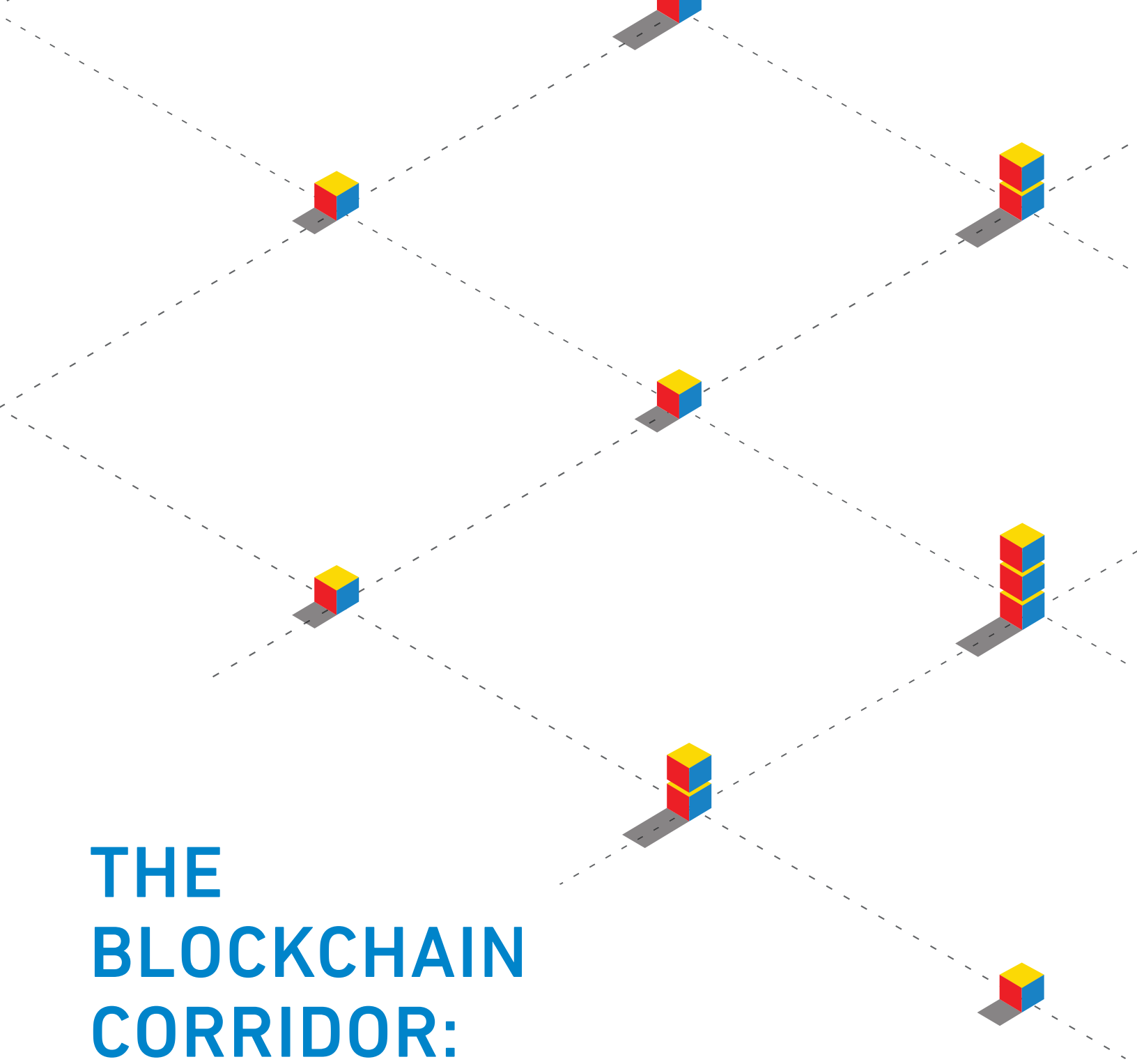

THE BLOCKCHAIN CORRIDOR:

Building an Innovation Economy in the 2nd Era of the Internet

Don Tapscott and Alex Tapscott | The Tapscott Group

Tuesday, Feb 7, 2017

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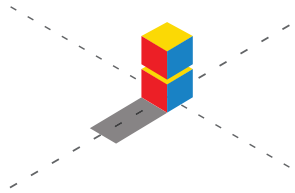
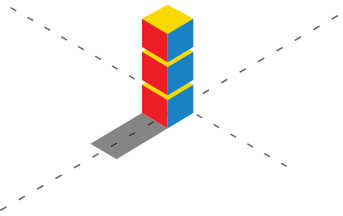
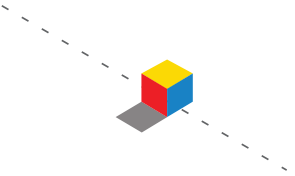
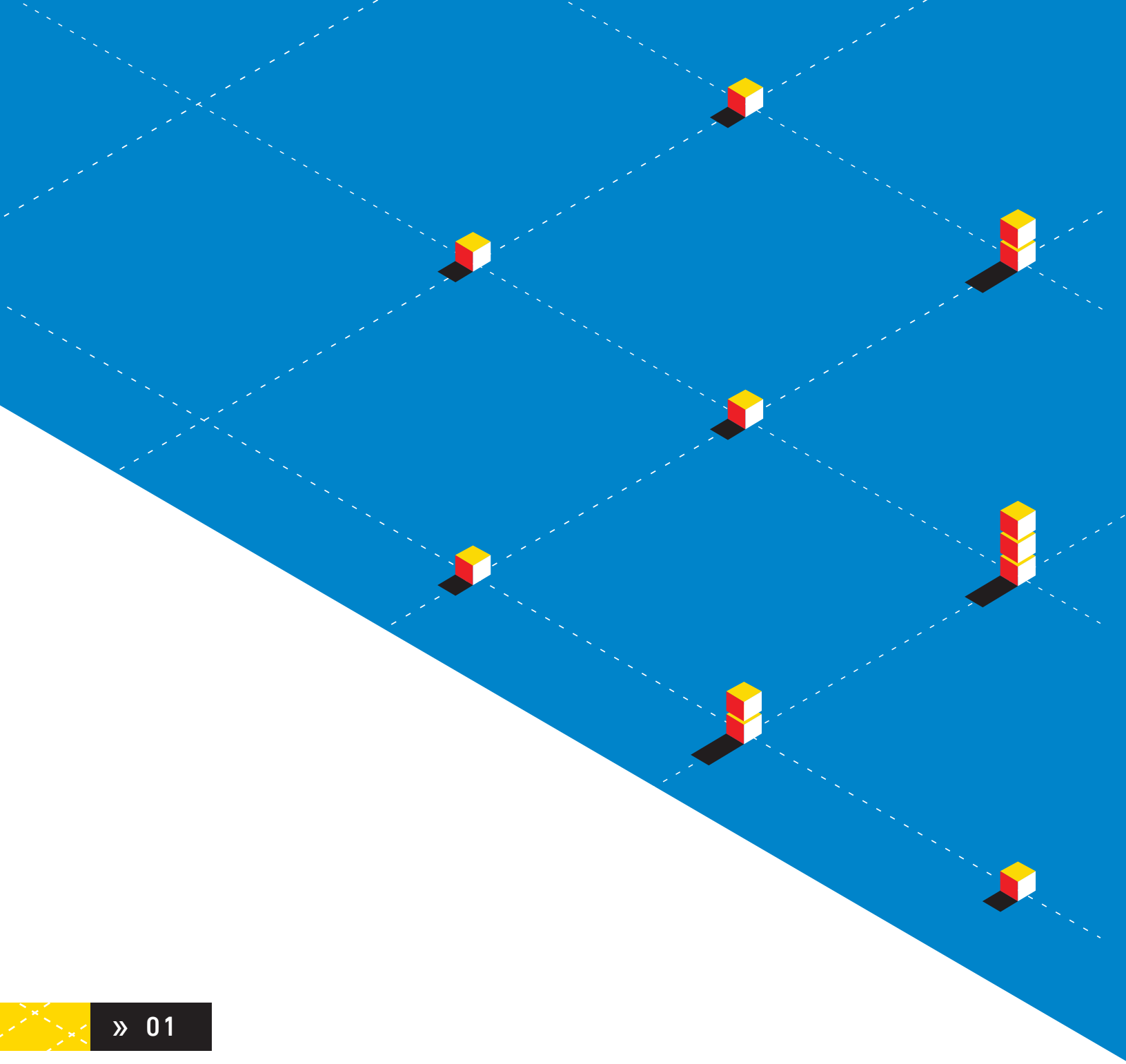








