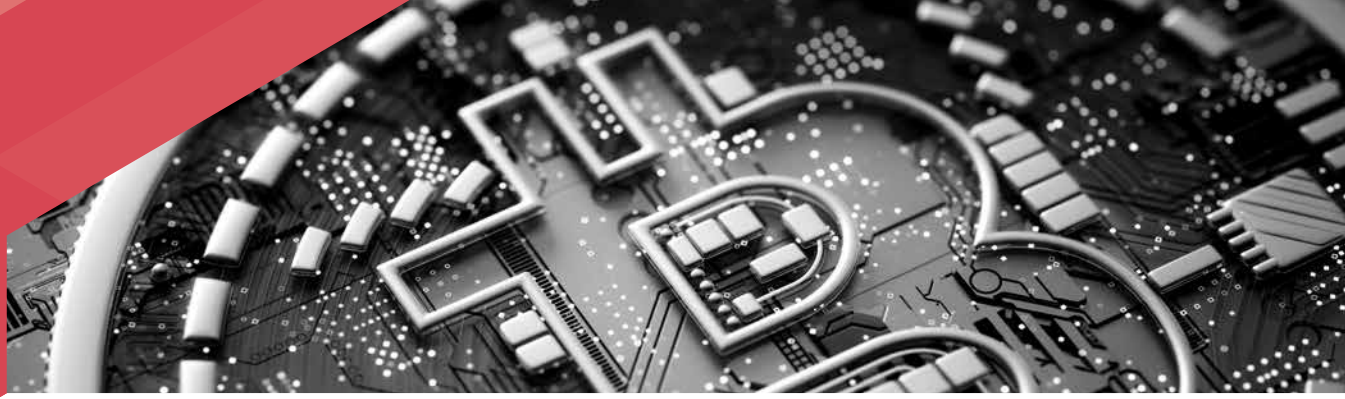
[3] *"Is there a role for blockchain in responsible supply chains", OECD, https://mneguidelines.oecd.org/Is-there-a-role-for-blockchain-in-responsible-supply-chains.pdf*

[4] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2020/03/canada-blockchain-ecosystem-2019-v2.pdf*

Centralized systems and ledgers, even those managed by intermediaries that are generally trusted by participating users, suffer from several structural problems. From the point of view of economic incentives, having monopolistic or oligopolistic access and control over large sets of valuable data creates opportunities for overcharging and corruption. From a security standpoint, centralized data systems become attractive targets for attack by hackers and can also become single points of failure causing disruption in case of a crash or outage.

A solution to these issues would be to decentralize such a dataset amongst several independent entities, each holding a redundant copy. This, however, raises new issues relating to version control and reconciliation between the various copies of the decentralized, shared ledger, and the interaction and relationship between the various users. Without central oversight, it is difficult to coordinate the actions of large groups of independent, anonymous users. Since there is no central version of the ledger managed by an overseeing authority, such a distributed network would need a mechanism to ensure that the shared ledger is not corrupted—either by honest mistakes, or by malicious actors.

The novel contribution of blockchain technology is that it solves this issue, also known as “double-spending” in the context of digital currencies; it allows for the decentralization of a shared ledger without the need for the various participants to trust each other. This is done through a distributed consensus protocol based on cryptography which allows the network to automatically decide whether to accept proposed additions to the ledger. Blockchains also have a game-theoretic incentive structure in place to ensure that nodes participate by running the computations required to maintain the shared ledger and validate new entries.



THE GLOBAL STATE OF PLAY

Canada's Blockchain Ecosystem

Canada's blockchain ecosystem has come a long way from its humble beginnings in late 2012.[5] Starting as a small gathering of crypto enthusiasts in Toronto, ICTC's *Building Canadian Consensus* found that in late 2019, Canada's blockchain workforce comprised of over 1600 professionals. Moreover, the Canadian blockchain ecosystem has survived the period commonly known as "Crypto Winter," following the dramatical fall in the price of Bitcoin, and now shows signs of maturation.

In 2019, there was notable blockchain activity across Canada, with predominant blockchain hubs located in Toronto and Vancouver. These two cities represented 65% of the country's total blockchain-identified workers at that time.

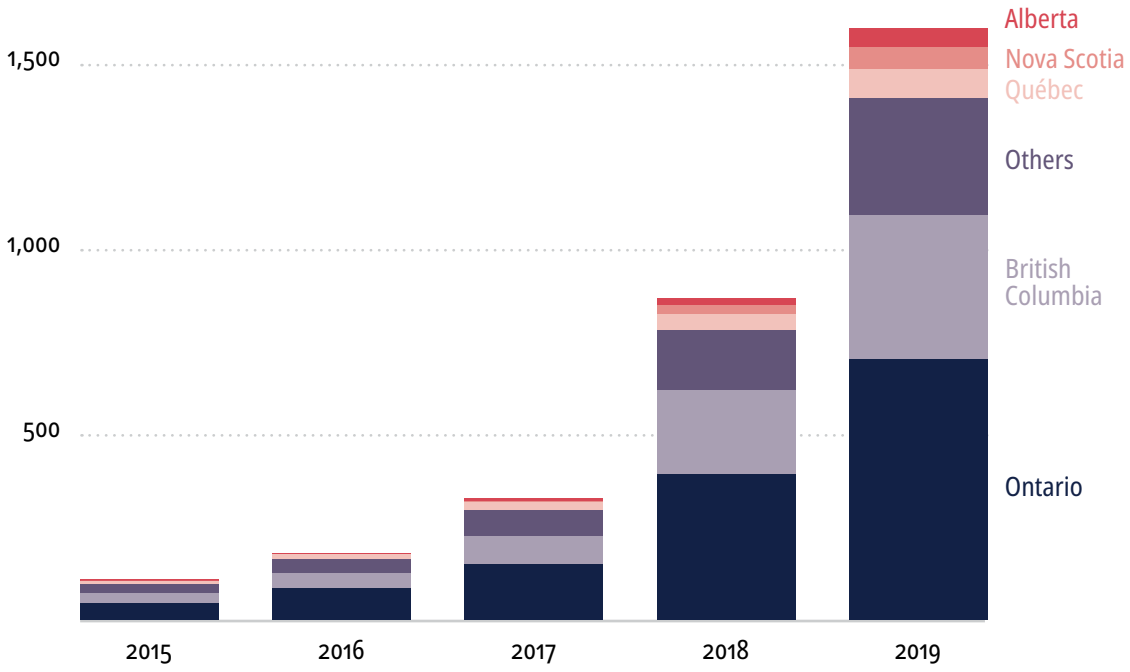


Figure 3. Blockchain workers by province in Canada.[6]

[5] *Claire Brownell, "Vitalik Buterin: The cryptocurrency prophet", Financial Post, June 27, 2017, https://business.financialpost.com/feature/the-cryptocurrency-prophet*

[6] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2019/12/canada-blockchain-ecosystem-2019.pdf*

SIGNS OF MATURITY

A look at the growth and composition of Canada's blockchain workforce over the last five years highlights two key trends. The first is the sheer increase in its size, growing almost 15-fold from 2015 to 2019. The second noteworthy trend is the shift from founders toward technical roles. From 2015 to 2019, founders have been a declining proportion of blockchain workers, falling from 23% to 14%. Meanwhile, developers have grown as a percentage of the total every year, rising from 3% to 11%. While it is unclear if or how these trends have shifted in 2020, these initial findings are suggestive of a maturing industry, where entrepreneurs are being supplemented by professionals.

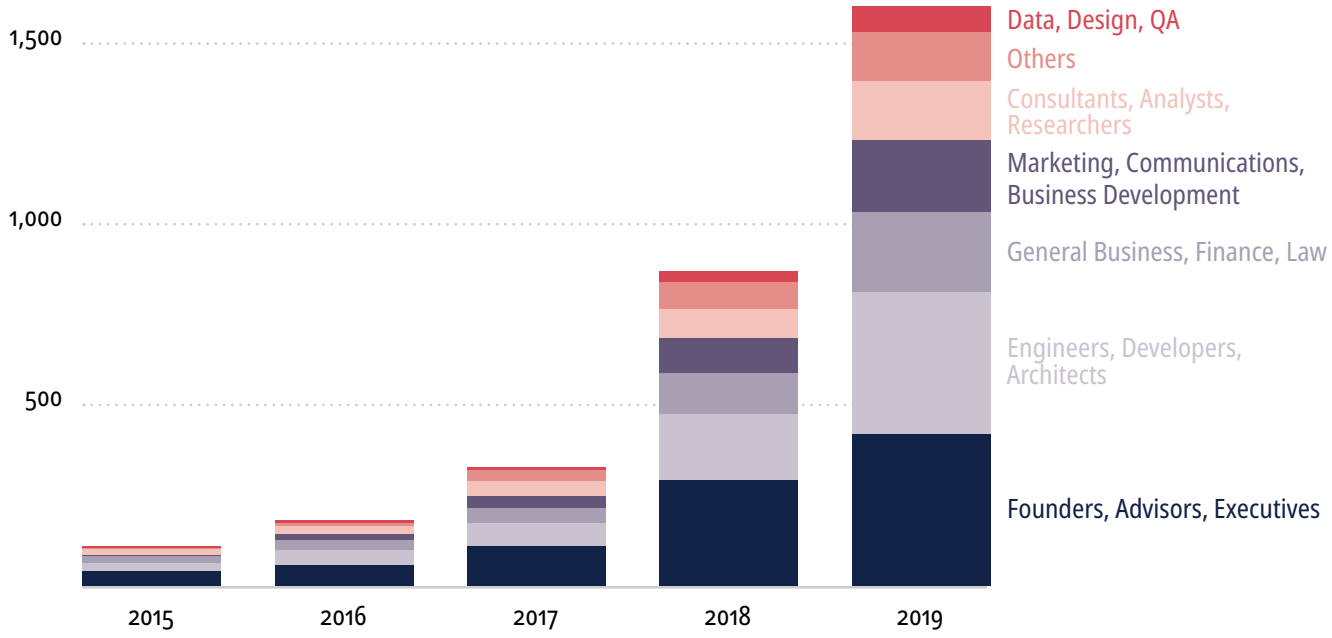


Figure 5. Types of blockchain roles in Canadian companies.[7]

Canada is home to many successful blockchain companies and research hubs. Ethereum, which was famously created in Canada, is considered one of the most important versatile blockchain platforms in the world. Ether—the cryptocurrency generated by the Ethereum platform—has surpassed $10 billion in market capitalization. Toronto leaders behind the Ethereum platform are Vitalik Buterin and Joseph Lubin. Other key figures in the Ethereum movement include Anthony Di Iorio and Gavin Wood. Alex Tapscott is the co-author of the Blockchain Revolution is another globally recognized leader in blockchain who is based in Toronto. Tapscott emphasizes the impacts of Ethereum in Canada, saying that it is not just a cryptocurrency but rather a platform that other companies can be built on.[8]

[7] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2019/12/canada-blockchain-ecosystem-2019.pdf*

[8] *"Ethereum and Canada, Why Canada Will Be A Leader Moving Forward", Ethereum Price, December 2, 2017, https://ethereumprice.ca/ethereum-and-canada/*

While Toronto was the first major hub for blockchain in Canada, 2019 saw Vancouver starting to overtake it in blockchain interest. When population differences are considered, BC is seen as a hub for diverse projects, not limited to a particular industry or platform.

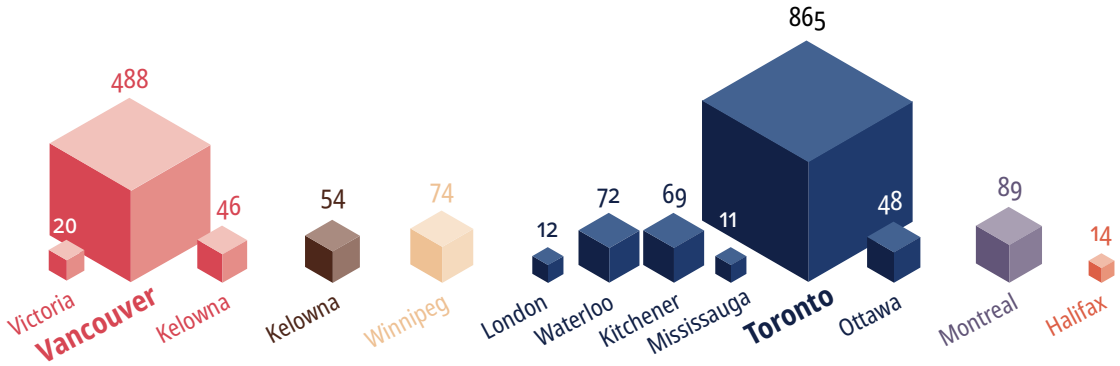


Figure 6. Number of unique blockchain job posts by Canadian city.[9]

Looking at all blockchain workers in Canada, most workers' last location of post-secondary education was in Ontario, with BC following in second place. The interest in blockchain-related work is highly shown across cities in Canada. These provinces have the highest number of blockchain startups in the country and are home to the majority of Canada's blockchain workforce.[10]

As the demand for blockchain technology is emerging, blockchain education has been woven into some curricula and education systems to help produce further skilled employees. A notable example includes George Brown College in Toronto, offering Canada's first full-time blockchain certificate, the Blockchain Development Program. It joins other international institutions in providing blockchain education covering full stack development, smart contracts, blockchain architecture, security practices, and laws and regulation.[11] York University in Toronto receives much interest from students keen on blockchain and related technology. The Blockchain Academy, part of York University's Lassonde School of Engineering, provides intensive training, creating certified blockchain professionals.[12] Similar to George Brown College, York also offers a certificate in blockchain development. As of January 2020, the University of British Columbia launched its graduate specialization in blockchain,[13] training masters and doctoral students in the blockchain field.[14]

[9] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2019/12/canada-blockchain-ecosystem-2019.pdf*
[10] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2019/12/canada-blockchain-ecosystem-2019.pdf*
[11] *"George Brown College to launch first Canadian blockchain development program, addressing urgent developer shortage", George Brown College, https://www.georgebrown.ca/releases/george-brown-college-launches-first-canadian-blockchain-development-program.aspx*
[12] *Blockchain Academy, https://theblockchainhub.com/academy*
[13] *Graduate Blockchain Training Path UBC, https://blockchain.ubc.ca/education/graduate-blockchain-training-path*
[14] *"UBC launches Canada's first graduate blockchain training path", Blockchain at UBC, June 11, 2019, https://news.ubc.ca/2019/06/11/ubc-launches-canadas-first-graduate-blockchain-training-path/*

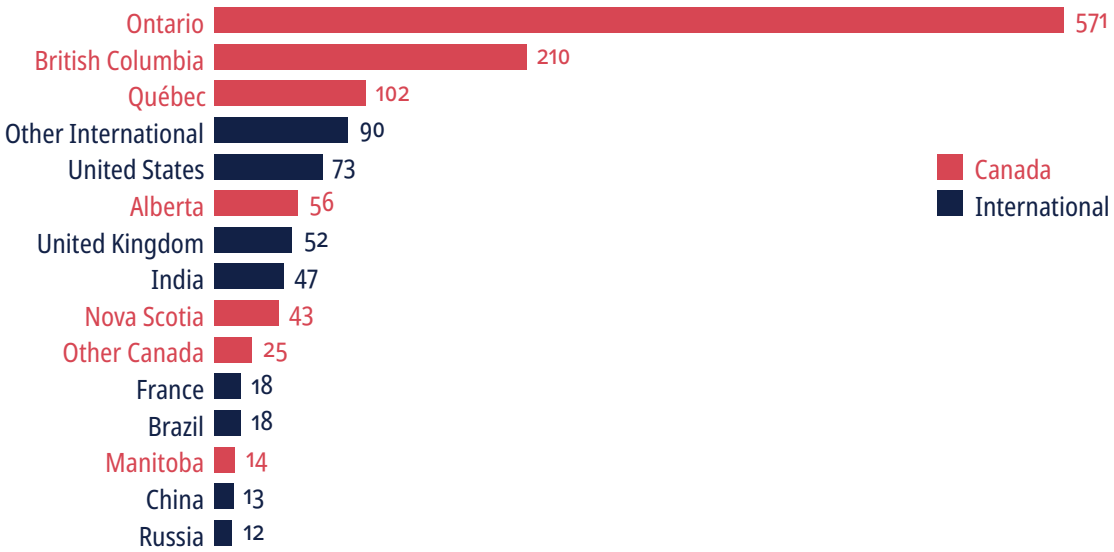


Figure 7. Last location of post-secondary study for Canadian blockchain workers.[15]

In 2018, Deloitte's global blockchain survey gathered data from over 1,000 respondents across the globe from countries including Canada, China, France, Germany, Mexico, the UK, and the US. Surveying mostly large companies with over $500 million in revenue, this research found that only 5% of businesses reported their organization having no plans for blockchain investment.[16] 39% of respondents reported that their organization will invest $5 million or more in blockchain technology.[17]

BLOCKCHAIN REGULATION IN CANADA

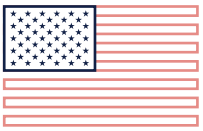
Blockchain-related policy in Canada is presently under consideration, particularly on the topic of token economy regulation. However, despite relatively slow movement to date, the Canadian Securities Administrators set blockchain as an emerging technology, part of its top priorities for 2019–2022.[18] Specifically, the Canadian Securities Administrators (CSA) is considering the growing influence of social media and innovation in distributed ledger technology, including blockchain, as well as the implications of activist short selling.[19] DLT has also been explored in Federal Agencies in Canada. The well-known Project Jasper, a collaboration between Payments Canada, the Bank of Canada, TMX Group, and Accenture, launched in March 2016, aimed to explore DLT use in settling payments, and how DLT can change future of payments in Canada.[20]

For a deeper introduction to blockchain, and a more detailed look at the blockchain landscape in Canada, please refer to ICTC's recent comprehensive blockchain report.[21]

[15] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2019/12/canada-blockchain-ecosystem-2019.pdf*
[16] *"Deloitte's 2018 global blockchain survey", Deloitte, https://www2.deloitte.com/content/dam/Deloitte/cz/Documents/financial-services/cz-2018-deloitte-global-blockchain-survey.pdf*
[17] *Ibid.*
[18] *"Canadian Securities Administrators includes blockchain and crypto-assets in Business Plan for 2019-2022", TokenPost, June 17, 2019, https://tokenpost.com/Canadian-Securities-Administrators-includes-blockchain-and-crypto-assets-in-Business-Plan-for-2019-2022-2254*
[19] *"Canadian Securities Administrators includes blockchain and crypto-assets in Business Plan for 2019-2022", TokenPost, June 17, 2019, https://tokenpost.com/Canadian-Securities-Administrators-includes-blockchain-and-crypto-assets-in-Business-Plan-for-2019-2022-2254*
[20] *Payments Canada, https://www.payments.ca/industry-info/our-research/project-jaspers*
[21] *Payments Canada, https://www.payments.ca/industry-info/our-research/project-jasper*

Notable Developments Abroad

Although blockchain has a vibrant history in Canada, some industry experts suggest that Canada may be at risk of losing its ground due to a conservative investment climate and regulatory uncertainty.[22] For comparison, the following is an overview of notable recent advancements, investments, and policy developments related to blockchain in other regions across the globe.