» 01

EXECUTIVE SUMMARY

The internet is entering a second generation and it is feasible that the vast ecosystem for this new era of technology could be based on Canada. Canada, in particular Ontario, is building strong clusters in artificial intelligence and quantum computing. The third leg of the stool is the technology underlying crypto-currencies – the blockchain. Along with its key applications like fintech, this new development of the digital age can be at the heart of a vibrant Innovation economy for Canada.

The first generation of the digital revolution brought us the internet of information. The second generation – powered by blockchain technology – is bringing us the internet of value: a new, distributed platform that will help us reshape the world of business and transform the old order of human affairs for the better.

As with all revolutions, there will be winners and losers. But if we do this right, blockchain technology can usher in a halcyon age of prosperity for all, and Canada will lead the way.

In internet parlance, this is "1993" for blockchain – the beginning of profound change. The coming decade will see blockchain technology impacting the way we do business, govern, communicate, manage our affairs and build value. In the process, industries will change, companies will be upended and through that creative destruction, untold value will be created.

The second generation of the internet presents Canada with a unique opportunity to lead this revolution, and to chart a path to an innovation economy built to last.

The first generation of the internet centered on Silicon Valley, which today is home to many of the world's largest Internet companies, and has become an engine of innovation, financing, incubation and acceleration of entrepreneurial activity and business transformation.

It is not yet clear where the second generation of the internet based on blockchain,and that includes so-called "Fintech," will be centered. What is clear, however, is that Canada today has a head start and thus a rare opportunity to be that global hub or, at least, one of a handful of such hubs. But for that to happen, a number of things need to change.

This report is the culmination of a project that aims to turn this vision into reality. The project has comprised three main elements:

- A blockchain strategy roundtable, held in Toronto on December 19 2016. Attended by more than 40 policymakers, entrepreneurs and other experts, the session focused on how Canada can become a world leader in blockchain technology. The list of attendees can be found in **Appendix A.**
- Secondary research on the state of the digital economy in Canada.
- Interviews with key stakeholders.

Our over-riding conclusion is that the Blockchain Revolution is well underway and gathering strength. Even so, much work remains to be done before the technology becomes widely accepted by everyday consumers and by companies and governments. Even as blockchain entrepreneurs work on advancing the technology, they need to come up with new applications that will broaden the technology's appeal.

The good news for Canada is that we already have a solid base to build on. The Tech North corridor between Toronto and Kitchener-Waterloo is emerging, as a recent NEXT Canada study puts it, as Canada's first "technology supercluster." This region is already a world leader in quantum physics and artificial intelligence. Blockchain, including financial services technology known as fintech, is ideally placed to be the third leg of the Tech North stool.

Canadian entrepreneurs have been on the leading edge of blockchain innovation from the start. Ethereum, Canada's least-known "unicorn," recently surpassed one billion dollars in value. Among others, Consensus Systems, run by Canadian CEO

Joseph Lubin, is building decentralized applications that could transform a number of industries- from financial services, audit, and professional services to manufacturing, telecommunications, music and film. Many of the bitcoin core developers are Canadian and many work in the start-up community. A growing constellation of entrepreneurs and technologists (Paycase, Protocol Fund, Tendermint, Nuco, Smartwallet, BlockStream, and many others) are trying to build the future with companies in Toronto, Vancouver, Montreal and elsewhere.

Blockchain enables far reaching changes to banking and the financial services industry and Canada also has strong financial institutions capable of embracing this technology to become the most innovative companies in the financial sector. We have a growing number of powerful incubators and accelerators, such as the Ryerson DMZ, rated #1 in North America. Canada is already the centre of global thought leadership on all things blockchain.

What's more, Blockchain dovetails with the priorities of all levels of government in Canada, from kick-starting innovation, to improving how those governments interact with citizens.

"Blockchain is a great example of innovative technology, and Canada has the opportunity to become a leader in its development. My goal is to support innovation in Canada by creating an environment where emerging technologies such as Blockchain can flourish, while at the same time protecting consumers when they use new and innovative technologies."

NAVDEEP BAINS
Minister of Innovation, Science and Economic Development

However, Canada needs to overcome several obstacles if it is to cement its leadership role in blockchain technology. Among them:

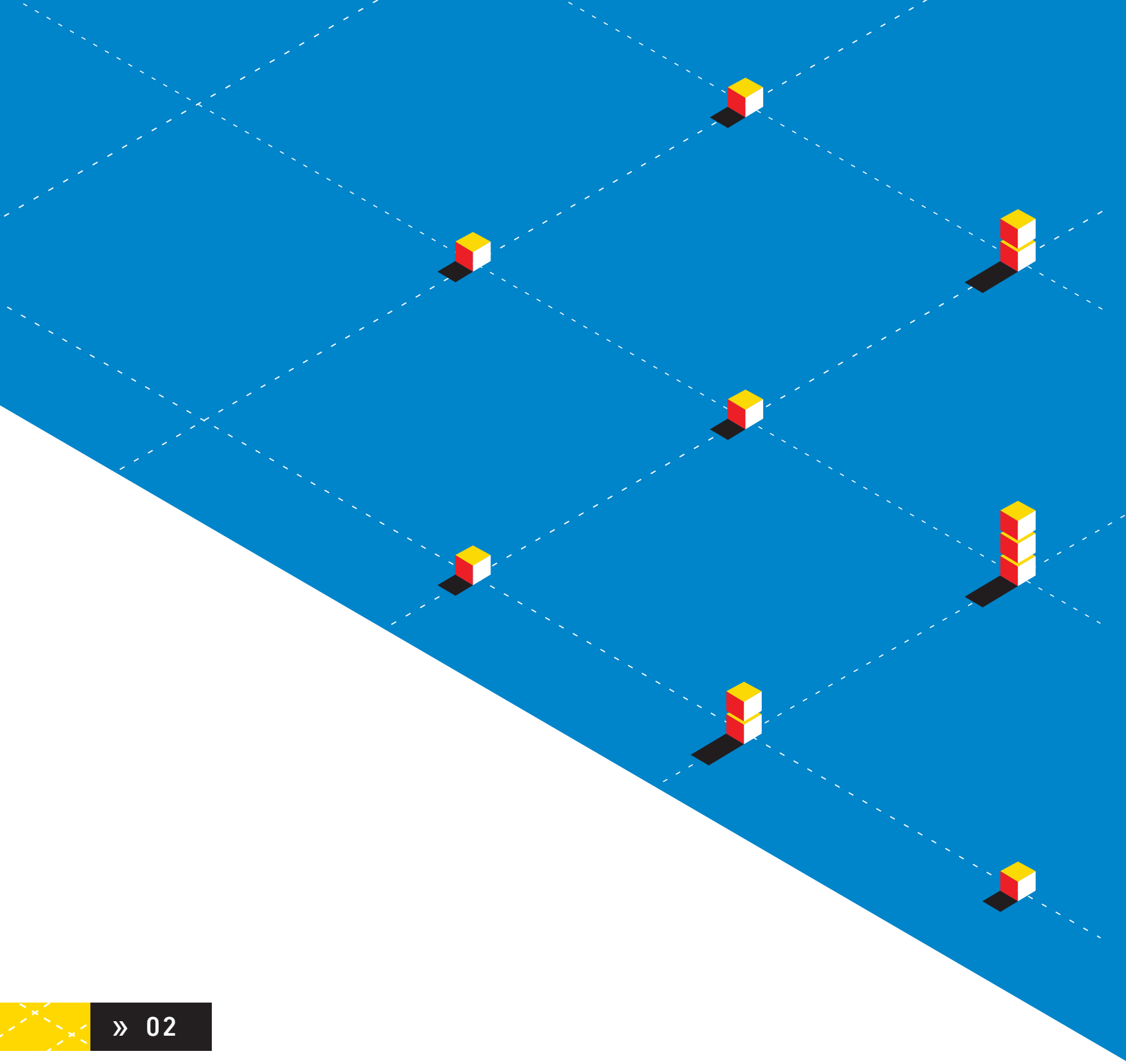
- Developing a clear strategy to ensure the blockchain era thrives in Canada
- Creating a broader base of support for blockchain
- Resolving funding bottlenecks in the start-up space across all industries
- Moving beyond a culture of risk aversion in some large Canadian institutions
- Improving research and development spending
- Addressing policy and regulatory issues
- Ending the brain drain
- Ending the startup drain

All stakeholders need to move forward without delay to alleviate these handicaps and identify specific niches where Canada has the competitive edge to be a leader. Collaboration is essential. We have much to learn from other jurisdictions—notably the U.K., Australia, Singapore, Dubai and Hong Kong—that have recognized blockchain's potential and have moved decisively to turn it into reality.

This report outlines a number of proposals to cement Canada's position as a global leader in blockchain technology:

- A Canadian digital economy commission
- Blockchain-tracked, flow-through share incentives to spur blockchain R&D
- A blockchain research institute
- A blockchain centre of excellence to complete the Tech North Corridor
- A fintech supercluster to establish Canada as the global leader
- Protect and expand access to the U.S. market
- Engage governments as model blockchain users
- Change the culture to create awareness and support risk-taking and innovation

We cannot afford to be complacent, nor is time on our side. Canada's leading position in the Blockchain Revolution could quickly evaporate as other hotbeds around the world, such as Berlin, Singapore, Shanghai, Tokyo, Sydney, London, and New York (to say nothing of Silicon Valley) race ahead. The time to act is now.



» 02

BACKGROUND: THE BLOCKCHAIN REVOLUTION HAS BEGUN

The Tapscott Group convened a meeting of senior business, government, and civil society leaders on December 19 2016 to explore the ways blockchain technology will transform money, business, government and society, and to answer the crucial question: Can Canada be the centre for the next era of the internet? We conducted an informal poll among roundtable participants on the potential of blockchain. The overwhelming view was that it will be transformative – the full results of these polls can be found in **Appendices B and C.**

"The combined effect of AI, cloud, sophisticated analytics and blockchain will have far-reaching potential for businesses and governments, in terms of how work is done and new avenues for growth."

BILL MORRIS
Canada President and Senior Managing Director, Accenture

"At IBM, we believe Blockchain will do for transactions what the Internet did for information."

DEBBIE LANDERS
vice-president for innovation investments, IBM Canada

(Note: all pull quotes are from interviewes conducted by the project team or comments made at the December 19. 2016 Blockchain Revolution Executive Roundtable in Toronto.)

"We're trying to apply blockchain as a solution to our current problems. We need to step back and be more open to doing business in a completely different way and looking at different business models."

DUBIE CUNNINGHAM
vice-president for innovation and digital banking, Bank of Nova Scotia

The internet is entering a second era—one that opens new horizons to a prosperous future. Yes, the digital revolution has already brought countless wonders. The internet, the web, social media, mobile computing, big data and the Cloud have paved the way for advancements in virtually every aspect of life. Yet these breakthroughs have barely scratched the surface of the internet's potential, especially when it comes to businesses and consumers.

The deep structures of corporations have changed little since the industrial age. Hierarchy, vertical integration and bureaucracy remain its hallmarks. What's more, the digital revolution has had little positive impact so far on overall living standards. Instead, we have seen wealth creation without commensurate job creation, and social inequality in many OECD countries. Privacy, the foundation of a free society, is being undermined by data frackers—conglomerates that mine vast pools of digital information, selling much of what they extract. Most people on the planet have yet to benefit from the digital economy; two billion of them don't even have a bank account.