United States

US BLOCKCHAIN ECOSYSTEM

The US blockchain ecosystem is one the largest and most robust in the world, with over 1400 companies[23] working in the industry, and large corporate investments in pilot projects and initiatives. The major hubs centre around New York, the San Francisco Bay area, Boston and Chicago, with smaller hubs in Austin, Atlanta, Denver, Raleigh, and Seattle.[24] According to Pitchbook data, blockchain companies in the US received funding to the tune of $8.4 billion USD from 2012–19, with a peak of $3.5 billion in 2018.[25] Companies operating in the blockchain space in the US cover a wide range of business sectors including cryptocurrency exchange and trading, digital payments, analytics and data management, asset management, enterprise software development, and decentralized financial services.

THE LIBRA PROJECT

Perhaps the single biggest development in blockchain in 2019, at least from the standpoint of media and regulatory attention, was Facebook's announcement of its Libra project,[26] initially slated for a launch in 2020.[27] Facebook's white paper,[28] published in June 2019 outlined its vision to develop a "stablecoin" built on blockchain technology with a value pegged to a basket of global fiat currencies including the US dollar, the euro, and the yen, and managed by the Libra association—a not-for-profit federation of companies in the tech, financial services, venture capital, and non-profit sectors. While some championed the idea and vision of the project,[29] it has faced a slew of setbacks and some of the most significant founding members of the Libra foundation have pulled out of the project.[30] [31] US regulators and lawmakers from across the political spectrum, in a congressional hearing in October 2019, cited serious concerns with the project, including inadequate privacy and anti-money laundering provisions, the risk it posed to the global financial system and the dominance of the US dollar, as well as numerous consumer protection issues.[32]

[22] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2019/12/canada-blockchain-ecosystem-2019.pdf*
[23] *Crunchbase, "United States Blockchain Companies", https://www.crunchbase.com/hub/united-states-blockchain-companies*
[24] *Jeff Kauflin, "The Top 15 Cities For Blockchain Technology Jobs In America", Forbes, February 26, 2018, https://www.forbes.com/sites/jeffkauflin/2018/02/26/the-top-15-cities-for-blockchain-technology-jobs-in-america/#3da75af74ac5*
[25] *John Dantoni, "Mapping out the blockchain ecosystem in the United States", The Block, February 5, 2020, https://www.theblockcrypto.com/genesis/54947/mapping-out-the-blockchain-ecosystem-in-the-united-states*
[26] *Libra Project, https://libra.org/en-US/*
[27] *Robert Hackett, "Why Facebook's Libra hangs in limbo – and what's next in the digital currency race", Fortune, December 19, 2019, https://fortune.com/longform/facebook-libra-stablecoin-digital-currency-crypto/*
[28] *"An Introduction to Libra", Libra Project, https://libra.org/en-US/wp-content/uploads/sites/23/2019/06/LibraWhitePaper_en_US.pdf*
[29] *Elena Botella, "What to Salvage From the Wreckage of Libra", Slate, December 23, 2019, https://slate.com/technology/2019/12/libra-facebook-cryptocurrency-developing-countries-remittances.html*
[30] *Jeff John Roberts and Robert Hackett, "Facebook's Libra Coalition Craters, as Visa, Mastercard, eBay, and Stripe Exit the Crypto Partnership", Fortune, October 11, 2019, https://fortune.com/2019/10/11/facebook-libra-partners-quit/*
[31] *"Vodafone quits Facebook's Libra currency", BBC News, January 21, 2020, https://www.bbc.com/news/business-51200446*
[32] *Jeff John Roberts and Robert Hackett, "Facebook's Libra Coalition Craters, as Visa, Mastercard, eBay, and Stripe Exit the Crypto Partnership", Fortune, October 11, 2019, https://fortune.com/2019/07/18/facebook-libra-cryptocurrency-washington-hearings-financial-system/*

While the Libra project in its current form seems to be in a rather tenuous position,[33] it has raised important concerns about the need for US lawmakers to start addressing issues of blockchain and cryptocurrency regulation with urgency.[34]

CRYPTOCURRENCY REGULATION IN THE US

At the end of 2019, there existed 22 bills on blockchain and cryptocurrency policy that were introduced in Congress and are scheduled for discussion in 2020.[35] They focus on three main areas: regulatory clarity for companies working in this sector, preventing misuse of the technology by bad actors (terrorists, money launderers, human traffickers), and the use of blockchain technology in government. With cryptocurrency regulation, lawmakers are grappling with the tradeoff between protecting consumers and encouraging innovation in what is still a "Wild West" atmosphere. The issue of regulatory clarity appears to be the most pressing, with the concern of innovation flight to countries with a clearer, encouraging regulatory environment being raised.

GROWTH OF BLOCKCHAIN PROJECTS IN THE US

Despite regulatory uncertainty, corporate investments in blockchain continue to grow with IBM expanding pilot projects on its permissioned Hyperledger platform to industries such as finance, food, global trade, and healthcare.[36] Banks and payments companies also continued their investment in developing blockchain-based solutions in the US to reduce the costs and complexity of securities settlements[37] and international payments systems.[38] Logistics and supply chain is an another sector where the benefits of blockchain technology have been widely accepted. Key players such as FedEx[39] and DHL[40] have made notable investments in the US aimed at digitizing record keeping and invoicing processes to unlock efficiencies, reduce processing times, and increase transparency and therefore provide greater visibility into expected cashflows.

However, despite these investments, the issue of regulation when it comes to blockchain remains on the minds of US businesses and lawmakers, alike. There have been calls from key industry leaders for improved collaboration between regulators[41] and industry bodies,[42] including the development clear, international rules and standards to facilitate interoperability and mass adoption of the technology. In February 2020, the US Treasury Secretary hinted at the coming introduction of stricter regulations on digital currencies in an effort to expose nefarious activities.[43] Developments in this space remain to be seen over the coming months.

[33] *Jeff John Roberts, "Analysis: Facebook's Crypto Dreams Hang by a Thread After Zuckerberg Hearing", Fortune, October 23, 2019, https://fortune.com/2019/10/23/analysis-facebooks-crypto-dreams-hang-by-a-thread-after-zuckerberg-hearing/*

[34] *Danielle Abril, "Facebook's Digital Currency Libra Is Forcing U.S. Regulations to Grapple with Blockchain", Fortune, June 20, 2019, https://fortune.com/2019/06/20/facebook-libra-regulation-cryptocurrency-blockchain/*

[35] *Jason Brett, "Crypto Legislation 2020: Analysis Of 21 Cryptocurrency And Blockchain Bills In Congress", Forbes, December 21, 2019, https://www.forbes.com/sites/jasonbrett/2019/12/21/crypto-legislation-2020-analysis-of-21-cryptocurrency-and-blockchain-bills-in-congress/#8abeba556c1b*

[36] *IBM, https://www.ibm.com/blockchain/industries*

[37] *Anna Irrera, "Exclusive: Banks to invest around $50 million in digital cash settlement project – sources", Reuters, May 16, 2019, https://www.reuters.com/article/us-banks-blockchain-exclusive/exclusive-banks-to-invest-around-50-million-in-digital-cash-settlement-project-sources-idUSKCN1SM2U0*

[38] *J.P.Morgan, https://www.jpmorgan.com/global/news/digital-coin-payments*

[39] *"Hyperledger Continues Strong Momentum with 14 New Members", PR Newswire, September 26, 2018, https://www.prnewswire.com/news-releases/hyperledger-continues-strong-momentum-with-14-new-members-300718918.html*

[40] *Eric Johnson, "Blockchain paying off for DHL Forwarding-HPe invoice processing", JOC, November 7, 2019, https://www.joc.com/technology/blockchain-supply-chain/blockchain-paying-dhl-forwarding-hpe-invoice-processing_20191107.html*

[41] *"FedEx CIO Looks to Industry Collaboration to Scale Blockchain", The Wall Street Journal, https://www.wsj.com/articles/fedex-cio-looks-to-industry-collaboration-to-scale-blockchain-11556572820*

[42] *Marie Wieck, "2019 Saw the End of Blockchain Tourism: Marie Wieck, IBM", CoinDesk, December 20, 2019, https://www.coindesk.com/2019-saw-the-end-of-blockchain-tourism*

[43] *Selva Ozelli, "US Takes Regulatory Steps for Blockchain Technology Adoption", Cointelegraph, March 17, 2020, https://cointelegraph.com/news/us-takes-regulatory-steps-for-blockchain-technology-adoption*

China

GOVERNMENT SUPPORT FOR BLOCKCHAIN SPURS GROWTH IN PROJECTS

In October 2019, Chinese President Xi Jinping gave a speech urging China to "seize the opportunity" presented by blockchain[44] and take a "leading position" in its development.[45] This was followed by the legislature passing a national law on cryptography,[46] and has widely been seen as one of the first clear instances of a large global power backing the technology. Encouraged by this public endorsement of the technology from on high, Chinese banks, tech giants, startups, and government agencies have prioritized blockchain projects, with over 500 such projects being registered with the Chinese government since March 2019. These include use cases in trade and finance, asset management, cross-border payments and supply chain financing, communications, records management and credentials, tax collection, and consumer electronics.[47] In Canada, Chinese blockchain darling Conflux recently started operations in Toronto; its founding team consists of a computer science professor from the University of Toronto, a PhD in computer science from UC Berkeley, and a Turing Award recipient. Tech giant Baidu, often called the "Google of China", launched a public beta version of its Blockchain as a Service (BaaS) platform Xuperchain in January 2020.[48] The platform aims to allow small and medium sized businesses to cheaply launch their own custom decentralized apps. The government also launched a blockchain pilot zone on the island province of Hainan[49] with a $148 million fund to finance blockchain companies.[50]

ONE CRYPTOCURRENCY FOR ALL

While the push from the Chinese government has been to promote blockchain technology, it has simultaneously continued its crackdown on cryptocurrency exchanges[51] and opposition to cryptocurrencies and the decentralized, public blockchains that underlie them. While this approach may seem contradictory at first glance, it is in keeping with China's plans to release its Central Bank Digital Currency,[52] and its wish to maintain control over the types of digital or cryptocurrencies traded[53] analogous to its control on the spread and use of the Internet via the Great Firewall.[54] The Chinese government has been cracking down on cryptocurrencies for a few years now, placing an outright ban on initial coin offerings (ICOs) in 2017, and suspending

[44] *Arjun Kharpal, "With XI's backing, China looks to become a world leader in blockchain as US policy is absent", CNBC, December 15, 2019, https://www.cnbc.com/2019/12/16/china-looks-to-become-blockchain-world-leader-with-xi-jinping-backing.html*
[45] *"China's leaders have embraced blockchains (er, minus the decentralized bit)", MIT Technology Review, October 28, 2019, https://www.technologyreview.com/f/614639/chinas-leaders-have-embraced-blockchains-erm-minus-the-decentralized-bit/*
[46] *"China Focus: China adopts law on cryptography", Xinhua, October 26, 2019, http://www.xinhuanet.com/english/2019-10/26/c_138505655.htm*
[47] *"From Banking Giants to Tech Darlings, China Reveals Over 500 Enterprise Blockchain Projects", CoinDesk, October 28, 2019, https://www.coindesk.com/from-banking-giants-to-tech-darlings-china-reveals-over-500-enterprise-blockchain-projects*
[48] *"Baidu's "Xuperchain" launch is just the beginning of China's blockchain rush", MIT Technology Review, January 9, 2019, https://www.technologyreview.com/f/615022/baidus-xuperchain-launch-is-just-the-beginning-of-chinas-blockchain-rush/*
[49] *"China's Hainan unveils measures to foster blockchain industry", Xinhua, December 5, 2019, http://www.xinhuanet.com/english/2019-12/05/c_138605932.htm*
[50] *Naomi Xu Elegant, "China's Big Blockchain Bet Aims for an Early Advantage Over the U.S.", Fortune, December 16, 2019, https://fortune.com/2019/12/16/china-blockchain-tech-us-war/*
[51] *Zheping Huang and Olga Kharif, "China's Crackdown on Cryptocurrencies Claims First Victims", Bloomberg, November 27, 2019, https://www.bloomberg.com/news/articles/2019-11-27/all-you-need-to-know-about-china-s-latest-crypto-crackdown*
[52] *Mike Orcutt, "China may be just about to launch its digital currency in two cities", MIT Technology Review, December 10, 2019, https://www.technologyreview.com/s/614905/china-digital-currency-dcep-test/*
[53] *"How China's New Cryptocurrency Could Track Money Flows, Challenge Facebook's Libra", January 2, 2020, https://www.wsj.com/video/how-chinas-new-cryptocurrency-could-track-money-flows-challenge-facebook-libra/F9E931FF-E80F-4D3B-866E-2796003CFD58.html*
[54] *Jason Brett, "China's Dichotomy Between Cryptocurrency And Blockchain", Forbes, December 30, 2019, https://www.forbes.com/sites/jasonbrett/2020/12/30/chinas-dichotomy-between-cryptocurrency-and-blockchain/#66ae965fe45a*

trading and accounts on major crypto exchanges.[55] It has also set up a task force that has put in place policies to discourage the mining of cryptocurrencies.[56] Some experts posit that the main aim of the government's push to promote blockchain technology is to help strengthen the RMB[57] and incentivize its use as a global reserve currency.[58]

DECENTRALIZED BUT HEAVILY SURVEILLED

Chinese blockchain standards set by its internet censorship agency require any "entities or nodes" that provide "blockchain information services" to collect users' real names and national ID or telephone numbers.[59] Critics and blockchain purists argue that such centralized control goes against the very purpose of using blockchains. Nonetheless, state support for the development of centralized blockchains as a leading database technology is seen as a promising opportunity. China's push to promote blockchain technology serves as a wake-up call for other nations to outline clear policies to encourage its development and have their say in the setting of international standards, particularly those that preserve the benefits of blockchains: transparency, immutability, and resilience.

European Union

LEADER OF THE PACK IN ADOPTION AND REGULATION

With large and robust banking and supply chain industries, European companies piloted blockchain-based projects early. Spanish banks BBVA and Santander,[60] telecom operator Telefonica,[61] and Danish shipping giant Maersk[62] are some of the key European companies to have implemented projects built on blockchain and distributed ledged technology platforms.

With a reputation for regulatory foresight and leadership, the EU is also making a concerted effort to be at the forefront, at least amongst OECD countries, of policy on blockchain and cryptocurrencies. While Switzerland is a European leader for regulation on blockchain and cryptocurrencies, smaller countries such as Malta[63] and territories such as Gibraltar[64] were amongst the first in the European Union to set up regulations related to DLT and promote blockchain innovation in their jurisdictions. Malta and Gibraltar are both recognized offshore financial centres that have set notable targets for FDI attraction, including in the area of crypto and

[55] *Arjun Kharpal, "Cryptocurrencies: Regulating the new economy", CNBC, August 9, 2018, https://www.cnbc.com/2018/08/09/cryptocurrencies--regulating-the-new--economy.html*
[56] *"Regulation of Cryptoccurency: China", The Law Library of Congress, August 16, 2019, https://www.loc.gov/law/help/cryptocurrency/china.php*
[57] *"Why China Is Banning Crypto but Is Bullish on Blockchain", CoinDesk, January 8, 2020, https://www.coindesk.com/why-china-is-banning-crypto-but-is-bullish-on-blockchain*
[58] *Naomi Xu Elegant, "Why China's Digital Currency Is a 'Wake-Up Call' for the U.S.", Fortune, November 1, 2019, https://fortune.com/2019/11/01/china-digital-currency-libra-wakeup-call-us/*
[59] *"China will now officially try to extend its Great Firewall to blockchains", MIT Technology Review, January 11, 2019, https://www.technologyreview.com/f/612749/china-will-now-officially-try-to-extend-its-great-firewall-to-blockchains/*
[60] *Arjun Kharpal, "Everything you need to know about the blockchain", CNBC, June 18, 2018, https://www.cnbc.com/2018/06/18/blockchain-what-is-it-and-how-does-it-work.html*
[61] *"Telefónica and IBM Collaborate to Apply Blockchain to Streamline Telco Processes", Telefónica , November 14, 2018, https://www.telefonica.com/en/web/press-office/-/telefonica-and-ibm-collaborate-to-apply-blockchain-to-streamline-telco-processes*
[62] *"TradeLens blockchain-enabled digital shipping platform continues expansion with addition of major ocean carriers Hapag-Llyod and Ocean Network Express", Maersk, July 2, 2019, https://www.maersk.com/news/articles/2019/07/02/hapag-lloyd-and-ocean-network-express-join-tradelens*
[63] *"Malta: Government Passes Three Laws to Encourage Blockchain Technology", Library of Congress, August 31, 2018, http://www.loc.gov/law/foreign-news/article/malta-government-passes-three-laws-to-encourage-blockchain-technology/*
[64] *"Regulation of Cryptocurrency: Gibraltar", Library of Congress, August 16, 2019, https://www.loc.gov/law/help/cryptocurrency/gibraltar.php*

blockchain. Switzerland has also actively sought to make itself a hub of blockchain and cryptocurrency innovation with low tax rates, and other business friendly policies. It has created an ecosystem branded "Crypto valley" centred around the canton of Zug, near Zurich.[65] Liechtenstein's parliament, in October 2019, adopted the "Blockchain Act" as a "comprehensive regulation of the token economy" after a year-long consultation and review process.[66] Larger European economies are also in the process of passing legislation relating to the regulation of blockchain, with Germany having released its comprehensive blockchain strategy[67] at the end of 2019, and France passing legislation in April 2019[68] outlining regulation around digital assets.

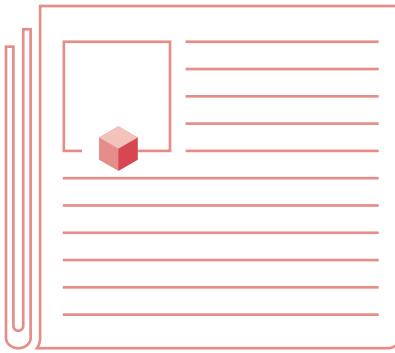
DOUBLING DOWN ON AN EU-WIDE BLOCKCHAIN STRATEGY

The European Commission organized the signing of a 30-country pact on blockchain, the European Blockchain Partnership, that will see EU-wide collaboration on regulatory and technical matters. It seeks to allocate €300 million in blockchain investment over a three-year period beginning in 2018.[69] It also set up, in February 2018, the European Blockchain Observatory & Forum,[70] a two-year project designed to provide "analysis, discussion, education, and meaningful recommendations to foster blockchain innovation in the European ecosystem."[71] In September 2019, the EU released a brochure outlining the European Blockchain Strategy,[72] highlighting €60 million to be released for blockchain-related investments in 2020 and further provisions in the 2021–27 budget.

CONTINUED COMMITMENT TO RESEARCH ON DIGITAL CURRENCIES

Finally, the European Central Bank (ECB), under the leadership of new president Christine Lagarde, is expanding its research focus on digital currencies. Lagarde emphasized that "central bank initiatives should neither discourage nor crowd out private market-led solutions for fast and efficient retail payments in the Euro area."[73] The ECB continues to conduct research along with national central banks, on the costs and benefits, feasibility, and potential side-effects of launching a central bank digital currency for the Euro area like the one being piloted by the People's Bank of China. To this end, it recently published a proof-of-concept project called EUROchain,[74] based on R3's Corda platform.[75]

[65] *Crypto Valley, https://cryptovalley.swiss/*
[66] *"Liechtenstein: Parliament Adopts Blockchain Act", Library of Congress, October 30, 2019, http://www.loc.gov/law/foreign-news/article/liechtenstein-parliament-adopts-blockchain-act/*
[67] *Ian Hall, "German blockchain strategy aims to head off 'stablecoin' currencies', Global Government Forum, October 10, 2019, https://www.globalgovernmentforum.com/german-blockchain-strategy-aims-to-head-of-stablecoin-currencies/*
[68] *"PACTE, the Action Plan for Business Growth and Transformation", Gouvernement, https://www.gouvernement.fr/en/pacte-the-action-plan-for-business-growth-and-transformation*
[69] *"Deloitte's 2018 global blockchain survey", pp 36, Deloitte, https://www2.deloitte.com/content/dam/Deloitte/cz/Documents/financial-services/cz-2018-deloitte-global-blockchain-survey.pdf,*
[70] *"EU Blockchain Observatory and Forum", European Commission, November 8, 2019, https://ec.europa.eu/digital-single-market/en/eu-blockchain-observatory-and-forum*
[71] *"Blockchain in Europe: A Case Study", ConsenSys, July 5, 2019, https://media.consensys.net/blockchain-in-europe-a-case-study-a302ecb163cc*
[72] *"European Blockchain Strategy – Brochure", European Commission, September 18, 2019, https://ec.europa.eu/digital-single-market/en/news/european-blockchain-strategy-brochure*
[73] *Kevin Helms, "EBC Wants Active Role in Crypto, Will Not Deter Private Solutions", Bitcoin, January 9, 2020, https://news.bitcoin.com/ecb-wants-active-role-in-crypto-will-not-deter-private-solutions/*
[74] *"Exploring anonymity in central bank digital currencies", European Central Bank, December 2019, https://www.ecb.europa.eu/paym/intro/publications/pdf/ecb.mipinfocus191217.en.pdf*
[75] *Robert Anzalone, "European Central Bank Announces New DLT Proof-Of-Concept Called EUROchain", Forbes, December 25, 2019, https://www.forbes.com/sites/robertanzalone/2019/12/25/european-central-bank-announces-new-dlt-proof-of-concept-called-eurochain/#19a5dbb43a76*



Recent Blockchain News

In the fast-moving world of blockchain and tech in general, new developments are continually in the headlines. The following are some of the recent major developments in the global blockchain industry.

7 February 2020

AUSTRALIA RELEASES NATIONAL BLOCKCHAIN ROADMAP[76]

The Australian Government in collaboration with academic and industry experts released a national blockchain roadmap[77] outlining short to medium-term opportunities in blockchain for government, business, and institutions. The report highlights use cases for Australian businesses and institutions, initiatives that include the development of common frameworks for blockchain education, a capability-development program for startups, and pilot projects with other countries.

11 February 2020

JOINT VENTURE LAUNCHES CANADIAN DOLLAR-PEGGED STABLECOIN FOR FINANCIAL SERVICES[78]

Canadian Stablecorp announces the issuing of a "QCAD" stablecoin intended for mass use, allowing its users to trade in other stablecoins. Canada Stablecorp is a joint venture between 3iQ and Mavennet Systems. Pegged to the Canadian dollar, the hope is that it will become the first mainstream stablecoin of this nature in Canada for general use.

4 March 2020

CONSENSYS, EY, AND MICROSOFT LAUNCH BASELINE PROTOCOL[79]

The Baseline Protocol[80] is an open-source initiative that combines advances in cryptography, messaging, and blockchain to deliver secure and private business processes at low cost via the public Ethereum Mainnet. The project aims to provide enterprise-grade data security on the public Ethereum blockchain using privacy-preserving techniques.

[76] *The Hon Karen Andrews, "Blockchain roadmap points the way to success", Australian Government, February 7, 2020, https://www.minister.industry.gov.au/ministers/karenandrews/media-releases/blockchain-roadmap-points-way-success*
[77] *"National blockchain roadmap", Australian Government, February 2020, https://www.industry.gov.au/data-and-publications/national-blockchain-roadmap*
[78] *Nikhilesh De, "A new stablecoin pegged to the Canadian dollar may help digitize the North American nation's financial markets" Coindesk, February 11, 2020, https://www.coindesk.com/joint-venture-launches-canadian-dollar-pegged-stablecoin-for-financial-services https://www.minister.industry.gov.au/ministers/karenandrews/media-releases/blockchain-roadmap-points-way-success*
[79] *"EY and ConsenSys Announce Formation of Baseline Protocol Initiative to Make Ethereum Mainnet Safe and Effective for Enterprises", ConsenSys, March 4, 2020, https://consensys.net/blog/press-release/ey-and-consensys-announce-formation-of-baseline-protocol-initiative-to-make-ethereum-mainnet-safe-and-effective-for-enterprises/*
[80] *GitHub, https://github.com/ethereum-oasis/baseline*

27 March 2020

WHO, IBM, AND MICROSOFT SET UP BLOCKCHAIN-BASED DATA HUB TO TRACK COVID-19[81]

The project MiPasa[82] is built on Hyperledger Fabric and is a collaboration between global health organizations and tech giants. It combines analytics tools and data sources to help citizens and public health officials detect COVID-19 infection hotspots.

9 April 2020

BITCOIN FUND OPENS AT TSX[83]

Canadian asset manager 3iQ Corporation successfully listed 5 million class A shares of the closed-end Bitcoin Fund[84] on the Toronto Stock Exchange at $10 a share, becoming the first listing of a cryptocurrency fund on a major global stock exchange. The exchange traded product offers investors exposure to US dollar price movements of Bitcoin.

16 April 2020

FACEBOOK UNVEILS LIBRA 2.0 WATERED DOWN IN A BID TO APPEASE REGULATORS[85]

Facebook released an update to its Libra white paper[86] outlining its revised and significantly scaled back plan to launch its digital payments platform. In the aftermath of widespread criticism from regulators, Libra's scope is now a lot more like a conventional digital payment platform, with its multi-currency stablecoin now taking a backseat to countries' digital currencies. It will now be built on a permissioned blockchain.

[81] *Gari Singh and Jonathan Levi, "MiPasa project and IBM Blockchain team on open data platform to support Covid-19 response", https://www.ibm.com/blogs/blockchain/2020/03/mipasa-project-and-ibm-blockchain-team-on-open-data-platform-to-support-covid-19-response/*
[82] *MiPasa, https://mipasa.org/*
[83] *"3iQ Receives Receipt for The Bitcoin Fund Final Prospectus", Globe NewsWire, April 2, 2020, https://www.globenewswire.com/news-release/2020/04/02/2010726/0/en/3iQ-Receives-Receipt-for-The-Bitcoin-Fund-Final-Prospectus.html*
[84] *"The Bitcoin Fund", TSX Money, https://web.tmxmoney.com/quote.php?locale=en&qm_symbol=QBTC.U*
[85] *"Facebook's Libra overhauls core parts of its digital currency vision", Financial Times, https://www.ft.com/content/23a33fcb-1342-4a18-be39-504e8507f752*
[86] *"Libra White Paper v2.0", Libra, https://libra.org/en-US/white-paper/*

Blockchain and COVID-19

The COVID-19 outbreak originated in China in late 2019 and became a global pandemic by March 2020. Currently, COVID-19 continues to spread rapidly across the world, with almost all countries reporting confirmed cases. COVID-19 has impacted every industry across the global economy. The resulting economic downturn is being called the "harshest global equity downfall since the Great Depression."[87]

Globally, researchers and businesses are coming together to develop mitigations and solutions in response to the crisis. Civitas, an app by Toronto-based startup Emerge, is relying on blockchain technology to help prevent and track the spread of COVID-19 in Latin America. Synching a user's profile with their government-issued ID on a DLT network, the app helps government officials determine whether and when an individual should be provided with a permit to leave their home.[88]

On April 17, Ubrich, an IoT blockchain-based organization, and CENTOGENE, a healthcare data firm, have joined forces to develop a solution that aims to address potential privacy issues arising from the collecting of personal data tied to the pandemic. While the collection of this data is key to tracking the spread of the virus, safely securing sensitive health data is also top of mind. Ubrich and CENTOGENE propose to store user data (test results) as "hash values" on a blockchain portal. The data can be retrieved at any time.[89]

In Canada, social distancing has highlighted the importance of digital signatures. While residents are self-isolating and social distancing, digital signatures can play a key role in helping Canadians continue to take care of critical responsibilities from home. Any document that requires notarization, such as real estate documents or auto insurance claims can be processed via secure digital signatures.[90] Canadian company Vaultie is addressing this need through a blockchain-secured and certified digital-signature platform that uses unique identifiers such as selfies, which are verified against government ID to process transactions.[91]

[87] *"5 charts that show the global economic impact of coronavirus", World Economic Forum, March 31, 2020, https://www.weforum.org/agenda/2020/03/take-five-quarter-life-crisis/*
[88] *Omar Faridi, "Toronto-based Blockchain Firm Emerge to Provide DTL-enabled App to Help Track Coronavirus-related Activities in Latin America", Crowdfund Insider, April 6, 2020, https://www.crowdfundinsider.com/2020/04/159792-toronto-based-blockchain-firm-emerge-to-provide-dlt-enabled-app-to-help-track-coronavirus-related-activities-in-latin-america/*
[89] *Marie Huillet, "New Blockchain Solution to Fight COVID-19 Complies with EU Data Privacy Regs", Cointelegraph, April 17, 2020, https://cointelegraph.com/news/new-blockchain-solution-to-fight-covid-19-complies-with-eu-data-privacy-regs*
[90] *Erin Bury, "How Covid-19 is highlighting the need for Canada to embrace digital signatures", BetaKit, March 25, 2020, https://betakit.com/how-covid-19-is-highlighting-the-need-for-canada-to-embrace-digital-signatures/*
[91] *Vaultie, https://vaultie.io/*

INDUSTRY OUTLOOK AND PERCEPTIONS

To inform this study, ICTC completed a total of 23 key informant interviews (KIIs) with global industry experts from various business sectors. Interviewees served as proxies for their organizations, providing key insights and feedback on topics such as use cases of blockchain across sectors, their views on the Canadian blockchain ecosystem, and Canada's viability for attracting blockchain-based FDI.

A large portion of the interviewees' businesses operate in all major world economies. When viewed as a whole, they have a presence in all six continents. Figure 8 highlights the geographic breadth of businesses interviewed in this study. ICTC gathered insights from companies based in more than 10 countries, worldwide. Figure 9 illustrates the organizations' key areas of business. Figure 10 provides their distribution by revenue in 2019.

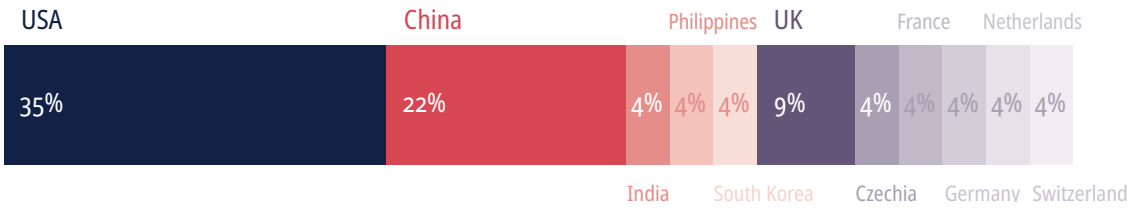


Figure 8. Interviewees: Location of global headquarters/main foreign outpost.

Figure 9. Interviewees: Self-identified industry classification.

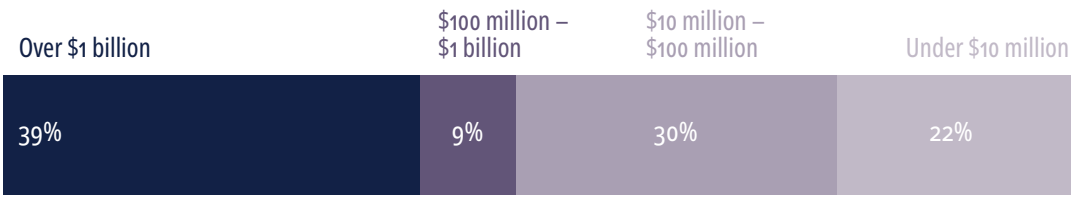


Figure 10. Interviewees: Annual Revenue in USD (2019).

Because blockchain is such a novel technology, interviewees showed varying tenures of blockchain investment, ranging from relatively new entrants to more seasoned blockchain operations. This distribution is in line with global interest in blockchain that saw a surge in 2016-17 accompanied by the boom in cryptocurrency valuations.

Figure 11. Interviewees' Tenure of blockchain investment.

The following themes highlight key ideas and topics that have been emphasized by interviewees in relation to blockchain as a technology as well as the relative attractiveness of Canada as a destination for blockchain investment.

Blockchain Is More Than Crypto

One of the most common challenges faced by over 40% of the interviewees in this study is having to overcome the common misconception held by many of their clients and the public at large: that blockchain is synonymous with Bitcoin and other cryptocurrencies. This has been compounded by several companies deliberately trying to conflate one with the other for gain during the peak of crypto mania in 2017.[92] [93]

> We find that unless the customer already comes to you requesting a blockchain solution, you go through two phases. The first phase is educating them that blockchain does not mean Bitcoin. And then the second phase is showing the value of blockchain.
>
> **— Principal, Information Technology & Software Services, South Korea**

Some interviewees also highlighted the growing use of the broader term "distributed ledger" instead of blockchain, in order to prevent confusion with cryptocurrencies.

> There is a double-edged situation associated with blockchain; it is both a challenge and an opportunity. When people say the word "blockchain," they immediately think of crypto. Some prefer to use the term "distributed ledger" so that it is not confused with crypto.
>
> **— CEO, Digital Technology/Consulting, USA**

With the spectacular bursting of the cryptocurrency price bubble in early 2018[94] coupled with other subsequent setbacks to the cryptocurrency market in Canada[95] and globally,[96] there is understandably some apprehension toward cryptocurrencies. Blockchain applications, however, go far beyond just cryptocurrencies. As the hype surrounding blockchain died down and we start to move out of the "trough of disillusionment" toward the "slope of enlightenment,"[97] there is a need for broader understanding of the blockchain value proposition—beyond just disentangling blockchain from Bitcoin and other cryptocurrencies.

[92] *Shannon Liao, "Tea, juice, and vape companies add 'blockchain' to their names to profit on bitcoin mania", The Verge, December 21, 2017, https://www.theverge.com/2017/12/21/16805598/companies-blockchain-tech-cryptocurrency-tea*
[93] *Luke Kawa, "What These Obscure Companies Were Doing Before They Pivoted to Crypto", Bloomberg, December 20, 2017, https://www.bloomberg.com/news/articles/2017-12-20/juices-bras-and-e-cigs-no-past-too-weird-for-new-crypto-firms*
[94] *"What next after cryptocurrency bubble bursts", Financial Times, https://www.ft.com/content/7ed0c3b8-a1f3-11e8-85da-eeb7a9ce36e4*
[95] *Daniel Shane, "A crypto exchange may have lost $145 million after its CEO suddenly died", CNN, February 5, 2019, https://www.cnn.com/2019/02/05/tech/quadriga-gerald-cotten-cryptocurrency/index.html*
[96] *"Exit Scams Swindled $3.1 Billion From Crypto Investors in 2019: Report", CoinDesk, August 12, 2019, https://www.coindesk.com/exit-scams-swindled-3-1-billion-from-crypto-investors-in-2019-report*
[97] *Meghan Rimol Gartner and Laurence Goasduff, "Garner 2019 Hype Cycle Shows Most Blockchain Technologies Are Still Five to 10 Years Away From Transformational Impact", Gartner, October 8, 2019, https://www.gartner.com/en/newsroom/press-releases/2019-10-08-gartner-2019-hype-cycle-shows-most-blockchain-technologies-are-still-five-to-10-years-away-from-transformational-impact*

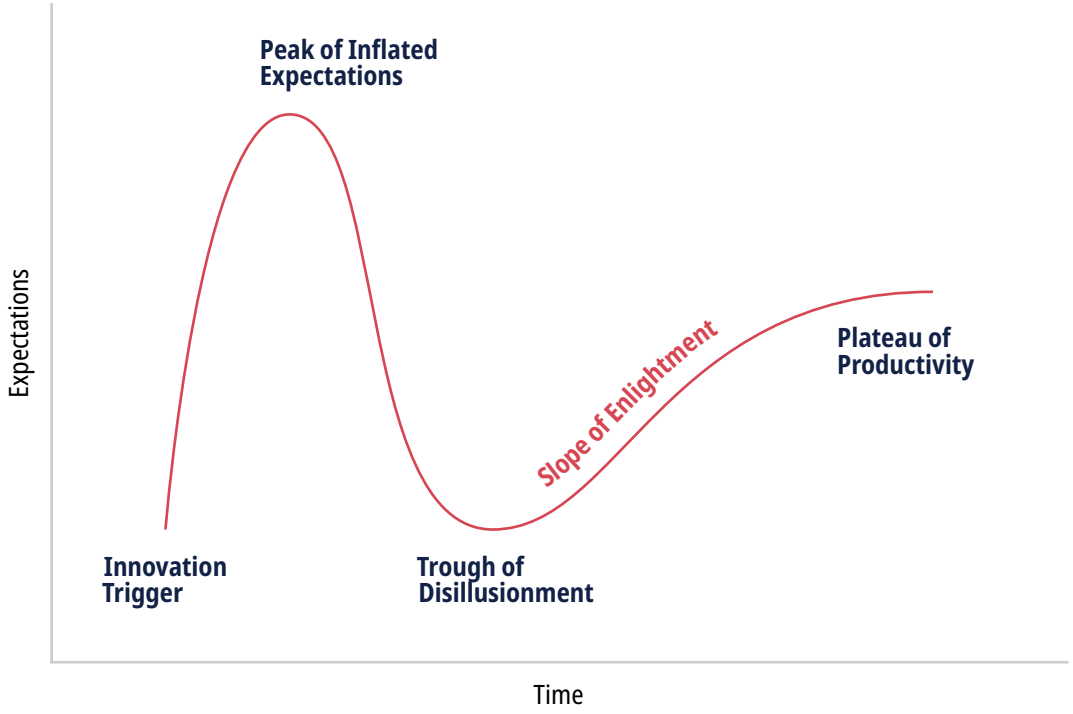


Figure 12. Gartner Hype Cycle.[98]

Some interviewees further emphasized that the widespread mistrust of cryptocurrencies, and blockchain by association, is a key obstacle for broader adoption of the technology because it keeps businesses and the public from appreciating its unique properties and value propositions.