Technology has contributed to the problem. At the annual meeting of the World Economic Forum in Davos, former Secretary of State John Kerry cited research that fully 85 percent of US job losses were due to technology and not outsourcing. Now with a new round of automation, robotics and disruptive business models are wiping out vast chunks of the workforce.

The internet of information also broke our intellectual property models, as people and organization published assets (of value to their owners) like music, undermining the rights and compensation for the value creators.

What if, in addition to the existing internet of information, we also had an Internet of value —a vast global ledger, available to everyone, that we could use to store, exchange and manage securely and privately any asset or thing of value – from money, stocks and bonds to music, votes, titles and deeds and intellectual property? What if we could build businesses and conduct transactions directly among ourselves with less friction from powerful outside intermediaries like banks, brokers and governments? And what if some Canadian institutions like our banks or governments were to embrace this technology to revamp their operations, cut costs, increase the metabolism of commerce and create new value for their stakeholders?

This new version of the internet is now taking shape. The digital revolution is ushering in a radically different platform that can take us through the next quarter century of human progress. At its core is blockchain—the technology underlying the digital currency bitcoin and the most exciting innovation in computer science in a generation.

Blockchain is open and programmable. As such, it holds the potential for unleashing countless new applications and capabilities that could transform our everyday lives.

At its most basic, blockchain is an incorruptible global database. It can provide a digital ledger programmed to record not just our financial transactions but every item of value in our lives: birth and death certificates, marriage licenses, deeds and titles of ownership, educational degrees, financial accounts, medical procedures, insurance claims, votes, transactions between smart objects….and everything else that can be expressed in code. Blockchain data represents the ultimate in accuracy because mass collaboration constantly reconciles it. We will not need to trust each other in the traditional sense, because blockchain guarantees integrity. Think of it as trust achieved through clever code and mass collaboration.

Some scholars argue that the invention of double-entry bookkeeping enabled the rise of capitalism, the nation-state and the modern economic order. Blockchain represents a similarly momentous leap forward: a transparent, incorruptible and global real-time reconciliation of digital transactions in every kind of commerce. Call it the digital reconciliation.

At the same time, it's important to note that blockchain has the ability to complement and strengthen current business models. It will enhance security and safety while allowing users to reduce costs. Blockchain is not a threat. Rather, it represents a massive opportunity for those who embrace it.

That is already clear in the financial services industry, where leaders—including Canada's big banks, insurers, pension funds and others— are coming to recognize blockchain's transformative benefits. Consider the implications of a vast global and distributed ledger running on millions of devices and open to anyone, where not just information but anything of ***value*** – money, equities, bonds and other financial assets, titles, deeds, intellectual property, even votes – can be moved and stored securely and privately, and where trust is established not by powerful intermediaries but through mass collaboration and clever code. This new native digital medium for value would act as a ledger of accounts, database, notary, sentry and clearing house, all operated through a consensus mechanism. This technology holds the potential to make financial markets radically more efficient, secure, inclusive and transparent.

Individuals also have much to gain. Blockchain represents a conduit for peer-to-peer interaction, enabling us to cut red tape and cost in our everyday dealings with businesses and governments without sacrificing security or privacy. It will be simpler, faster and cheaper to conduct our banking transactions, pay our taxes and apply for municipal licences—to give just three examples.

The opportunities — and potential risks — are immense. Blockchain may enable incumbents to do more with less, expand their services, reduce risk and cut costs. But it also radically lowers barriers for new-entrants to create alternatives to the conventional financial industry, challenging incumbents in virtually every market where they operate.

Blockchain began as the enabling technology of bitcoin, but has since expanded into a far larger ecosystem of technologies. Take, for example, Hyperledger, a project founded by the Linux Foundation, which counts hundreds of large organizations, such as Accenture, IBM, Thomson Reuters and dozens of banks as members. Their goal is to build enterprise grade blockchain technology that could be implemented in every industry in the economy. Another blockchain called Ethereum, founded in Canada, is pioneering a radical new technology called smart-contracts, which could simplify and streamline business logic inside and between organizations and enable totally new business models. Today much of the innovation on this platform is happening through partnerships between startups

and large corporations. R3, a consortium of many of the world's largest banks, is pioneering innovations like real-time digital settlement and digital fiat currencies. Canada's five big banks are all members and have launched a trial with the Bank of Canada to develop a digital loonie. Look a bit further and you'll find companies like Digital Asset Holdings, run by Blythe Masters, former CEO of JP Morgan's investment bank; Nuco, run by Matthew Spoke, who ran the blockchain practice at Deloitte Canada; and Chain, which counts NASDAQ and VISA as investors, building private blockchain solutions for businesses like banking, manufacturing and energy providers.

Bitcoin provided the spark, but this wildfire of innovation is the result of breakneck progress by innovators, entrepreneurs and big business alike. And these examples are only scratching the surface. All the core functions of financial intermediaries are poised to be transformed; the industry's leaders and new-entrants alike will have little choice but to find a way of harnessing blockchain technology.

Interest in blockchain across other sectors and in government is spreading fast in Canada, and beyond our borders. Our recent book ***Blockchain Revolution: How the Technology Behind Bitcoin is Changing Money, Business and the World*** cites many examples of how governments and businesses are putting the technology to practical use in people's everyday lives. To cite just one recent development that illustrates the speed of this revolution around the world: Deloitte, the international consultancy, recently opened a blockchain lab in the Silicon Docks neighbourhood of Dublin, Ireland. The firm now has more than 800 staffers worldwide working on blockchain-related initiatives. Canada dare not be left behind.

SOME BLOCKCHAIN CHALLENGES

As described above, the Blockchain Revolution will bring an abundance of benefits to governments, businesses and consumers. But like every revolutionary technology, it comes with challenges and shortcomings that we need to acknowledge and address. Below are some of the common criticisms. But before dismissing all things blockchain, ask yourself: Are these fatal flaws, or implementation challenges to overcome? We are confident it's the latter.

» **The technology is not ready for prime time.** If everyone rushed to get bitcoin for example, the blockchain would become unstable: its infrastructure lacks the transactional capacity to on-board millions of people. Many interfaces are user-*unfriendly*, requiring a high tolerance for alphanumeric code, and users lack legal recourse because the law has yet to rule on the irrevocability of transactions and smart contracts.

» **The energy consumed is unsustainable.** The proof-of-work method used to secure the bitcoin network involves hashing, the process of running pending transactions through a secure hash algorithm (SHA-256) to create a hash (a digital digest) that solves a puzzle. But hashing burns a lot of electricity, and the trend is toward more hashing.