> People don't [always] understand that there are other uses for blockchain. They affiliate blockchain to crypto. If they could understand blockchain is the only data structure that can accommodate networking as well as computing, it will solve a lot of problems. There is no other data structure that does this. If there was one, I would have used it.
>
> **— CTO, Internet of Things: Hardware/Software, USA**

> We have challenges getting the market to recognize our new approach; most people are still confused about the technology and the associated new models.
>
> **— Founder, Digital Technology/Consulting, China**

[98] *"Gartner Hype Cycle", Gartner, https://www.gartner.com/en/research/methodologies/gartner-hype-cycle*

Key Value Drivers: Hopes for Efficiency, Transparency, Auditability

The most immediate promise of blockchain-based solutions—at least as identified by interviewees in this study for the enterprise setting—was the reduction of overhead costs through an increase in efficiency, transparency, and auditability.

Digitizing transaction records on shared, distributed ledgers and tokenizing asset ownership can allow for faster transactions[99] and reduced interest costs[100] while simultaneously reducing the potential for fraud and money laundering. Efficiencies generated by digitizing and consolidating identification records can lead to lower customer service call times and higher throughput in call centres for example, leading to reduced overhead costs. Another example of blockchain's value proposition lies in its tamper-evident nature. This promises to prevent financial and reputational losses due to waste, fraud, and black/grey market activities in the supply chains of pharmaceuticals, electronics, automobiles, food, and a host of other consumer goods.

Finally, some interviewees also noted that a distributed network of data and greater visibility along value chains would allow for new and improved product and service offerings; this was especially highlighted in conjunction with other advanced technologies, such as artificial intelligence (AI) and internet of things (IoT) sensors.

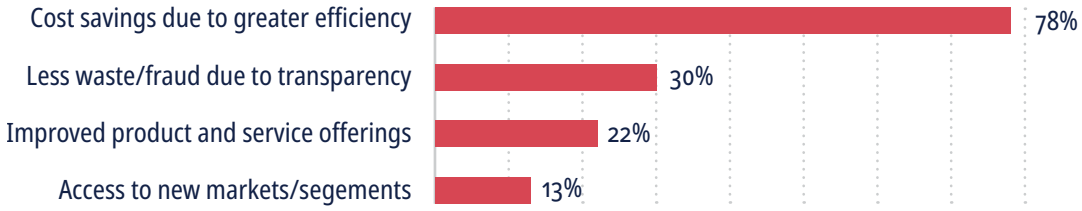


Figure 13. Key value propositions for blockchain use according to interviewees.

[99] *"Blockchain in Finance: Project i2i: Blockchain Case Study for Payments in the Philippines" Consensys, https://consensys.net/blockchain-use-cases/finance/project-i2i/*
[100] *"Jasper Phase III Securities Settlement Using Distributed Ledger Technology", October 2018, https://www.payments.ca/sites/default/files/jasper_phase_iii_whitepaper_final_0.pdf*

Table 3. Interviewees' Blockchain use cases

Finance	Supply Chain Management	Others
Cross-border transfers	Chain of custody & provenance	Blockchain as a service
Digital assets / tokenization	Oil & gas flow tracking	Copyright protection
Loan participation & syndication	Pharma supply chain management	Digital identity & credentials
Loyalty rewards	Warranty management	Medical records & clinical trial data
Mobile payments		Tamper-proof monitoring of hardware
Securities settlement		
Trade financing		

> Blockchain technology's core proposition is to create trust, transparency, auditability, patient empowerment… supply chain management, [and] clinical trials. For example, process automation in a trusted environment will improve quality, patient safety, and reduce costs. This is where I believe blockchain technology may help patients and the pharma industry along with the entire ecosystem, including regulators, insurers, hospital networks.
>
> **— VP, Life Sciences, Germany**

Co-opetition: Getting Competitors to Work in Consortia

Pioneers and purists envision blockchain in its public, permissionless form as delegating the notion of trust away from corruptible institutions to a peer-to-peer network secured with cryptography. Since this network would be built through incentive-compatible participation and consensus, it would obviate the need for institutions, central authority, and intermediation. However, the current Proof of Work (PoW) consensus protocol involves critical hurdles in unreasonably high costs for scaling, energy consumption,[101] transaction costs, and latency.[102] There is even a valid critique illustrating an inherent limit to the economic value a PoW-based public blockchain before its incentive structure breaks down and it becomes an attractive target for a 51% attack.[103]

To sidestep these issues of scalability and to allow for tighter control on data in the blockchain, the most common enterprise use cases currently are in private and permissioned blockchain. Even in these closed networks though, true economies of scale and value are only expected when multiple competitors in an industry or sector

[101] *Peter Fairley, "Ethereum Plans to Cut Its Absurd Energy Consumption by 99 Percent", IEEE Spectrum, January 2, 2019, https://spectrum.ieee.org/computing/networks/ethereum-plans-to-cut-its-absurd-energy-consumption-by-99-percent*
[102] *Jonathan Chiu and Thorsten V. Koeppl, "Incentive Compatibility on the Blockchain", Bank of Canada, July 2018, https://www.bankofcanada.ca/wp-content/uploads/2018/07/swp2018-34.pdf*
[103] *Eric Budish, "The Economic Limits of Bitcoin and the Blockchain", Federal Reserve Bank of Atlanta, June 5, 2018, https://www.frbatlanta.org/-/media/documents/news/conferences/2019/0519-financial-markets-conference/papers/budish_research-session-one_economic-limits-bitcoin-blockchain.pdf*

come together in a consortium and build a non-competitive technology layer. Nearly 45% of interviewees raised this issue, noting that co-opetition is a tricky dynamic to initiate and coordinate.

This challenge is echoed in a 2019 study conducted by the University of Cambridge;[104] it found that out of 67 live enterprise blockchain networks surveyed worldwide, only 22% were consortium-led—developed by numerous entities working together cooperatively. The others were either managed by a single dominant market player, or by a government-led initiative.

Blockchains work best when you have a consortium of players working together to achieve the blockchain objective. And I think one of the biggest challenges is getting people together or getting companies together to work on one use case.

— Innovation Lead, Financial Services, USA

Blockchain is a "WE technology"— a collaborative technology which only works when multiple parties work together with a common goal and purpose that they work toward. It can be [that they work] competitively, but it is collaborative. Other technologies are "I technologies," so all the centralized systems, whether it's an ERP or CRM system or even a social media network, those are all "I technologies." They are centralized and noncollaborative at the protocol bit. They are fundamentally different. To explore "WE technologies," we need a "WE mindset," which is difficult because we are predominately an "I society." That's really the biggest challenge to unlocking the power of blockchain.

— Innovation and Emerging Technology Lead, Digital Technology/Consulting, India

Building on the notion of blockchain as a "we technology," another interviewee highlighted this need for large-scale cooperation at an industry level. Specifically, this interviewee points to fragmented attempts at monetization as derailments to the overall goal of improving the technology and getting it ready for mass adoption.

I think that those who are still trying to monetize [blockchain], are actually slowing down the adoption. The sooner we can keep people from spending time that is essentially not productive time from trying to monetize it, [the better]. And once we can build this non-competitive layer, we can all take advantage of it. The sooner we can get to that, the sooner we can accelerate the adoption of this technology.

— Blockchain Strategist, Transportation/Logistics, USA

[104] *Michel Rauchs et al., "2nd Global Enterprise Blockchain Benchmarking Study", Cambridge Centre for Alternative Finance, 2019, https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2019-ccaf-second-global-enterprise-blockchain-report.pdf*

The Stifling Effect of Regulatory Uncertainty

Another external impediment to the scaling up of blockchain solutions from the proof-of-concept stage to production is regulatory and legal uncertainty. Over 60% of the interviewees in this study, especially those in large companies or in heavily regulated industries such as financial services and healthcare, highlighted that until larger questions of regulation were resolved, the return on investment in blockchain solutions would remain too uncertain to allow for any meaningful large-scale capital expenditure.

Since we work in a highly regulated environment, if you look at some of the classic use cases—and the most advanced is surely in pharma supply chain management—I think you will only see true benefits when the new technology is accepted by regulators so that you can fully implement it. As long as you work on pilot projects, you can identify savings; but those are "virtual savings," as you still have to maintain legacy systems and the traditional way of operating.

— VP, Life Sciences, Germany

There's still so much regulatory uncertainty in the space and regulation can turn a turn on a dime. So, it's very difficult to invest heavily into a technology that may not take the shape that you expect it to take because of regulation.

— Innovation Lead, Financial Services, USA

Other younger companies, especially those in knowledge-intensive sectors such as digital technology and consulting (with few fixed assets) also spoke about the possibility of innovation flight to countries with consistent and innovation-friendly regulations and growth incentives.

There is no difference between Canada and the US in terms of the regulatory environment. If I want to be really blunt, the money is in Singapore, Hong Kong, Shenzhen, London, maybe less so in Paris. It's in Silicon Valley, in New York. It's not in Toronto, Ottawa, or Vancouver, sadly. So, if Canada wants to be competitive, long term, it needs to give proper incentives [in terms of] regulation, tax, and financing.

— Innovation Lead, Digital Technology/Consulting, USA

The Need for Cross-Disciplinary Talent

One final, forward-looking theme that emerged from nearly 50% of interviews with experts in this study was the need for cross-disciplinary talent that is comfortable working at the intersection of technology and business. Initially, some industry experts foresaw blockchain being a foundational technology like TCP/IP,[105] one that will create whole new business models rather than just disrupting existing ones with a more efficient version. Although such large-scale changes take considerable time to come to pass, some view current blockchain solutions—like those aimed at unlocking value through cost savings and waste reduction—as relatively low hanging fruit. Uncovering new value propositions and novel revenue streams alongside reimagining entire value chains to harness the benefits of blockchain (especially when combined with other advanced technologies such as AI and IoT)[106] will take deep knowledge of both the foundational technologies and the business environment in various sectors. This kind of foundational change is ultimately dependent on multidisciplinary talent that is highly skilled on both technical and business fronts.

> We are in need of more talent that feels comfortable working at the intersection of science, healthcare and global tech. We need them to identify new use cases and other opportunities to harness the benefits of these new technologies. [We need] new, creative thinkers, refreshed minds from all kinds of backgrounds. We need IT talent to implement but also talent on the business side to identify value propositions that new tech offers and how best to leverage tech.
>
> **— VP, Life Sciences, Germany**

> Most of our partners [in the US] are boutique partners. We've gone with them because we've found it difficult to find talent that's comfortable working with blockchain and tech as well as their respective domains of expertise. By going after boutique partners, we are able to find people who are comfortable with tech/blockchain and also domains like telecom, financial services, supply chain/logistics, warranty management, etc. The talent is out there but not easy to find—especially as we need people who are comfortable with both tech and business knowledge.
>
> **— Principal, Information Technology & Software Services, South Korea**

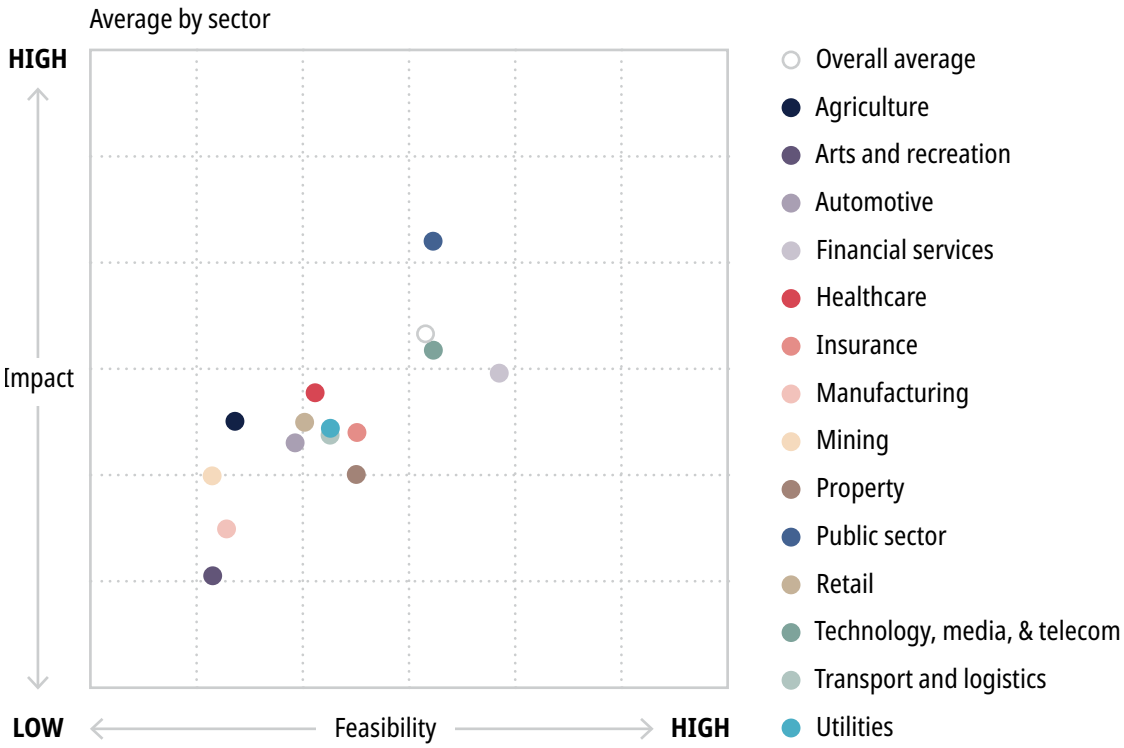
[105] *Marco Iansiti and Karim R. Lakhani, "The Truth About Blockchain", Harvard Business Review, 2017, https://hbr.org/2017/01/the-truth-about-blockchain*

[106] *"Avivah Litan, "IoT integration is a Sweet Spot for Blockchain Per Gartner Survey", Gartner, December 5, 2019, https://blogs.gartner.com/avivah-litan/2019/12/05/iot-integration-sweet-spot-blockchain-per-gartner-survey/*

IV. BLOCKCHAIN ACROSS SECTORS

Around the world, the use and implementation of blockchain has been growing. Figure 14 displays a McKinsey analysis, showing the different sectors to which blockchain can be applied, ordered by impact and feasibility. Financial services, retail, and public administration are among the highest impact and highest feasibility sectors, while the lowest impact and lowest feasibility has been identified as arts and recreation as well as manufacturing.

Figure 14. Blockchain opportunities by sector.[107]



[107] *Brent Carson et al., "Blockchain beyond the hype: What is the strategic business value?", McKinsey Digital, June 2018, https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/blockchain-beyond-the-hype-what-is-the-strategic-business-value*

Building our Canadian Consensus[108] revealed an array of blockchain use cases, identifying applications of blockchain worldwide and in Canada. Below is a snapshot of potential and existing use cases of blockchain across seven key sectors of the digital economy. These sectors include the following: advanced manufacturing, agriculture and ocean technology, business and financial services, digital technology, life sciences, natural resources, and transportation and logistics.

Advanced Manufacturing

To date, some of the biggest challenges with the implementation of blockchain are in the manufacturing sector. Although blockchain was not originally intended for use in enterprise systems,[109] the challenge with its adoption in the manufacturing space appears to lie more with the desire and ability to apply it widely. A recent Gartner survey found nearly 35% of entrepreneurs in the manufacturing sector were not interested in applying blockchain technologies.[110] The main reason for this was a concern over scalability—the challenge of widespread deployment, including across vendors (many of which do not currently work with blockchains). This was perceived as a considerable upfront investment that many were reluctant to make.

Yet, integrating blockchain into modern-day factory settings is becoming increasingly recognized as valuable. Manufacturers are trending toward mass customization and interconnected factories as part of the Industry 4.0 movement. For example, a "factory of the future" would incorporate complete data sharing with all points of its network. Unlike traditional databases, blockchain technology would be able to store the data in a tamperproof version.[111]

To pinpoint situations where blockchain is the right technology to use to support operations, a manufacturer must conduct a structured assessment, starting with identifying the company's current business problems and future needs.[112]

However, it is by no means a panacea for all challenges in industrial operations. In some cases, centralized databases like Amazon's Quantum Ledger offer much higher processing speeds and could be a better option, depending on the specific needs of a business.[113]

A further use of blockchain, particularly when combined with IoT sensors, is to effectively maintain an immutable data storage technique, which could eliminate the need for manual audit checks. Here, blockchain can help enable automated

[108] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2020/03/canada-blockchain-ecosystem-2019-v2.pdf*
[109] *Karen Haywood Queen, Brett Brune, "Eight key blockchain challenges for manufacturers to overcome", SME, January 31, 2019, https://www.sme.org/smemedia/sme-media/in-blockchain-we-trust/eight-key-blockchain-challenges-for-manufacturers-to-overcome/*
[110] *Agnus Loten, "Amid Blockchain Hype, Few Deployments, Limited Interest, Study Finds" Wall Street Journal, May 4, 2018, https://blogs.wsj.com/cio/2018/05/04/amid-blockchain-hype-few-deployments-limited-interest-survey-finds/*
[111] *Daniel Küpper et al., "Blockchain in the Factory of the Future", BCG, July 15, 2019, https://www.bcg.com/en-ca/publications/2019/blockchain-factory-future.aspx*
[112] *Ibid.*
[113] *Ibid.*

communication by facilitating a blockchain-based system to validate the integrity of the data,[114] which cannot be altered. Global manufacturing companies like Syncron are currently experimenting with blockchain as a means of improving traceability, enabling advantages such as cost savings and higher productivity. A collaboration between Bosch and Cisco Systems led to the development of an open-source standard for the integration of blockchain and IoT. This effort could help data transfer smoothly in and between blockchain systems.[115] Other industry alliances have also formed, including the Trusted IoT Alliance (not merged with the Industrial Internet Consortium) that works on developing best practices relating to IoT and blockchain and the Enterprise Ethereum Alliance whose goal is to develop open blockchain specifications that can improve global business interoperability.

Agriculture and Ocean Technology

Similar to other industries, the peer-to-peer transactions without the need of a central authority or intermediaries could have potential benefits in the agriculture sector. For example, "Smart Agriculture" incorporates various features such as IoT, sensors, machine learning—with data management being key to its establishment. While common methods to managing agricultural data can suffer from data distortion or cyber attacks, blockchain technology is able to store information and data from various points—growth, sale, distribution of produce—with the data being immutable.[116]

Blockchain can be integrated into several processes in agriculture. For example, in the area of crop and soil management, temperature, moisture, and information about pesticide and water use can be captured from IoT devices. In warehousing and distribution, food safety can be measured according to quality-control data and findings. Lastly, in retail and marketing, data on compliance and taxes can include crop and soil monitoring, warehousing and distribution, as well as retail and marketing. Relevant data can be generated, processed, and saved on the blockchain, which can help shape informative insights and decisions on the entire process.[117]

> To maintain the land as dry and wet as required, we will need a blockchain technique in combination with AI to control all 1500 pumps and sluices we have, especially with regard to energy use. Blockchain ensures the safe, un-hackable working of a system. We have also designed a method for the inspection of dykes by using blockchain.
>
> **— Blockchain Consultant, Agricultural Technology, Netherlands**

[114] *Nichole Jao, "Utilizing blockchain to bolster automation in smart factories", Tech Node, October 23, 2019, https://technode.com/2019/10/23/utilizing-blockchain-to-bolster-automation-in-smart-factories/*
[115] *Daniel Küpper et al., "Blockchain in the Factory of the Future", BCG, July 15, 2019, https://www.bcg.com/en-ca/publications/2019/blockchain-factory-future.aspx*
[116] *Hang Xiong et al., "Blockchain Technology for Agriculture: Applications and Ration", Frontiers in Blockchain, February 21, 2020, https://www.frontiersin.org/articles/10.3389/fbloc.2020.00007/full#B28*
[117] *Akash Takyar, "Blockchain in Agriculture – Improving Agricultural Techniques", LeewayHertz, https://www.leewayhertz.com/blockchain-in-agriculture/*

Blockchain poses another interesting use case in the ocean and sea food industry. It is estimated that globally, as much at 60% of sea food is discarded, lost or wasted in the supply chain process, with another 20% mislabeled and only 1% inspected for fraud. By introducing blockchain-powered traceability into the sea food supply chain, fish waste could be reduced, improving profitability. Beyond profitability, the reduction in waste of sea food is critical, as nearly 90% of global fish are overfished or fully exploited. Some existing use cases in this sector include the following:

> French company Carrefour commenced the Carrefour Quality Line (CQL) with QR-codes, allowing customers to scan the barcode on a package of milk to understand how the cows producing the milk were fed, how the milk was packaged, and other relevant information.[118]

> US company Fishcoin brings traceability to sea food while incentivizing supply chain stakeholders to share data from harvest points to consumption (coins, which can equate to monetary value, are provided for the sharing of this data).[119]

> IBM developed a permissioned blockchain network called Food Trust,[120] bringing together various stakeholders in the food supply chain (growers, processors, wholesalers, distributors, manufacturers, retailers, etc.). The blockchain keeps an immutable record of food provenance, chain of custody, and processing and transaction details to enhance visibility and accountability across the supply chain.

Business and Financial Services

Finance and fintech use cases are perceived as the most mature for blockchain both in Canada[121] and globally.[122] However, blockchain's characteristics pose challenges and risks for the legal frameworks of banks and financial institutions. Since financial services are regulated and have a form of centralized structure, this is in complete contradiction with blockchain, the latter having no centralized figure. Some argue that if blockchain were to be fully introduced in the sector, it could pose challenges for accountability and responsibility.

Traditional financial systems are centralized. This presents notable security risks,[123] especially if hackers or other malicious actors breach a database. Blockchain can counter those risks by transforming the overall sector by lowering overall costs, cutting fees associated with the operation of infrastructure and ATMs, and electricity

[118] *Ben Sillitoe, "Carrefour to enable milk traceability using blockchain", Essential Retail, March 9, 2019, https://www.essentialretail.com/news/carrefour-milk-traceability-using/*
[119] *Fishcoin, https://fishcoin.co/*
[120] *"IBM Food Trust. A new era for the world's food supply", IBM, https://www.ibm.com/blockchain/solutions/food-trust*
[121] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2019/12/canada-blockchain-ecosystem-2019.pdf*
[122] *Ian Pollari, "Fintech predictions 2019", KPMG, https://home.kpmg/xx/en/home/insights/2019/02/fintech-predictions-2019.html*
[123] *Alex Tapscott and Don Tapscott, "How Blockchain Is Changing Finance", Harvard Business Review, March 1, 2017, https://hbr.org/2017/03/how-blockchain-is-changing-finance*

demands. It is estimated that the average consumer could save more than $500 USD in banking and insurance fees with smart contracts that are based on blockchain technology.[124]

Other notable transformations that could occur with the implementation of blockchain in the financial sector include executing faster transactions and improving transparency. These promising features are primarily what drive large banks and financial institutions to invest in blockchain. Spanish bank Santander estimates that implementing blockchain solutions in banks could save $15 billion to $20 billion a year in infrastructure costs alone.[125]

> The entire trade settlement system today is built on legacy systems that often work on batch processes in the middle of the night. With blockchain, you have the concept of asset ownership that lives on the blockchain itself. And that can be settled in near real time. I think the holy grail that a lot of the banking industry is looking for is real-time trade settlement.
>
> **– Innovation Lead, Financial Services, Global**

On the consumer front, Capgemini estimates that overall savings could total $16 billion in banking and insurance fees by integrating blockchain into its smart contract applications including retail banking, insurance, and investment banking.[126] Examples of finance companies making notable headway in blockchain use include the following:

> R3 consortium is testing how to use blockchains in digital identification and in capital market transactions.[127]

> Utility Settlement Coin (USC) project, launched by large financial institutions such as Santander and Deutsche Bank among others, is developing blockchain versions of major fiat currencies, including the US dollar, the Canadian dollar, the British pound, the Japanese yen, and the euro. This "collateralized digital currency" helps reduce process complexity and time for settlements for international transfers.[128]

> Banks across Canada, such as the Royal Bank of Canada (RBC), are investigating new uses for blockchain in moving payments between banks across various countries.[129]

[124] Capgemini, October 11, 2016, https://www.capgemini.com/news/consumers-set-to-save-up-to-sixteen-billion-dollars-on-banking-and-insurance-fees-thanks-to/
[125] Yessi Bello Perez, "Santander: Blockchain Tech Can Save Banks $20 Billion a Year", Coindesk, June 16, 2015, https://www.coindesk.com/santander-blockchain-tech-can-save-banks-20-billion-a-year
[126] Capgemini, October 11, 2016, https://www.capgemini.com/news/consumers-set-to-save-up-to-sixteen-billion-dollars-on-banking-and-insurance-fees-thanks-to/
[127] "Blockchain for capital markets and fintech", R3, https://www.r3.com/customers/capital-markets/
[128] Ian Allison, "14 Banks, 5 Tokens: Inside Fnality's Expansive Vision for Interbank Blockchains", Coindesk, June 13, 2019, https://www.coindesk.com/fnality-utility-settlement-coin-central-bank-token-blockchain
[129] Matt Scuffham, "Exclusive: Royal Bank of Canada using blockchain for U.S./Canada payments – executive", Reuters, September 27, 2017, https://www.reuters.com/article/us-rbc-blockchain/exclusive-royal-bank-of-canada-using-blockchain-for-u-s-canada-payments-executive-idUSKCN1C237N

Digital Technology

With digital technology being a large sector encompassing anything from telecommunications to creative technology, media and some forms of consulting, potential use cases of blockchain here are numerous.

In the telecommunications sector, blockchain can be integrated to enhance privacy and confidentiality. Spain's biggest telecommunications company, Telefónica has been involved in multiple blockchain projects to produce business solutions for customers. A notable example is its use of the IBM Blockchain Platform to trace international calls, and log their origin, destination, and duration on the decentralized platform. This is done, ultimately, to enhance trust in the telecommunications sector. The platform will be used to help a network of peers, including operators, vendors, and service providers with authorized access. This platform would have the added effect of making it easier to identify and reconcile any errors in billing, accounting, reporting, and could also help discover fraudulent behaviour.[130]

Blockchain consulting firms provide consulting services to businesses, helping them integrate the technology. The growing demand for professional advice on blockchain integration has resulted in the strong growth of blockchain consulting firms as well as niche operations by existing consulting firms to provide advice on blockchain.[131] In 2019, consulting firms comprised 14% of all blockchain businesses in Canada.[132] Large consulting firms, including Deloitte and Accenture among others, all have blockchain teams. Deloitte (a key leader seeding a generation of blockchain leaders in Toronto) provides architecture, digital design, and development on blockchain technology to help companies with innovative blockchain solutions to address business concerns.[133]

For the past few years, we have been working with clients to build out a business proposition or value proposition in the blockchain space. Most of our work is done on Ethereum blockchain, but we do also use private blockchains.

— Partner, Digital Technology & Consulting, UK

We have a cloud unit that is focused on providing technical service to enterprises, and we use our blockchain engine as a BaaS Platform to help customers start their own blockchain applications and business alliances. We chose blockchain as a creative technology to optimize business reliability and protect copyright.

— Blockchain Product Lead, Digital Technology, China

[130] *"Telefónica and IMB Collaborate to Apply Blockchain to Streamline Telco Processes", Telefónica, November 14, 2018, https://www.telefonica.com/en/web/press-office/-/telefonica-and-ibm-collaborate-to-apply-blockchain-to-streamline-telco-processes*
[131] *Swati Goyal, "Blockchain Consulting Firms – All You Need To Know", 101 Blockchains, January 16, 2019, https://101blockchains.com/blockchain-consulting-firms/*
[132] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2019/12/canada-blockchain-ecosystem-2019.pdf*
[133] *Deloitte, https://www2.deloitte.com/us/en/pages/consulting/topics/blockchain.html*

Life Sciences

Blockchain can be highly beneficial for the life sciences sector. The pharmaceutical industry, for example, can greatly benefit from blockchain. The MediLedger Pilot Project consists of 25 pharmaceutical companies, with goals to explore and evaluate how blockchain can be used to meet the 2023 requirements of the Drug Supply Chain Security Act (DSCSA). It is hoped that the pharmaceutical supply chain would be improved with blockchain but also that the counterfeiting of pharmaceuticals would be curtailed. Pilot participants include big organizations such as Walgreens, Sanofi, and Amgen, among others.[134]

There have been approximately 20 new life sciences pilot projects in the US in 2019 under the DSCSA Pilot Project Program, with a handful identified as related to blockchain.[135] In another notable blockchain pilot study, the DSCSA Blockchain Interoperability Pilot, Merck teamed up with IBM, Walmart, and KPMG to integrate blockchain technology in the US pharmaceutical supply chain. This partnership came about in response to the recent US Drug Supply Chain Security Act proposed by the Food and Drug Administration (FDA) that explores issues on regulatory compliance, drug supply chain, drug shortages, drug recalls, and clinical trials.[136]

Another benefit of blockchain in the life sciences sector is ability to safeguard personal data. Here, the decentralization of electronic health records through blockchain would make it virtually impossible for others to tamper with the system; this would improve health data security, especially from malicious actors. Even in the unlikely event that a hacker was able to breach the blockchain, they would only get access to very minimal data (on a specific transaction block), which would be virtually unusable. Additionally, because of the peer-to-peer sharing nature of blockchain, it would not be possible to alter the data[137]—this process is much more secure than currently existing options in any centralized system. In its 2018 report on digital health technology, Accenture found that more than 90% of health executives emphasized the importance of treating patients as partners and making data security a central concern.[138] Furthermore, 91% of those executives believed that blockchain and smart contracts will be vital for the healthcare sector over the next few years.[139]

> We have so far looked into cases in supply chain management and collaboration with other companies and tech providers. Like many major organizations, we are also interested in the sharing of healthcare data associated with new payment models.
>
> **– VP, Life Sciences, Germany**

[134] *MediLedger, https://www.mediledger.com/solution-protocols*
[135] *FDA U.S. Food & Drug Administration, https://www.fda.gov/drugs/drug-supply-chain-security-act-dscsa/dscsa-pilot-project-program*
[136] *"From Factory to Patient: Merck Pilots Blockchain Project to Trace and Track Drugs", Merck, June 2019, https://www.merck.com/about/featured-stories/from-factory-to-patient-merck-pilots-blockchain-project-to-trace-and-track-drugs.html*
[137] *Chrissa McFarlane, "Blockchain: Unlocking Healthcare Data to Empower Patients and Improve Care", HIMSS, October 21, 2019, https://www.himss.org/resources/blockchain-unlocking-healthcare-data-empower-patients-and-improve-care*
[138] *Ibid. Note: data information was found on above link.*
[139] *Ibid.*

> The biggest issue [in the healthcare sector] is that we all need to understand who in ecosystem could benefit from blockchain technology. It's very patient-centred... Secondly, since the technology is still novel, we are trying to improve our understanding and awareness of the technology and what the best governance practices should be.
>
> **— VP, Life Sciences, Germany**

Natural Resources

Enabling blockchain in the energy sector could help establish smarter consumption systems. Tokenization in this sector refers to converting energy or other assets like oil or gold into digital tokens that can be stored, monitored, and traded on a blockchain. For example, WePower, a blockchain-based green energy trading platform connecting buyers to energy producers, has tokenized a year's worth of Estonian grid data. This initiative has rendered it the first for energy blockchain technology. Each token is representative of one kilowatt-hour of power and are tradeable and sold by linking two parties on the blockchain.[140] Traditionally, energy grids are centralized and managed by large corporations.

Many types of energy sources can be traced through blockchain technology. It would allow electricity buyers, for example, to ensure that their electricity supplies are clean. In Spain, Acciona Energy has partnered with FlexiDAO to trace renewable energy generation, including wind and hydro. The project "GREENCHAIN" is a permissioned version of Ethereum for the energy sector.[141]

> Tracing the renewable origin of energy is ever-growing, associated with the growth of the corporate contracting market for green energy, and blockchain technology can facilitate this service considerably to clients in any part of the world.
>
> **— Belén Linares, Director of Innovation of Acciona, Spain[142]**

Blockchain can also create solutions for tracking conflict materials such as tantalum or diamonds.[143] The use of a blockchain could identify how, when, and under which conditions the materials were extracted, tracking its journey from end to end. Understanding this journey would help companies like Tesla or Dell, which source materials like tantalum for their products, ensure they are compliant with SEC guidelines. At the same time, it can help assure buyers of diamonds that their gems are not blood or conflict diamonds. With the demand for ethically sourced materials like diamonds on the rise, blockchain may be a viable solution in this space.

[140] Jason Deign, "WePower Is the First Blockchain Firm to Tokenize an Entire Grid
[141] "ACCIONA will extend blockchain traceability to its renewable generation globally", Acciona, December 17, 2018, https://www.acciona.com/news/acciona-extend-blockchain-traceability-renewable-generation-globally/
[142] Nicky Morris, "Renewable energy company Acciona adopts blockchain traceability", Ledger Insights, 2019, https://www.ledgerinsights.com/renewable-energy-acciona-blockchain-traceability/
[143] TRACR, https://www.tracr.com/

Transportation and Logistics

In transportation and logistics, blockchain can be a powerful tool for supply chain management, a process that typically requires different processes and numerous intermediaries. Blockchain provides an ideal solution to the lack of transparency that currently exists in modern supply chains. Integration of blockchain in a supply chain provides real-time tracking of products; blockchain also reduces the costs of tracking items as well as the related time loss and human errors. Traditional supply chain transactions are complicated because many commodities are involved—food products, consumer goods, etc. Blockchain would track products "end-to-end" to create accurate records of transactions and tracking products through all stages in the supply chain.[144]

Most appropriately, manufacturers can use blockchain to verify the origins of products and ensure quality checks or compliance with specifications. This transparency can be applied to suppliers, sourcing, procurement, and even quality on a shop floor, including machine monitoring. The notion of using blockchain to improve quality control is important because product recalls can lead to a substantial loss in revenue. For example, in 2018, over 400 food recalls in the US totalled $3.5B.[145] Blockchain's value in manufacturing rests with the supply chain process, and specifically with its ability to improve tracking and traceability.

Current examples of companies offering supply chain solutions via blockchain include:

> Walmart has launched its supply chain and blockchain project, a collaboration between Walmart Canada and DLT Labs. This project will serve over 400 retail stores across Canada, tracking deliveries, verifying transactions, and automating payments between the company and trucking companies.[146]

> TradeLens,[147] a platform powered by IBM's permissioned blockchain, provides digital tools for data sharing and collaboration between all entities in the global shipping and trade industry.

> Komgo is a blockchain-based open platform for commodity trading. Komgo partnered with ConsenSys and Kaleido to develop its enterprise blockchain solution.

[144] *Abhishek Bansal, "How blockchain can help organisations tackle key supply chain issues", YourStory, December 11, 2019, https://yourstory.com/2019/12/blockchain-startup-supply-chain-issues*
[145] *Louis Columbus, "How Blockchain Can Improve Manufacturing In 2019", Forbes, October 28, 2018, https://www.forbes.com/sites/louiscolumbus/2018/10/28/how-blockchain-can-improve-manufacturing-in-2019/#510482a85db6*
[146] *Rick Delafont, "Walmart Canada Launches Largest Blockchain for Supply Chain Management Ever", NewsBTC, 2019, https://www.newsbtc.com/2019/11/14/walmart-canada-launches-largest-blockchain-for-supply-chain-management-ever/*
[147] *"Digitizing The Global Supply Chain", TradeLens, https://www.tradelens.com/about*

Startup company Arcade City operates similar to other ride-sharing companies but has incorporated blockchain to allow drivers to determine their own rates; unlike other traditional ride-sharing apps, Arcade City does not have an intermediary. Arcade City serves as the first peer-to-peer rideshare network. It also utilizes blockchain to log interactions, and all transactions are facilitated on a blockchain system.[148]

As for the risks, it is a peer-to-peer technology, i.e., car sharing is a match-making process with supply and demand. Peer-to-peer technology will disrupt that. With blockchain, the "middleman" is no longer needed.

— Blockchain Strategist, Transportation, US

[148] *"Banking Is Only The Beginning: 58 Big Industries Blockchain Could Transform", CB Insights, April 2, 2020, https://www.cbinsights.com/research/industries-disrupted-blockchain/*

ROLLUP: IS BLOCKCHAIN A METHOD OF ATTRACTING FDI INTO CANADA?

For 10 years now, Canada's blockchain ecosystem has been growing and maturing, with established hubs now visible in Toronto and Vancouver, and smaller ones emerging in Alberta, Quebec, and Atlantic Canada. Canada is now home to a breadth of skilled talent with digital backgrounds. In 2019, there were over 1600 blockchain professionals across Canadian cities. Much of this talent was working on innovative applications across various sectors, generating intellectual property and highlighting the technology's various new use cases. These features were regarded as attractive to potential investors.

Although interviewees in this study saw Canada's blockchain ecosystem as having potential, many expressed concerns about the nation's ability to attract FDI on the blockchain front. The biggest hurdles to FDI attraction were regarded as regulation standstill and a conservative business climate that has a lower than average tolerance for risky technologies like blockchain.

Below are a few key factors that were highlighted by interviewees as relevant to Canada's ability to attract blockchain-based FDI.

Talent is Key

More than 70% of interviewees stated that Canada's biggest asset to FDI attraction was its access to and availability of human capital. Canada's largest blockchain hubs are Vancouver and Toronto, and interviewees lauded the quality of blockchain skilled talent coming out of institutions like the University of Waterloo, York University, Ryerson University, and the University of British Columbia. At the college level, George Brown College in Toronto was well respected as taking a lead in talent generation with its now well-known "Blockchain Development Program" certificate.

Additionally, with many blockchain workers in Canada educated outside of the country, interviewees felt that Canada's blockchain ecosystem will benefit from the ability to attract skilled workers from around the world. Most interviewees highlighted that Canada's immigration system prioritized skilled talent. They highlighted programs like Express Entry and Global Skills as key to attracting the skilled workers needed to fuel Canada's existing and emerging blockchain hubs.

Intellectual Property Advances and Digital IDs

Owing partially to the availability of skilled talent, many interviewees felt that Canada was making considerable advances in relation to blockchain intellectual property. Ethereum originated in Canada, and several interviewees pointed to Canada's newly emerging leadership in the area of self-sovereign and digital identity. Many saw digital IDs as a promising area of blockchain application, where Canada stands to not only grow but show global leadership. One example of advances in this space include the cross-provincial collaboration between BC and Ontario to set up the Verifiable Organizations Network, focusing on identity management and ethical handling and storage of personal data. Another key example is the development of the Pan-Canadian Trust Framework Overview. Created by the Digital ID and Authentication Council of Canada, it focusses on the requirements and goals of the Canadian digital ID ecosystem.