» **Governments will stifle it.** Where governments have undermined centrally- controlled networks like Napster, pure peer-to-peer networks like Tor have persisted. Will the bitcoin blockchain network hold its own against mighty central authorities? There must be a stable approach to regulation, legislation, and negotiation of treaties to minimize uncertainty, so that investors will continue to support development.

» **Powerful incumbents will usurp it.** Corporations captured and are now using the internet in their private empires to extract most of its value. Will incumbents defend their territory, lobbying so that onerous regulations apply to small start-ups and suing any start-up that survives the regulatory inquisition?

» **Incentives are inadequate for distributed mass collaboration.** Bitcoin miners have an incentive to secure the bitcoin network because, if it failed, all the unconverted bitcoin earned by mining would be at risk. So any design change must set appropriate incentives to maintain miner decentralization. But is that possible? The number of new bitcoins that miners can earn halves every four years. What will happen when the reward drops to zero?

» **Blockchain is a job killer.** A global platform that drops the cost of participating and establishing trust could attract more participants—not only enabling entrepreneurs to raise capital, rent assets, and create jobs in poor communities but also improving the delivery of aid and reducing corruption, a precondition for jobs.

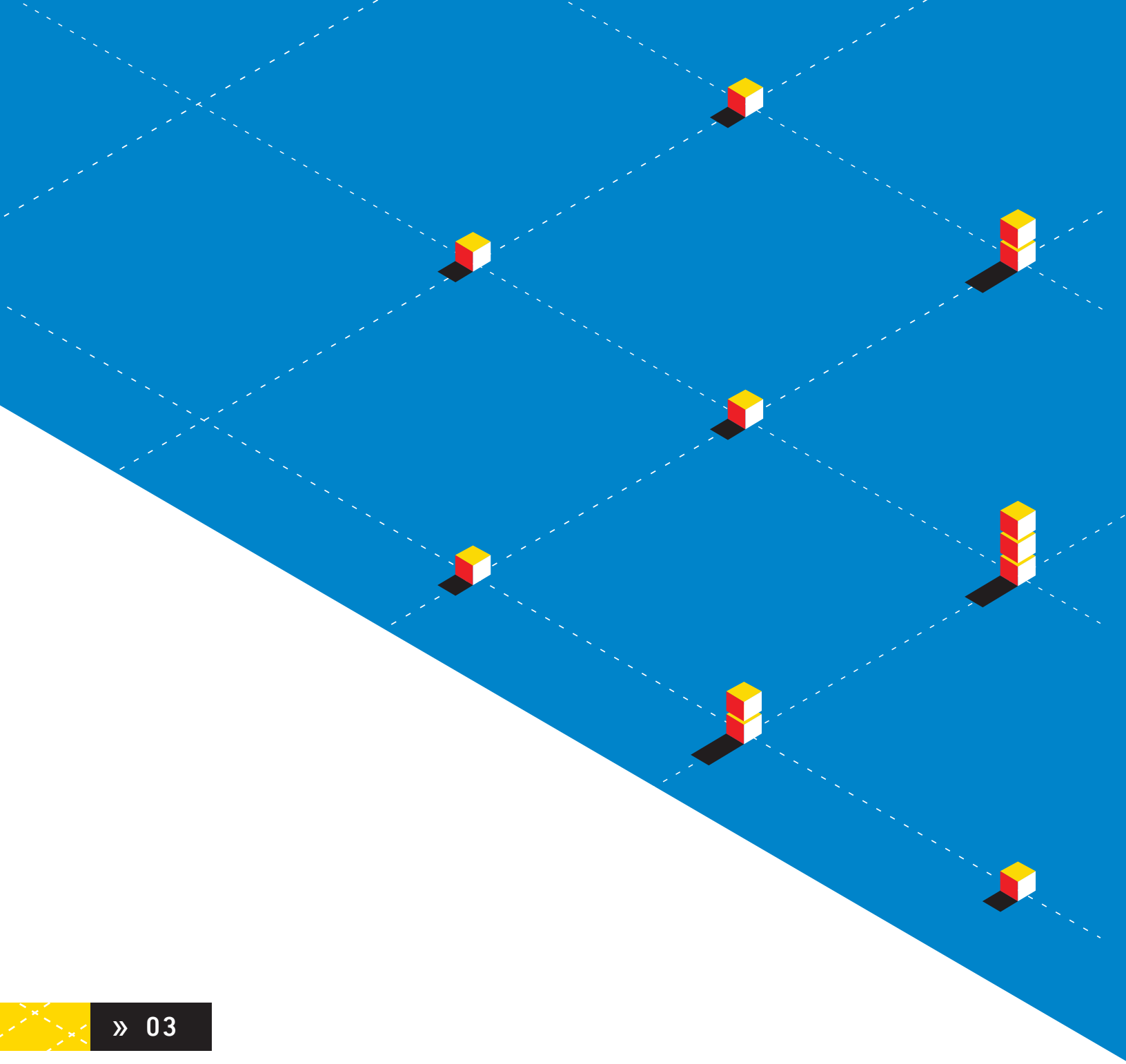
» **Governing the protocols is like herding cats.** Unlike the internet, the bitcoin community lacks formal oversight bodies to anticipate needs and guide their resolution. Community members prefer it that way but cannot agree on a way forward. If we don't address governance, then the movement could collapse on itself as it disintegrates into warring factions.

» **Distributed autonomous agents will form Skynet.** According to researchers in artificial intelligence, we are years, not decades, away from autonomous offensive weapons and militarized drones. How should society govern them? We recommend that app developers identify any significant public impact—good, bad, or neutral—and alter source code and designs accordingly.

» **Big Brother is (still) watching you.** While blockchains ensure a degree of anonymity, they provide a degree of openness. Corporations and countries known for spying will likely redouble their efforts because value is involved. Imagine a big bull's-eye on top of the internet. The good news is that shenanigans are transparent on the blockchain.

» **Criminals will use it.** Criminals have always embraced new technologies as first users – from the automobile, to the internet to cellphones. So is the case with blockchain. There is nothing unique to blockchain technology that makes it more attractive to criminals than other technologies. The most sophisticated authorities in general believe that digital currencies could help law enforcement to fight cybercrime by providing a record of suspicious activities.

We have conducted a detailed analysis of these and other challenges. You can find them in chapter 10 of our book, **Blockchain Revolution.** On balance, the arc of technological history has been positive. Consider the many advances in medicine, from R&D to treatment and prevention: technology has made for greater human equity, productive capability, and social progress. Leaders of this new distributed paradigm must stake their claim and initiate a wave of economic and institutional innovation so that everyone has an opportunity. Canada has a special opportunity to do so.