Regulatory Uncertainty Dampening FDI Prospects

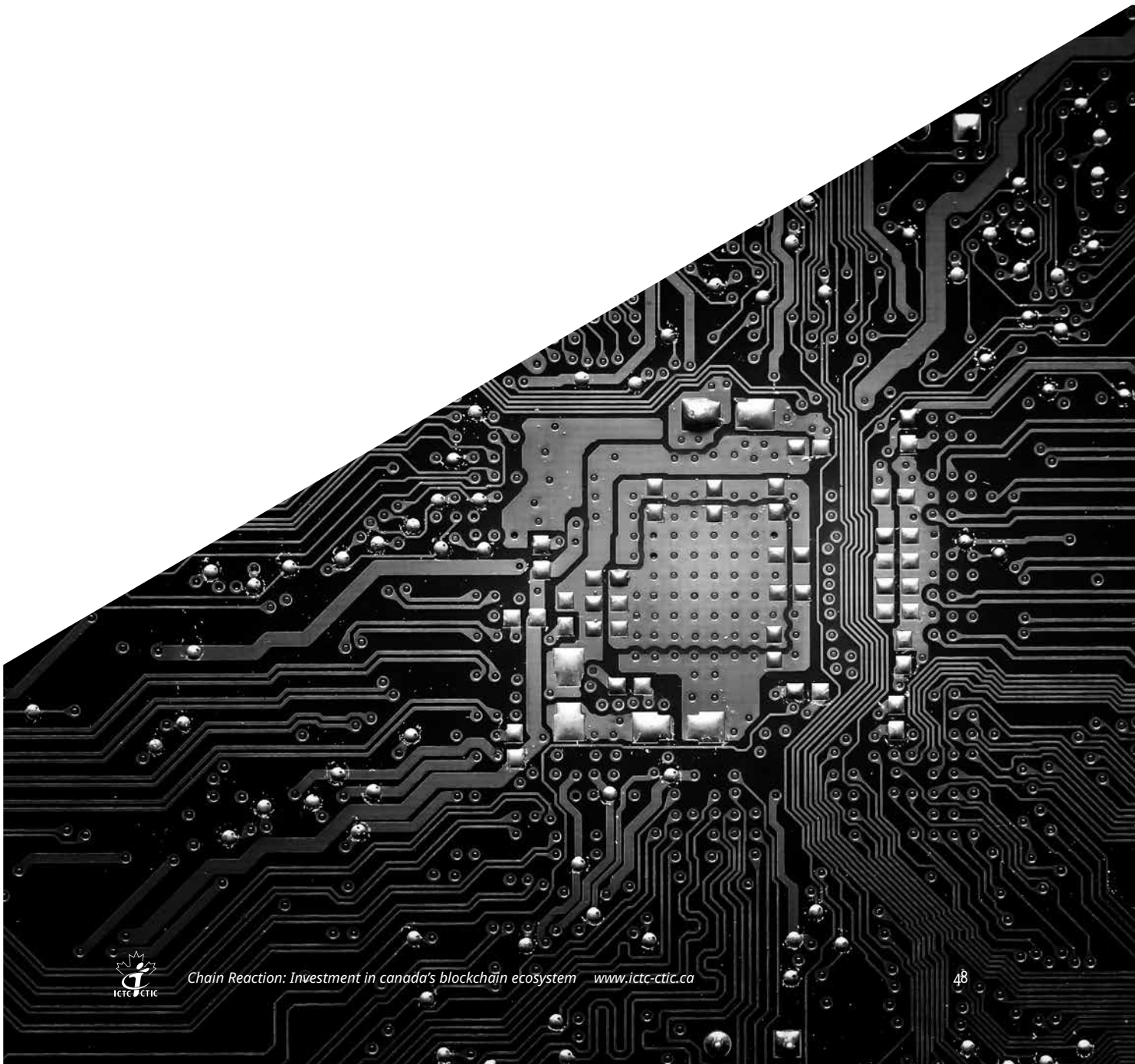
Overwhelmingly, the biggest red flag for blockchain-based FDI attraction is regulatory uncertainty. Over 8o% of interviewees in this study identified concerns about regulatory uncertainty as potentially curtailing investment. Key worries were slow regulation developments for know-your-customer (KYC) and anti-money laundering provisions in banking, as well as laws regulating access, control, and storage of personal data.

While apprehension is reasonable, there have been some positive developments in the space of blockchain regulation in Canada, especially related to cryptocurrencies and digital assets. Although regulatory sandboxes have been in existence for some time (a blockchain example is Launchpad, established by the Ontario Securities Commission), Canadian Securities Administrators recently set up a regulatory sandbox for blockchain and other fintech businesses. It aims to create a regulatory framework for crypto-asset trading and other custodial and disclosure requirements related to crypto-securities.

These are steps in the right direction, however interviewees maintained that Canada's regulatory regime for blockchain is unclear and unresponsive, which could weaken Canada's prospects for attracting investment compared to other countries with more advanced regulatory systems in place.

Conservative Business Climate Means Minimal Application

A second issue of concern was raised primarily by interviewees whose businesses already have a presence in Canada: Canada's tech sector is more risk averse than that of the US or other international competitors. Although interviewees acknowledged growing blockchain hubs like Toronto and Vancouver, they stressed challenges in obtaining public and private investment and buy-in. Specifically noted was a lack of interest in actual blockchain adoption (beyond theoretical use cases) among Canadian businesses. In some instances, weak business cases with unclear outcomes or highly conservative risk tolerances were also highlighted as a challenge. Many interviewees whose companies have a presence in both Canada and internationally also identified challenges related to buy-in and interest in blockchain applications within Canada compared to other jurisdictions, possibly due to lack of blockchain knowledge.



CONCLUSION

Using a combination of primary and secondary research, this study provides insights on key strategic themes on Canada's blockchain ecosystem and its ability to attract foreign direct investment.

As with any emerging technology, blockchain is going through its own iteration of the hype cycle—having passed from the peak of crypto mania at end 2017 to the trough of the subsequent "Crypto Winter." There is still, however, significant apprehension following the spate of ICO failures and fraud. Blockchain is still widely confused with cryptocurrencies despite having many more use cases. A lot of the initial hype around the technology has now died down, and various viable use cases are being trialled and pushed into production in enterprise settings across a wide range of industry sectors from financial services to healthcare and supply chain management. The most common use cases currently focus on reducing overhead costs by taking advantage of the efficiency, transparency, and accountability that blockchain solutions can provide. True economies of scale, however, are only expected to arise when multiple competitors in an industry or sector come together in a consortium and build a non-competitive technology layer. Another major roadblock for substantial blockchain investment, especially in industries such as financial services and healthcare, is regulatory and legal uncertainty.

Canada's blockchain ecosystem has seen tremendous growth since its beginnings in 2012 and now boasts growing hubs in Vancouver and Toronto, with others emerging in Quebec, Alberta, and Nova Scotia. Canada punches above its weight in the global blockchain community and is respected for its human capital, innovation hubs, intellectual property, and its championing of a global, diverse, and highly skilled workforce. Other innate characteristics such as its high quality of life and a stable economy and social system are added advantages. Canada's strategic initiatives to promote technological innovation as a key economic growth driver along with its favourable skilled labour migration policies, make it an attractive destination for investment in general, while challenges related to regulation and a risk-averse business culture can dampen FDI prospects.

As an open economy in the global ecosystem, it always faces the threats of talent and innovation flight to other jurisdictions. However, by furthering its competitive advantage in human and intellectual capital, Canada can create a vibrant ecosystem that attracts and retains skilled talent and private sector investment while also cultivating a deeper understanding of the technology and its true value propositions.

APPENDICES

Research Methodology

This study uses both qualitative and quantitative research methods for the assessment of blockchain trends globally and in Canada, and for the analysis of Canada's relative strengths and weaknesses.

PRIMARY RESEARCH

ICTC conducted a total of 23 key informant interviews (KIIs) with a globally diverse group of industry participants. Interviews were recruited through targeted outreach. Interviews were conducted between January and March 2020. Participants were blockchain experts with international organizations. The outreach targeted companies across the seven sectors identified as key innovative areas in the Canadian digital economy.[149] The 23 interviews included companies in the following industries: agriculture and ocean technology, business and financial services, digital technology, life sciences, natural resources, and transportation and logistics. Advanced manufacturing was also a sector of interest for this study, however, despite substantial outreach, ICTC was not able to source any interviewees from this sector.

Almost 40% of the interviewees were from large multinational companies (revenue of over US $1B in 2019) that operate in all major world economies. Viewed as a whole, these companies have a presence across all six continents. Interviewees represented organizations headquartered in eleven different countries in North America, Europe, and Asia.

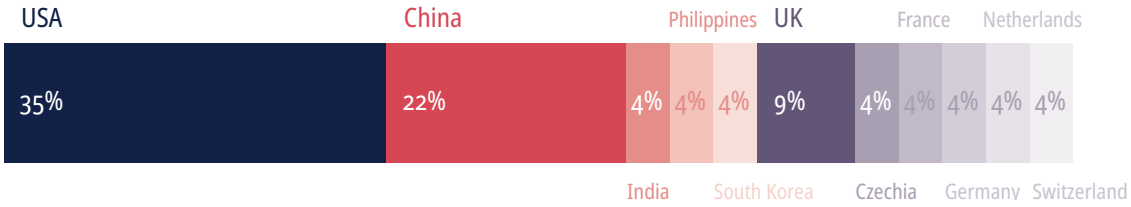


Figure 18. Interviews: Location of global headquarters/foreign outposts.

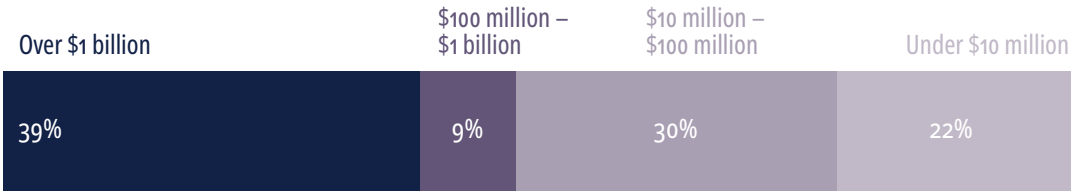


Figure 19. Interviews: Annual by company size (2019 revenue in USD)

[149] Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2019/11/canada-growth-currency-2019-FINAL-ENG.pdf

Each interview lasted approximately one hour. Interviewees addressed topics that included their company's outlook on blockchain, use cases for their industry, and barriers to blockchain adoption and investment. They then discussed their perceptions of and experiences in Canada (and its suitability as a potential location for international business development and/or investment). They highlighted what they considered to be Canada's key strengths and weaknesses with respect to blockchain development and innovation.

Due to the nature of the study, all insights collected from KIIs are displayed in aggregate only, and all quotes are replicated with no personal identifiers to protect the confidentiality of interviewees and their organizations.

SECONDARY RESEARCH

A thorough review of global and Canadian blockchain literature was initially conducted to guide the study, which helped outline the research questions and methods. This also helped in establishing a list of key global organizations and identifted key informant participants for this study.

Apart from research and data sets compiled by ICTC as part of its previous blockchain report, *Building Canadian Consensus: Our Maturing Blockchain Ecosystem,*[150] research and data from the following sources were also used:

Bank of Canada

Cornell University, INSEAD, and World Intellectual Property Organization

Gartner

Harvard Business Review

Kearney

McKinsey & Company

Michigan State University

Organization for Economic Co-operation and Development

Statistics Canada

United Nations Economic and Social Council

[150] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2020/03/canada-blockchain-ecosystem-2019-v2.pdf*

Limitations of Research

While efforts were made to mitigate biases or knowledge gaps in the report, uncertainty is inevitable in research on such a novel technology, especially in its relatively early stages. The following section discusses several limitations embedded in the study.

DATA

As blockchain is a relatively new technology, existing data are rare. Existing datasets related specifically to blockchain are scarce in both the Canadian and international context. ICTC started collecting data on Canada's blockchain ecosystem as part of its previous report, and that data set has been used to inform this report as well. That dataset represents a specific moment in time and is not necessarily indicative of the current blockchain reality in Canada, following the economic shut down and global volatility caused by COVID-19.

KEY INFORMANT INTERVIEWS

While every effort was made to have as representative a global sample of interviewees as possible, some limitations do exist. Interview invitations targeted blockchain experts in leadership or executive positions, working with large multinational blockchain organizations in the seven key sectors identified.

ICTC recognizes that 23 interviews are not a large enough sample to accurately generate a consensus around the direction of blockchain investment in Canada. However, this global sample of interviews and participants generated overall themes and interesting insights to inform investment strategies. They should not, however, be treated as objective trends.

Every effort was made to ensure relatively equitable distribution of interviewees across sectors. There was, however, a skew in the sample toward the digital technology and financial and business services sectors. Together, these two comprised over 80% of all interviews. This is simply due to the nature and novelty of the technology and the fact that most enterprise blockchain companies self-identify in those sectors.

As mentioned, ICTC was unable to secure interviews in the advanced manufacturing sector. As per Figure 15, the manufacturing sector is the least interested in blockchain development and integration, which may explain its lack of response to ICTC outreach for this study. The COVID-19 pandemic and related supply chain disruption also forced the cancellation of an interview (scheduled for March) with a large manufacturer based in Asia.

Figure 20. Interviews by sector

Key Concepts in Blockchain

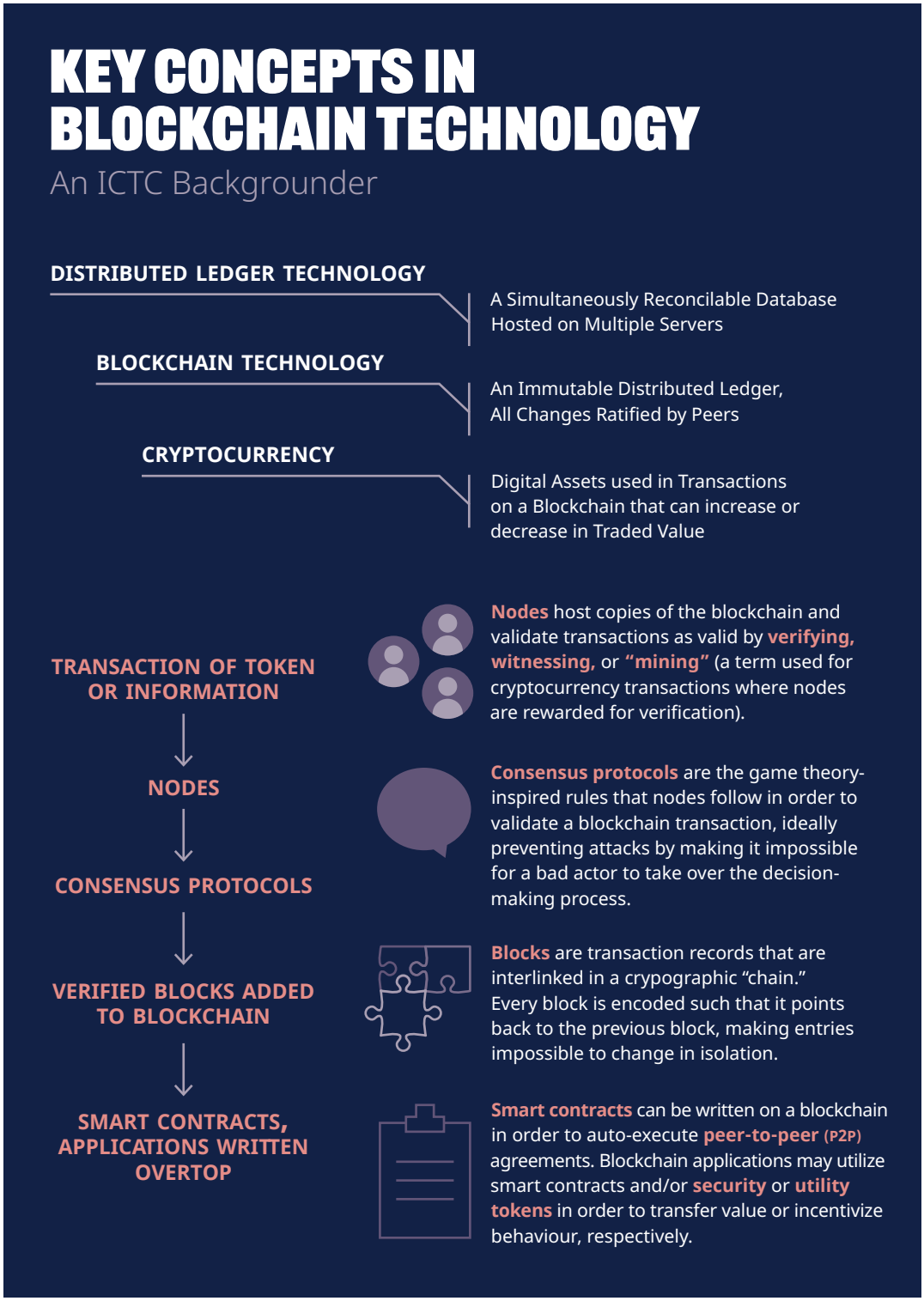


Figure 20. Key concepts in blockchain technology.[151]

[151] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2019/12/canada-blockchain-ecosystem-2019.pdf*

SWOT Analysis

Canada remains an attractive destination for investment. It consistently ranks highly on indices relating to governance,[152] economic freedom,[153] [154] political and financial risk,[155] [156] quality of life,[157] [158] market potential,[159] competitiveness,[160] and data infrastructure.[161] [162]

However, a large portion of FDI into Canada currently focuses on its traditional strengths in areas like natural resources, and manufacturing,[163] and therefore fluctuates with commodity prices. FDI inflow to Canada since the global recession of 2008 has closely tracked movements in the price of Western Canadian Select (WCS)[164]—Canada's primary heavy crude benchmark. FDI picked up between 2010 and 2013 and then dropped when oil prices tumbled, and Alberta suffered a recession. By 2017, FDI inflow to Canada was 55% lower than its peak in 2013.

The last few years have seen the emergence of FDI in high-growth technology-based sectors like digital media, advanced manufacturing, and artificial intelligence.[165] This shift is driven, in part, by Canada's pivot toward tech innovation and its commitment to global collaboration and, in part, because of the steady decline of the oil and gas sector, which traditionally received a significant portion of foreign investment.

There are, however, key FDI areas where Canada currently lags behind its OECD peers—and may even be losing ground. This section analyzes the relative strengths and weakness of Canada's blockchain ecosystem, outlines opportunities to further its edge with regards to attracting foreign investment, and highlights potential threats in the future.