» 03

CANADA AS A GLOBAL HUB FOR THE INTERNET'S SECOND ERA

The consensus from the roundtable and our other research is that Canada has the talent, capital and other resources to position itself as a global blockchain hub. Toronto is home to five powerful, stable and well-managed banks. We have a well-educated population and world-renowned universities with respected computer science departments. A strong stable of innovative entrepreneurs is emerging as more young people seek careers as business builders. Not least, we have the benefit of stable and well-managed governments at all levels, with little of the upheaval and uncertainty roiling other countries, including the U.S.

EY, the global consultancy, estimated in a February 2017 study that at least 44 financial technology firms attracted investment in Canada in 2015. These investments totaled almost $695 million, nearly matching investment in the U.K.This continues a sharply upward trend. Fintech investment in Canada grew at an annual pace of 35% between 2012 and 2014, and quadrupled in 2014-15.[1]

Ontario is in an especially strong position to help shape and lead this emerging technology, in the process building tangible value for the entire Canadian economy. NEXT Canada, a group of business leaders and academics, noted in a December 2016 report that "Canada's nascent technology supercluster in the Toronto-Waterloo region has the potential to become one of the world's top innovation ecosystems." [2]

The NEXT Canada study notes that the Toronto-Waterloo corridor is already a world leader in quantum physics and artificial intelligence. Our research suggests that blockchain, including other fast-growing field of financial services technologies, known as fintech, is ideally placed to be the third leg of this supercluster.

A Blockchain Corridor would turbo-charge the region's economy in much the same way as Facebook, Apple, Netflix and Google—commonly abbreviated to FANG—have helped put a rocket under Silicon Valley. The region would draw talent from around the world, turning a often-lamented brain drain into a brain gain. A hub of expertise along these lines would help propel the Blockchain Revolution across a wide range of businesses and governments, giving Canada a head start as the second generation of the internet unfolds. New export markets will open up, creating a virtuous circle as the Blockchain Corridor spurs innovation in small-business financing, entrepreneurship and research into new applications.

Below are some of the benefits that Canada, and especially the Toronto-Waterloo corridor, can offer.

A STRONG FINANCIAL SECTOR

Ontario's financial services sector is the second largest in North America, after New York, measured by employment. Combined, Ontario's financial services industry employs more than 380,000 people in the province. Besides the big five banks, all based in Toronto, Ontario is home to some of the world's biggest pension funds and to the Toronto Stock Exchange. These institutions are well placed to cooperate in blockchain development to an extent that few of their counterparts in other parts of the world are able or willing to do. Unlike in the U.S. or other G8 countries in Canada our financial service industry is dominated by a few large players who operate in a relatively streamlined business environment and as peers they could collaborate to do nothing less than reinvent the financial services industry.

TALENT AND DIVERSITY

"Canada has become one of the most accepting countries to cultures and people. Toronto is very much the most diverse city in the world right now. That's created a lot of tolerance among people, and collaboration that you don't see anywhere else. That hunger, that creativity, that level of enthusiasm...putting all that into play is the power of diversity."

ABDULLAH SNOBAR
executive director, DMZ,
Ryerson University

The Greater Toronto Area offers access to a vast pool of skilled workers, including many talented immigrants, with high living standards. Canada makes an impressive showing in the OECD's latest PISA global education survey, which tested over half a million 15-year old students in 72 countries in science, math and collaborative problem-solving. Canada is one of only eight countries in the 2015 rankings where at least nine out of ten 15-year-olds have mastered the basics that every student should know before leaving school. While the survey ranks Canada seventh in science education, Australia places 14th, the U.K. 15th, and the U.S. only 25th. Canada also scores well above these countries in math education. What's more, Canada is one of just five jurisdictions that achieve both high standards of excellence overall and equity in education outcomes.[3]

Many studies have noted that Canada has a critical mass of universities, colleges and incubators to supply the needs of a fast-growing technology cluster. The universities include, but are not limited to: University of Toronto, McMaster University, University of Waterloo, Wilfrid Laurier University, York University, Ryerson University, Conestoga College, Trent University, and University of Guelph. Startup incubators in the region include: Communitech, the MaRS Discovery District, Velocity at University of Waterloo, DMZ at Ryerson, NEXT Canada, and Creative Destruction Lab at the Rotman School of Management, along with several other University of Toronto entrepreneur centres. OneEleven, backed by the Ontario Municipal Employees Retirement System (OMERS), one of North America's biggest pension funds, is a post-seed funding tech accelerator that brings together venture capitalists, companies, government, academia and the most ambitious tech founders to scale up of its portfolio companies. OMERS is also one of Canada's largest and most active venture capital investors.

These organizations already enjoy an enviable reputation, both in Canada and beyond our borders. Ryerson's DMZ has been ranked the number one university incubator in North America and third in the world by UBI Global. The University of Waterloo is a prime source of recruits for some of the world's most admired companies, such as Google and Microsoft. The Waterloo-based Communitech hub served 907 companies in 2016, of which 717 were start-ups. Tenants at MaRS now include such well-known firms as Autodesk, Facebook Canada, Etsy, Airbnb and JLABS, a division of Johnson & Johnson Innovation. The list goes on.

Canada's diversity is a crucial piece of our talent advantage. According to Statistics Canada's National Household Survey, 22% of the population was born outside Canada, the highest proportion of any major industrialized country.[4] Toronto is often described as the world's most multicultural city, ahead of Brussels, Auckland, London and Los Angeles. According to one report, more than half of its residents were born outside Canada.[5]

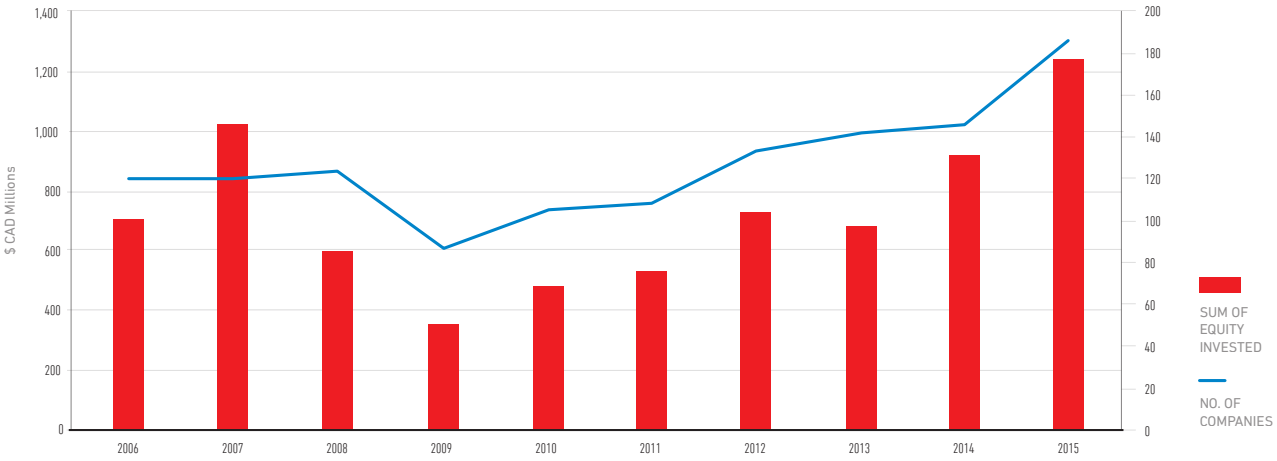
This diversity brings not only talent but also tolerance for unfamiliar ideas and a willingness to collaborate on unfamiliar terrain—all vital components of innovation. Abdullah Snobar, executive director of Ryerson University's DMZ incubator, who immigrated to Canada from Jordan, cites the example of an 11 year-old girl from Afghanistan who has come up with the idea of using 3D printing to produce Barbie dolls in various shapes, sizes and colours.