[152] *DataBank, The World Bank, https://databank.worldbank.org/source/worldwide-governance-indicators*
[153] *Economic Freedom, Fraser Institute, https://www.fraserinstitute.org/economic-freedom/map?geozone=world&year=2017&page=map*
[154] *2020 Index of Economic Freedom, https://www.heritage.org/index/ranking*
[155] *"Country Risk Information", AM Best Rating Services, http://www3.ambest.com/ratings/cr/crisk.aspx*
[156] *https://www.coface.com/Economic-Studies-and-Country-Risks/Canada*
[157] *"World Happiness Report 2019", World Happiness Report, March 20, 2019, https://worldhappiness.report/ed/2019/*
[158] *"2019 Human Development Index Ranking", United Nations Development Programme, 2019, http://hdr.undp.org/en/content/2019-human-development-index-ranking*
[159] *"Market Potential Index (MPI) – 2019", globalEdGE, https://globaledge.msu.edu/mpi/data/2019*
[160] *Klaus Schwab et al, " The Global Competitiveness Report 2019", World Economic Forum, http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf*
[161] *Silja Baller et al., "The Global Information Technology Report 2016", World Economic Forum, http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf*
[162] *The Open Data Barometer, https://opendatabarometer.org/?_year=2017&indicator=ODB*
[163] *Statistics Canada. Table 36-10-0009-01 International investment position, Canadian direct investment abroad and foreign direct investment in Canada, by North American Industry Classification System (NAICS) and region, annual (x 1,000,000) https://doi.org/10.25318/3610000901-eng*
[164] *Alberta Government, Economic Dashboard, https://economicdashboard.alberta.ca/OilPrice*
[165] *Alexandra Cutean et al., "A New Partnership with the EU", ICTC, February 2020, https://www.ictc-ctic.ca/wp-content/uploads/2020/02/canada-eu-partnership-v2.pdf*

Strengths

SKILLED WORKFORCE AND HUMAN CAPITAL

Canada's key strengths in blockchain were highlighted by over 70% of interviewees in this study. They relate to human capital, innovation hubs, intellectual property, and Canada's championing of a global, diverse, high-skill workforce. Canada's blockchain hubs are predominately Vancouver and Toronto, with signs of growth in cities like Montreal, Ottawa, and Calgary, each with specific industry strengths. For example, in 2019, Quebec and Alberta had mainly cryptocurrency companies, while British Columbia, Nova Scotia, and Ontario saw different blockchain company types.[166]

> Canada's strong point will always be that it has English and French [-speaking] young talent. Canada could be the world's main ICT talent training country.
>
> **— Blockchain Consultant, Agricultural Technology, Netherlands**

Canada's biggest strength in blockchain is its pool of skilled talent and its strong academic and research institutions. There are vibrant research labs with a growing number of blockchain research projects in universities across the country (Waterloo,[167] York,[168] Ryerson,[169] UBC).[170] George Brown College in Toronto also offers its now well-known "Blockchain Development Program", a one-year certificate course.[171]

> Canada is one of the very strong tech hubs, with key academic institutes looking into the development, refinement, advancement of blockchain protocols and all the technological questions around it. It has very strong infrastructure and collaboration amongst academic centres. Canada identified STEM and tech as a future key value proposition. Digital superclusters and other initiatives have good investment backing. Plus, blockchain needs to be seen in conjunction with other new technologies such as AI. Canada is at the forefront of this digital development.
>
> **— VP, Life Sciences, Germany**

[166] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2019/12/canada-blockchain-ecosystem-2019.pdf*
[167] *University of Waterloo, Blockchain Research, https://uwaterloo.ca/blockchain-research/*
[168] *York University, blockchain.lab, https://blockchain.lab.yorku.ca/*
[169] *Ryerson University, Cybersecurity Research Lab, https://www.ryerson.ca/tedrogersschool/cybersecurity-research-lab/research-projects/*
[170] *University of British Columbia, Blockchain@UBC, https://blockchain.ubc.ca/*
[171] *George Brown College, Blockchain Development Program, https://www.georgebrown.ca/programs/blockchain-development-program-t175/*

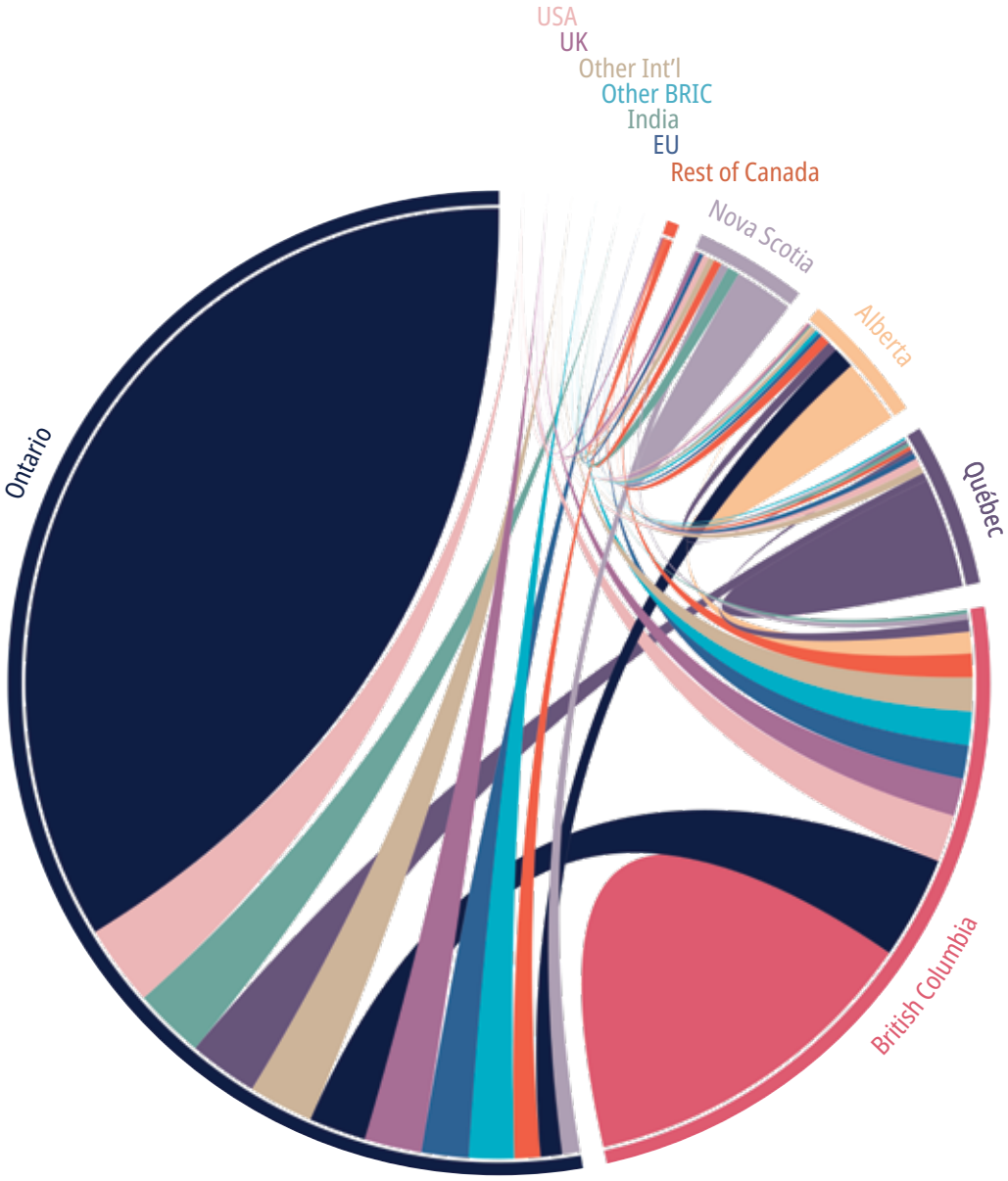


Figure 15. Canada's blockchain workforce, 2019

The figure above is a snapshot of the Canadian blockchain workforce in 2019, as conveyed in ICTC's report Building our Canadian Consensus. The blue arcs represent the relative size of the workforce in the various provinces. The inner chords depict the flows of workers into those provinces from the location of their most recent education.

Although this picture of the workforce is tied to a specific moment in time, notable features include (a) the highly interconnected and mobile nature of the Canadian blockchain workforce, and (b) the significant proportion of internationally educated workers.

GROWING ECOSYSTEMS AND STRATEGIC INITIATIVES

Canada is also home to strategic initiatives promoting innovation in technology as a key driver of future growth.[172] Along with the government's ambitious Innovation Superclusters Initiative[173] and the synergistic benefits of strengthening tech hubs across Canada, the blockchain hubs in Canada, especially around Toronto, have seen the emergence of lively and engaged communities that bring together technologists, entrepreneurs, and academics. Toronto's Meetup public group, The BlockchainHub, has over 4000 members that meet regularly to raise awareness and understanding of blockchain technology.[174] The website meetup.com lists over 25 active blockchain communities in the greater Toronto area,[175] each with over 250 members, convening regularly for hackathons and discussions on blockchain technology, business models, use cases, and crypto-economics, and to promote ideation, networking, and learning.

With large and active communities of blockchain developers, researchers, and entrepreneurs in Ontario and BC, and vibrant hubs emerging in Quebec, Alberta, and Nova Scotia, Canada punches well above its weight and is very well represented in the global blockchain community.

> Toronto and Vancouver have vibrant ecosystems. [There is a] strong Canadian community in the crypto world and the Ethereum world. [It] works in the same way a diaspora works—more Canadians in the ecosystem, greater number of personal relationships, more people getting pulled in, and as the ecosystems mature this means more companies founded in Canada that end up staying in Canada.
>
> **— Cofounder, Digital Technology, USA**

TALENT ATTRACTION AND INTELLECTUAL PROPERTY GENERATION

As with other knowledge-intensive and innovation-heavy sectors that rely on highly skilled workers, Canada's blockchain ecosystem stands to benefit from its commitment to diversity and globalism. Canada holds strong appeal for skilled workers from around the world because of its vibrant economy, strong institutions, high quality of life, and broad support for immigrants.[176] Canada's skilled labour migration system is the longest standing and most elaborate among OECD countries and was recently declared a role model for successful migration management.[177] Over 60% of Canada's foreign-born population is highly educated, which ranks it at the top of OECD countries.[178] Canada's immigration system is also lauded for its responsive and data-driven nature. The Express Entry program, with its sophisticated and customizable selection mechanism, allows Canada to attract high-skill workers in target sectors to fill labour supply gaps and boost the economy.

[172] *Government of Canada, "Canada's new superclusters", January 27, 2020, https://www.ic.gc.ca/eic/site/093.nsf/eng/00008.html*
[173] *Government of Canada, "Innovation Superclusters Initiative", September 4, 2018, http://www.ic.gc.ca/eic/site/093.nsf/eng/home*
[174] *"The BlockchainHub", Meetup, https://www.meetup.com/The-BlockchainHub-v0/*
[175] *Meetup.com, Blockchain groups in Toronto, https://www.meetup.com/topics/blockchain/ca/on/toronto/*
[176] *Government of Canada, "Immigration key to unlocking Canada's future economic success", June 24, 2019, https://www.canada.ca/en/immigration-refugees-citizenship/news/2019/06/immigration-key-to-unlocking-canadas-future-economic-success.html*
[177] *Kathleen Harris, "OECD report praises Canada's system as one of most successful in world", CBC News, August 13, 2019, https://www.cbc.ca/news/politics/economic-labour-migration-hussen-oecd-1.5244416*
[178] *OECD, "Recruiting Immigrant Workers: Canada 2019", August 13, 2019, https://www.oecd-ilibrary.org/social-issues-migration-health/recruiting-immigrant-workers-canada-2019_4abab00d-en*

> [Canada] has, at least thus far, avoided some of the tribalism that is causing internal friction to an awful lot of the other developed economies. I think that technology provides infrastructure where the advantages of globalism just far outweigh any sort of nationalistic view. Canada's embrace of diversity is ultimately going to prove to be an enormous competitive advantage.
>
> **— Strategic Advisor, Digital Technology/Consulting, Switzerland**

A few interviewees also highlighted Canada's leadership in the field of self-sovereign and digital identity. The Governments of British Columbia, Ontario, and Canada have set up the Verifiable Organizations Network (VON),[179] an open-source collaboration to enable trusted identity management while decentralizing the handling and storage of personal data. In May 2019, the BC government launched OrgBook BC[180] (a searchable directory of public, verifiable data issued by government authorities about businesses in British Columbia)[181] built as part of the VON.

> The Government of British Columbia is doing some amazing work on the self-sovereign identity space, working closely with Hyperledger Aries, Indy, and as technical advisors for Sovrin. Any company in BC can get their own decentralized identifier and login into a public blockchain… They are flying the flag for self-sovereign identity work.
>
> **— Innovation Lead, Digital Technology/Consulting, UK**

In the private sector, Canada's major lenders in collaboration with telecom firms, credit agencies, and technology company SecureKey released a blockchain-based digital identity system in May 2019.[182] Its service Verified.Me[183] allows customers of the participating lenders to verify their identity and access banking, telecom, and insurance services, and personal data such as health records and credit scores.

> It seems there's a base level of knowledge that is lacking elsewhere because Canada has been investing in this space for well over a decade. So, they have this kind of innate advantage that they didn't even realize they had. The rest of the world right now is looking to Canada for leadership in digital identity.
>
> **— CTO, Business & Financial Services, USA**

[179] *Verifiable Organizations Network (VON), https://vonx.io/about/*
[180] *Government of British Columbia, OrgBook BC, https://orgbook.gov.bc.ca/en/home*
[181] *Sovrin, "Use case spotlight: The Government of British Columbia uses the Sovrin Network to take strides towards a fully digital economy", March 11, 2019, https://sovrin.org/use-case-spotlight-the-government-of-british-columbia-uses-the-sovrin-network-to-take-strides-towards-a-fully-digital-economy/*
[182] *Doug Alexander, "Blockchain Adopted by Canadian Banks to Verify Client Identities", Forbes, May 1, 2019, https://www.bloomberg.com/news/articles/2019-05-01/blockchain-adopted-by-canadian-banks-to-verify-client-identities*
[183] *Verified.Me, https://verified.me/*

Weaknesses

REGULATORY UNCERTAINTY

The single biggest red flag in Canada's blockchain ecosystem and its attractiveness for FDI is regulatory uncertainty. This was raised by over 80% of interviewees in this study. To be fair, this is certainly not a problem unique to Canada. Regulatory uncertainty has hindered significant investment in several jurisdictions, with enterprises reluctant to make large-scale investments into blockchain technology until key regulatory questions are answered. These include issues relating to know-your-customer (KYC) and anti-money laundering provisions in banking,[184] and laws regulating access, control and storage of personal data such as the Health Insurance Portability and Accountability Act (HIPAA) in the US, and General Data Protection Regulation (GDPR) in the EU.[185]

There have been some encouraging developments in Canada, especially on the cryptocurrency and digital asset front. The Canadian Securities Administrators (CSA), an umbrella organization for Canada's provincial and territorial securities regulators, has set up a regulatory sandbox for blockchain and other fintech businesses seeking to offer innovative products, services, and applications in Canada. The initiative allows "firms to register and/or obtain exemptive relief from securities laws requirements under a faster and more flexible process than through a standard application, in order to test their products, services and applications throughout the Canadian market on a time-limited basis."[186] It was introduced as part of the CSA's 2016-2019 Business Plan with an eye on modernizing the regulation of securities markets. The CSA's 2019–2022 Business Plan lists blockchain as a key strategic area[187] and outlines initiatives to propose a regulatory framework for crypto-asset trading and other custodial and disclosure requirements related to crypto-securities.

Despite these steps, the wider perception remains that Canada's regulatory regime for blockchain is unclear and unresponsive, which has diminished Canada's attractiveness to some blockchain entrepreneurs.

This regulatory uncertainty in Canada's blockchain ecosystem becomes an even bigger impediment to FDI attraction when viewed in combination with Canada's high score on the OECD's FDI Regulatory Restrictiveness Index.[188] The index is measured by comparing and assessing countries' FDI rules, with a higher score denoting a more restrictive FDI environment. Canada's overall score of 0.161 ranks it the fourth most restrictive country in the OECD.

[184] *Matt Higginson, Atakan Hilal, and Erman Yugac, "Blockchain and retail banking: Making the connection", McKinsey & Company, June 2019, https://www.mckinsey.com/industries/financial-services/our-insights/blockchain-and-retail-banking-making-the-connection*
[185] *Healthcare Information and Management Systems Society, "Blockchain Regulatory & Compliance Considerations", https://www.himss.org/blockchain-regulatory-compliance-considerations*
[186] *"CSA Regulatory Sandbox", Canadian Securities Administrators, https://www.securities-administrators.ca/industry_resources.aspx?id=1588*
[187] *"CSA Business Plan, 2019-2022", Canadian Securities Administrators, https://www.securities-administrators.ca/uploadedFiles/General/pdfs/CSA_Business_Plan_2019-2022.pdf*
[188] *"OECD FDI Regulatory Restiveness Index", OECD, https://data.oecd.org/fdi/fdi-restrictiveness.htm*

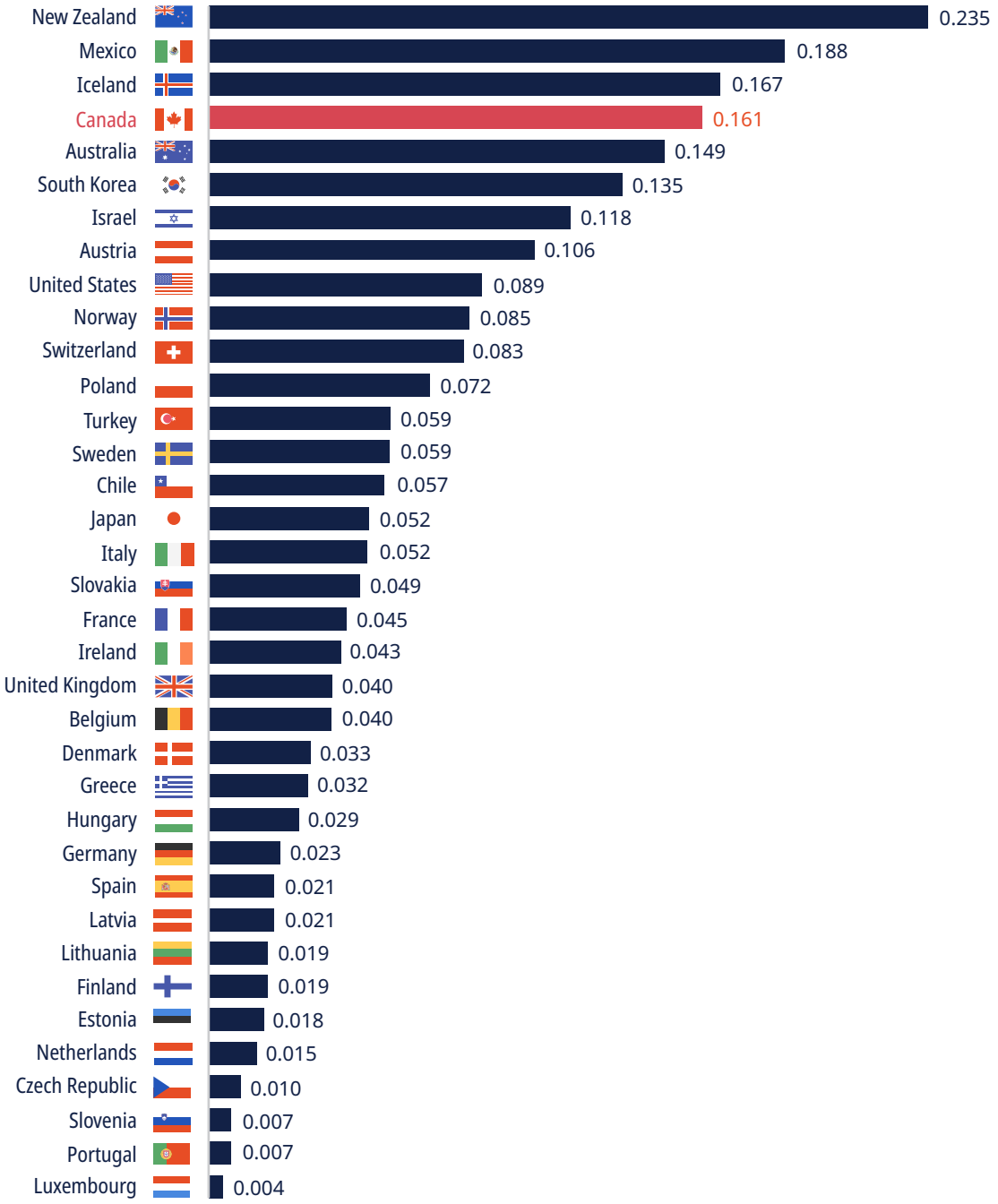


Figure 16. FDI regulatory restrictiveness index, OECD (2018).

> There are regulatory challenges because regulators move at glacial speeds, while in blockchain space, we say one calendar year is 10 blockchain years. The space of innovation and change is exponential, which clashes with the evolution of regulatory frameworks.
>
> **— Emerging Technology Lead, Digital Technology/Consulting, USA**

When considering Canada as a destination for investment, a lack of supportive policy for blockchain industry often comes up.

— Blockchain Product Lead, Digital Technology, China

Interviewees pointed to other jurisdictions, both large and small, that were taking a more proactive and leading role in shaping clear blockchain strategies at the national and sectoral level. Their assertion was that clear regulatory frameworks enable innovation and attract investment, which spurs greater adoption. In heavily regulated industries such as financial services and healthcare, regulatory uncertainty worldwide has limited sizable investment in blockchain because large enterprises cannot assess the potential returns.

If you believe that certain legal and regulatory standards may, to some extent, drive and determine adoption, it is my feeling that other countries or regions may drive this. In terms of privacy, Europe is setting the highest standards. In healthcare and pharma regulatory standards, the US FDA leads the world in terms of policy and forward-looking philosophy.

— VP, Life Sciences, Germany

In [terms of] regulatory barriers, [in Canada] there is some legal system reform that needs to occur. Places like Malta, Estonia, and others have recognized smart contracts that are binding. In Canada, there are some legal challenges that need to be worked out, but in most cases, regulatory actions follow what industry is doing and its practices.

— Partner, Digital Technology/Consulting, UK

SCALE-UP ISSUES IN THE TECH SECTOR

A second issue raised, primarily by interviewees whose businesses have a presence both internationally and in Canada, contrasted the risk-taking culture in Canada's tech industry with that in the US and other countries.

It would be unfair to brand Canadians as entirely risk averse—Canada outpaces its OECD peers in entrepreneurial ambition[189] and in measures such as (per-capita) new firm creation, public sector R&D spend, research output of its universities, and ease of starting a business.[190]

[189] *Niels Bosma et al., "2019/2020 Global Report", Global Entrepreneurship Research Association, 2020, https://www.gemconsortium.org/file/open?fileId=50443*
[190] *Soumitra Dutta, "Global Innovation Index 2019: Creating Healthy Lives – The Future of Medical Innovation", Global Innovation Index, 2019, pp. 108, https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII%202019-Executive-Web.4.pdf*

However, the problem is often in the scale-up phase. Most new Canadian companies face challenges in securing access to capital, strategic procurement, and good executive talent. They also face a regulatory ecosystem that is currently inadequate to sustain high-growth businesses in the knowledge economy, especially for safeguarding intellectual property and developing standards.[191]

I spent most of my career down in the US. How they process and incorporate risk into the decision making is just extraordinary. They don't dwell on their failures. They are willing to declare a failure and pivot to something more interesting. The equity support factors that in because they have very much a portfolio-management approach to things: You can't succeed if you're not willing to fail.

I think the two biggest missing pieces [in Canada] are this kind of maturity in equity markets and executive talent: finding good quality startup and scale up CEOs to grow interesting ideas, establish networks, connect the right people and hire the right people. That is a discrete skill set and it is concentrated in some major ecosystem hubs. Toronto is the best in Canada, but it's still not among the top 10 in the world.

— Strategic Advisor, Digital Technology/Consulting, Switzerland

I think there is this Canadian syndrome in tech that the best tech will win and doesn't need to be marketed. Canadians [companies] downplay the business development, marketing, and sales aspects of technology and think that the best tech will win. Investors come in and buy companies for far lower multiples than they would if they were in the States because the revenue lines just aren't there, and they weren't pursuing the proper business development side vis-a-vis the technology side. I call it a 'Nortel hangover': that the technology will sell itself. No, it won't! So you run the risk of teaching the world how to do something but not doing it for them.

— CTO, Business & Financial Services, USA

[191] *"It's time to dispel the myth that Canadian businesses are risk averse", Financial Post, March 14, 2019, https://business.financialpost.com/technology/its-time-to-dispel-the-myth-that-canadian-businesses-are-risk-averse*

Opportunities

Considering the broad strategic themes outlined in Section III and Canada's strengths and weaknesses as described above, the following key opportunities for Canada's blockchain ecosystem emerge. The overarching theme is to avoid complacency and expand on relative strengths while mitigating weaknesses.

EDUCATION AND TRAINING

While Canadian universities and technical institutes have started offering blockchain certifications and courses,[192] there is a need to ramp up these programs and expand their scope beyond just the technical aspects of blockchain. As highlighted in Section III above, the real value propositions that blockchain technology promises will come from reimagining traditional business models, revenue streams, and gaining greater clarity on the regulatory and legal fronts. Expanding the blockchain curriculum beyond just the technical aspects to the legal and business dimensions will help spur broader debate on these issues while also cultivating a blockchain workforce with a deeper understanding of the technology and its uses. Greater public discourse on blockchain could also serve to reignite public interest in blockchain in the aftermath of the Initial Coin Offering crypto bubble and help dispel common myths that conflate blockchain and cryptocurrency, and some of the hype.

I think the barrier right now is people don't truly understand what blockchain tech is and what it can do. I would like to see more and more universities start to have their classes on blockchain—not only blockchain tech but also in the commercial department and legal department.

— CEO, Digital Technology/Consulting, China

I'd like to see disciplines in business schools, in computer science departments, and in engineering start to incorporate some of these ideas into their curriculum. I'd like to see some business professors start to think through some of those consequences [of incorporating blockchain] and prepare the Canadian innovation ecosystem to be ready for and leverage the emergence of this new infrastructure as soon as it becomes viable. I think there's going to be an awful lot of advantage in being an early mover and, like there was in the internet era… speed and agility and is going to be important.

— Strategic Advisor, Digital Technology/Consulting, Switzerland

[192] *Ryan McLaughlin et al., "Building Canadian Consensus: Our Maturing Blockchain Ecosystem", ICTC, November 2019, https://www.ictc-ctic.ca/wp-content/uploads/2020/03/canada-blockchain-ecosystem-2019-v2.pdf*

LEVERAGING EXISTING SUCCESSES IN ECOSYSTEM DEVELOPMENT

Canada's experiences with establishing its world-class ecosystem in machine learning and artificial intelligence can also serve as a useful guide. Canada's AI/ML ecosystem has been a fruitful public-private partnership[193] that has incorporated "government funding, venture capital, university research initiatives, and private sector sponsorship."[194] While it is fair to say that a large portion of the investment so far has gone toward research, there are growing signs of commercialization being borne out of this ecosystem that marries academia with industry. Startups such as ElementAI[195] and business-owned research centres like Borealis AI[196] and Layer 6[197] are some leading examples of academic research environments housed within businesses.

Innovation in Canada's AI sector is spearheaded by research centres that bring together academics and industry practitioners in major cities like Toronto,[198] Montreal,[199] and Edmonton.[200] Funding for these institutes has been part of a forward-looking Pan-Canadian AI strategy[201] designed to spur research and innovation, attract and retain top talent, and catalyze private sector investment. A similarly forward-looking, coherent strategy for blockchain technology development in Canada could help propel it to a leadership role at the global stage.

> We definitely have lots of great talent here [in Canada]—we have some really good computer science programs, and we turn out a lot of really great engineers. I do wish we had better blockchain programs within the universities themselves. So I'd want to see more academic research in the space coming from the top universities. I think if we had strong academic programs, then that would attract some of the top talent, much like what [Prof. Geoffrey] Hinton[202] did with AI over at U of T. He has attracted a lot of talent within the AI space. I feel if we had some similar pathways in our [blockchain] education system here, we could attract true global talent.
>
> **— Innovation Lead, Financial Services, USA**

[193] *Michael Smith, "How Canada has emerged as a leader in artificial intelligence", University Affairs, December 6, 2017, https://www.universityaffairs.ca/features/feature-article/canada-emerged-leader-artificial-intelligence/*
[194] *Tom Davenport, "Learning From The Canadian Model of AI", Forbes, November 19, 2019, https://www.forbes.com/sites/tomdavenport/2019/11/19/learning-from-the-canadian-model-of-ai/#724285322300*
[195] *Element AI, https://www.elementai.com/research*
[196] *Borealis AI, https://www.borealisai.com/en/*
[197] *Layer 6, https://layer6.ai/*
[198] *Vector Institute, https://vectorinstitute.ai/*
[199] *Montreal Institute for Learning Algorithms, https://mila.quebec/en/mila/*
[200] *Alberta Machine Intelligence Institute, https://www.amii.ca/about-us/*
[201] *"Canada first to adopt strategy for artificial intelligence", United Nations Educational, Scientific and Cultural Organizations, November 22, 2018, http://www.unesco.org/new/en/media-services/single-view/news/canada_first_to_adopt_strategy_for_artificial_intelligence/*
[202] *Vector Institute, https://vectorinstitute.ai/team/geoffrey-hinton/*

Such measures to further strengthen current blockchain hubs in Canada could also have a direct impact on FDI inflow. Recent research, conducted by the consulting firm Kearney, shows that nearly 60% of global investors make FDI decisions by identifying target regions or cities instead of only selecting target countries.[203] This effect appears to be even stronger for the Americas and in the IT sector, and the trend has been growing over the last few years.

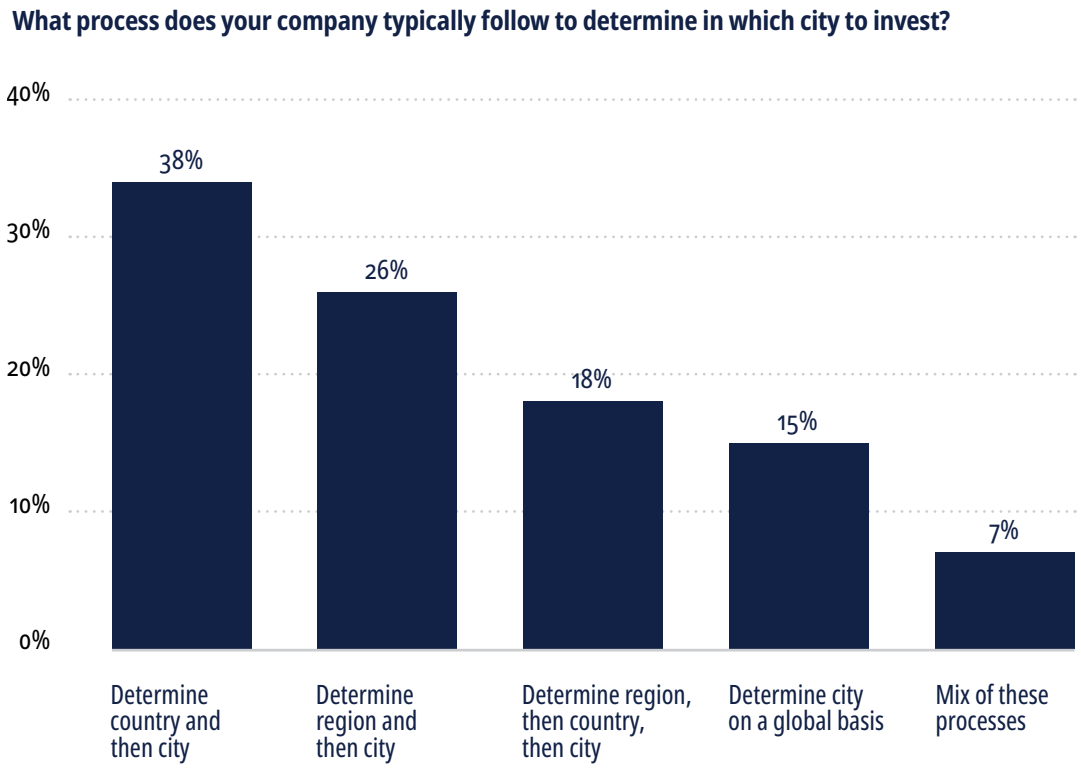


Figure 17. FDI decision making process, global sample.[204]
Source: 2019 A.T. Kearney Foreign Direct Investment Confidence Index

The appeal of large urban hubs to investors is their ability to cultivate and attract top talent. This seems to form a powerful cycle with innovation hubs with good tech talent, attracting more capital, which further attracts more talent. Even so, the two most important overall factors for FDI decision makers remain tax incentives and innovation capabilities.[205] In this regard, findings from ICTC's recent report[206] on CETA and Digital FDI opportunities for Canada are relevant: a large majority of interviewees were not aware of any Canadian FDI incentive programs, nor of the Innovation Superclusters Initiative. This lack of knowledge represents an opportunity for targeted marketing and engagement with companies, highlighting the strengths and successes of Canada's blockchain ecosystem and its wider tech community.

[203] *"Facing a growing paradox", A.T. Kearney, https://www.kearney.com/foreign-direct-investment-confidence-index/2019-full-report*
[204] *Ibid. Figure 13.*
[205] *Ibid. Figure 6.*
[206] *Alexandra Cutean et al., "A New Partnership with the EU", ICTC, February 2020, https://www.ictc-ctic.ca/wp-content/uploads/2020/02/canada-eu-partnership-v2.pdf*

Threats

TALENT DRAIN

The cultivation of a global, modern workforce cuts both ways. While Canada looks to benefit from its pool of high-skill, multinational workers, it must strive to ensure it is creating a welcoming environment for innovation and investment to retain this workforce. One of the key threats facing the Canadian blockchain ecosystem is talent drain.

Interviewees often commented that Canadians are highly motivated. Given the lack of established blockchain organizations in Canada that offer in-person blockchain technology training, those who are involved in blockchain are highly interested and driven to learn on their own. While programs such as the one at George Brown College can help address the lack of blockchain-developer talent and education in blockchain, the need for blockchain talent is on the rise in Canada. Industry experts recognize that when people who want to learn about blockchain face insufficient resources to do so, that potential talent leaves Canada for better equipped jurisdictions such the US. A recent study by Randstad found that approximately 1% of Canada's talent leaves for the US every year, with Silicon Valley being a key destination for tech talent.[207]

> [While] Canada's blockchain ecosystem is relatively active and healthy compared to a lot of places now, it doesn't have access to the kind of capitalization that some of these plays are going to require. And the risk is that there is a brain drain—as soon as someone has a very good idea that some capital firm is going to basically say, 'That's great! We're going to buy you, but we're going to move you to some extended ecosystem that will accelerate your success in the Bay [area] or in New York or Boston.' So those are always going to be challenges for Canada, but I guess you have to accept those challenges as part of being a participant in global economy.
>
> **— Strategic Advisor, Digital Technology/Consulting, Switzerland**

Although one of the two chief reasons for talent drain was compensation, the other ties back to the relatively small tech ecosystem in Canada and the challenges of scaling up Canadian-grown companies. "Brand recognition"[208] is a motivating factor for talent drain, with the vast majority of big players in tech—namely ones that are reported as attractive for new grads—being based in the US.

[207] *"The tech brain drain and talent shortage in Canada", Randstad, 2019, https://www.randstad.ca/employers/workplace-insights/job-market-in-canada/the-tech-brain-drain-and-talent-shortage-in-canada/*
[208] *Ibid.*

INNOVATION DRAIN

Tied to talent drain, innovation drain is another threat to the growth of Canada's blockchain ecosystem. Although some of this may be mitigated by increasing R&D funding for innovative startups in Canada, Canada must focus on scaling up and helping small and medium sized companies grow, commercialize, and penetrate international markets. For blockchain specifically, regulation plays an important role. Regulatory uncertainty is still a key impediment to blockchain expansion in a lot of large economies. With the large funding hubs located in the US, Europe, and Asia,[209] and tax-friendly regimes in Switzerland,[210] Singapore,[211] and other countries, the risk of Canadian entrepreneurs relocating to more innovation-conducive regimes is very real.

While carefully crafted and competitive tax regimes need to be researched and compared to other jurisdictions, regulation is one area that Canada can strive to mend its reputation as a slow mover in tech. Some useful steps in this direction would be to increase public-private blockchain pilot projects like Project Jasper,[212] to be more proactive in the use of flexible policy tools like developing standards for blockchain and distributed ledger technology, and to foster multi-lateral and international cooperation in blockchain regulation.[213]

> Canada has potential for investment and product development. This technology more than others is very global—it is extremely common for members of an organization to come from multiple countries. Canada is 'global friendly' compared to other countries. [But] people do not have strong country alliances. Most of the people I know that work out of a given country spend time in other countries. [There is a] kind of jurisdiction shopping—[looking for] the best country for regulatory purposes.
>
> Right now, Canada is probably around a 5 on a scale of 0–10, it's not a 0, [so] it's not something that is going to scare off every investor. It's not a 10, [so] it's not a magnet to draw everyone from around the world. It's in the middle.
>
> **— Cofounder and Researcher, Digital Technology, USA**

> If regulation has too heavy of a hand in the space, then it could essentially kill the blockchain industry in Canada and have it move to more regulatory friendly places, which is not something I personally would like to see. And so as long as regulation doesn't have too heavy of a hand, then Canada has all the other right ingredients to foster growth.
>
> **— Innovation Lead, Financial Services, USA**

[209] *Lawrence Lundy and Joel John, "Investments in Blockchains 2019", Outlier Ventures, August 2019, https://outlierventures.io/research/investments-in-blockchains-2019-23-7-billion-raised-by-3738-blockchain-companies-since-2013/*
[210] *The Economist, "Tales from the crypto-nation", February 24,2018, https://www.economist.com/finance-and-economics/2018/02/24/a-banking-centre-seeks-to-reinvent-itself*
[211] *Wolfie Zhao, "Singapore's Tax Agency Proposes to Exempt Cryptos From GST", Coindesk, July 8, 2019, https://www.coindesk.com/singapore-proposes-to-end-double-tax-on-cryptocurrencies*
[212] *"Digital Currencies and Fintech: projects", Bank of Canada, https://www.bankofcanada.ca/research/digital-currencies-and-fintech/projects/*
[213] *Michael Crawford and Danielle Pineda. "Inside the Black Blocks", Mowat Centre, August 2018, https://munkschool.utoronto.ca/mowatcentre/wp-content/uploads/publications/168_inside_the_black_blocks.pdf*