Lastly, Canada is already the centre of global thought leadership on blockchain opportunities and use-cases. Our book ***Blockchain Revolution*** has sold more copies than all other books on the topic combined. Since its publication in May 2016, it has been the #1 book on all pertinent categories on the U.S. amazon.com, including banking and digital currencies. It has been translated into 14 languages worldwide, including Chinese, Japanese, Korean, Spanish, and German.

IMPROVED INVESTMENT CLIMATE

Venture capital investment, the kind needed to spur development of blockchain applications, is accelerating. Thomson Reuters' Venture Capital Review reports that venture capital activity in Canada grew by 36% in 2016 to $3.7bn, the highest in 15 years. The advance was led by Ontario, with a 49% surge in activity, making it the fourth biggest state or province in North America for venture capital investment, behind only California, New York and Massachusetts. What's more, Toronto posted the highest increase in activity among all North American cities. Indeed, Toronto, with a 52.7% jump was one of only two large cities to post a growth in venture capital last year. (The other was the Orange County metropolitan area in California.) [6]

Figure 1: INVESTMENTS IN ONTARIO 2006-15



Source: Ontario government

FINTECH INNOVATION

Canada's big banks are already embracing blockchain. Linda Mantia, RBC's executive vice-president for digital, payments and cards, told CoinDesk in February 2016: "If you look at every major advancement enabled by technology, there's always hype. Eighty percent of the money won't make it, but the last 20% can be massive. At the end of every hype there's something transformative." She added that RBC would not shy away from the opportunities and risks involved: "No one wants to miss it. If you don't hop on the hype bandwagon, you'll be left behind." [7]

The banks and other financial institutions have begun work on a wide range of blockchain applications, often in partnership with much smaller, entrepreneurial firms. Some examples:

» RBC, CIBC, National Bank of Canada and ATB Financial, have joined a network created by San Francisco-based Ripple Labs that aims to use blockchain to speed up cross-border payments from days to seconds. The Bank of Canada is also researching the technology. The Ripple network has recently advanced from an experimental to a pilot phase where partner banks are moving money among themselves and eliminating the financial middlemen that have traditionally verified cross-border transactions.

- Some banks have successfully used their loyalty and internal rewards programs as blockchain guinea pigs.
- The Bank of Canada has said that it will publish the results of tests using a blockchain prototype and a digital currency in early 2017. The central bank has collaborated with Payments Canada, commercial banks and R3, a blockchain start-up. R3 has also taken part in experiments with more than a dozen European and U.S. banks. Besides its willingness to explore exploring blockchain, the Bank of Canada has taken an enlightened view of crypto-currencies, notably bitcoin. This positive stance by one of the world's most respected central banks strongly reinforces private sector efforts to raise Canada's profile as a blockchain hub. Carolyn Wilkins, deputy governor of the Bank of Canada, is viewed internationally as a leader on how this technology can transform banks. She and Alex Tapscott were chosen by the International Monetary Fund to be members of its founding advisory board on fintech innovation.
- In December 2016, the Royal Canadian Mint joined a blockchain platform run by Goldmoney, a subsidiary of Toronto-based BitGold. The deal marks the first time that mint-vaulted bullion can be traded on a private digital ledger. Goldmoney, which has more than a million users and $1.7-billion in client assets, said that the deal would enable investors and traders to circumvent the banking system with no settlement delays.

BLOCKCHAIN ENTREPRENEURSHIP

Beyond financial services, Canada—and especially Ontario— can make a big impact by supporting a fast-growing group of blockchain entrepreneurs. Under the right conditions, entrepreneurs are the engines of economic vitality in society. They bring fresh thinking to the marketplace and fuel the creative destruction that allows economies to prosper. Canadian entrepreneurs have been at the cutting edge of blockchain innovation from the start.

Consider Ethereum, the most successful startup in Canada you've never heard of. It was founded in 2014 by a 19-year old University of Waterloo dropout named Vitalik Buterin, a polymath and autodidact who saw the potential of blockchain long before most had awoken to the idea. Kick-started by a record-shattering crowd sale in 2014 where he raised US$18m in a global initial *coin* offering, Ethereum is now a certified "unicorn" valued at more than $1bn. It is used by dozens of Fortune 500 companies, among them, Microsoft, JP Morgan and BHP Billiton.

Ethereum is based on the premise that blockchain technology can do more than simply move and store value. Specifically, Ethereum pioneered smart contract technology, which, as its name suggests, is software that mimics the logic of contracts but with guaranteed execution, enforcement and payments. As a programmable platform capable of complex business logic like contracts, Ethereum has the potential to transform every industry and even transform how our institutions—from corporations to governments—function in the economy and society. Today, thousands of developers around the world are harnessing this uniquely Canadian invention to rethink everything from stock exchanges to supply chains.

Other Canadian blockchain and fintech pioneers include:

- Consensus Systems, run by Canadian CEO Joseph Lubin, is building decentralized applications that promise to shake the windows and rattle the walls of a dozen or more industries—from financial services, audit, and professional services to manufacturing, telecommunications, music and film.
- Toronto's MaRS Discovery District launched a fintech hub in February 2015 to work with the financial services sector and with start-ups to break new ground in financial services technology. IBM recently became the hub's first technology tenant, joining financial services companies such as CIBC, Manulife and payments processor Moneris.
- Some of the inudustry's most promising young start-ups, such as Nuco, Paycase, Tendermint and Protocol Fund are also based in the Toronto area.
- Major Canadian investment banking firms are raising funds for blockchain startups to help them manage their assets digitally, according to a report by the Digital Finance Institute and McCarthy Tetrault.

GOVERNMENT PRIORITIES

"It's wonderful that we have such a convergence of talent and opportunity in blockchain. This technology can be at the centre of an Ontario technology and innovation powerhouse."

CHARLES SOUSA
minister of finance, Ontario

In Canada, the Blockchain Revolution dovetails neatly with current public policy priorities. At the federal level, blockchain technology is an excellent opportunity for a "made in Canada" approach and fits neatly into the current government's priorities such as its Innovation Agenda.

As the 2016 budget noted: "*To drive growth, to improve the livelihoods of Canadians and to create jobs in areas including manufacturing, digital technology and renewable energy, Canada must be on the leading edge of this change. Innovation is today's driver of inclusive growth, and Canada must be in it to win*.... Canada will be propelled by its creative and entrepreneurial citizens; its leading science and technology; its excellent innovation infrastructure; and its globally competitive companies offering high-quality products and services, thriving within a business environment that supports commercialization and growth. Through 2016 and 2017, the Government will define a bold new plan, its Innovation Agenda, to achieve this vision."

Many of this report's recommendations fit well with the Innovation Agenda in terms of talent, financing, partnerships across businesses and industries, cluster formations, culture change and regulatory issues to spur the adoption of new technologies and innovation performance.

Blockchain is also relevant to the work being done by the government's advisory council on economic growth, launched in March 2016. This initiative, led by McKinsey & Co.'s global managing partner Dominic Barton, has already issued two reports on new ways for more Canadians to acquire the skills demanded by a global economy.[8] The finance department has used its consultations ahead of the 2017 budget to develop ideas on "preparing for the jobs of tomorrow" and "creating new opportunities for trade and investment from around the world." Blockchain ticks both these boxes.

Most provinces are also pulling out the stops in their search for ways to reduce dependence on resource extraction and traditional manufacturing. It is widely recognized that one of the best ways—if not, the best way—of achieving this goal is to encourage entrepreneurship and innovation in the digital economy.

The drive towards a more knowledge and innovation-based economy is especially vigorous in Ontario. Among the goals set out in Premier Kathleen Wynne's 2016 mandate letter to her minister of economic development and growth is "aggressively accelerating the growth of the innovation economy in Ontario including the successful scale-up of high-potential, high-growth companies." The mandate letter directs the minister to work "with the financial services community, including the Toronto Financial Services Alliance, to identify options that increase the amount of capital invested by financial institutions and pension plans in innovative, high-growth companies."

Brad Duguid, the minister of economic development and growth, told the Canadian Club in November 2016:

"Our challenge is to ensure that our entrepreneurs move those start-ups to scale ups and scale ups to global companies here in Ontario. That means helping our fast runners run faster and focusing on companies in Ontario with the greatest growth potential.

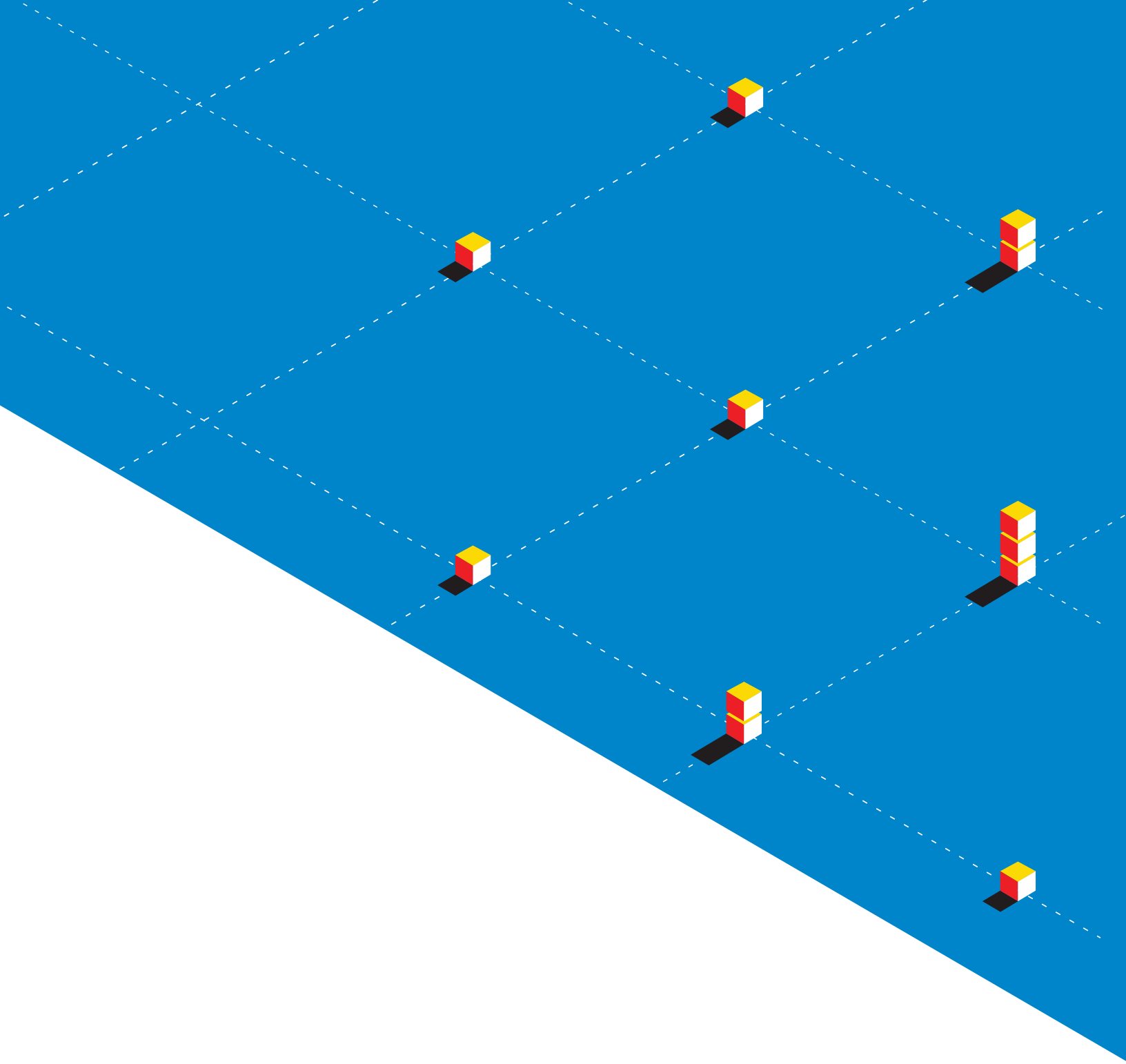
It says goodbye to the feel-good, spread-the-peanut-butter approach of government trying to be everything to every sector to every company. That approach might make us feel good but in this fiercely competitive global economy we must focus on where we're strongest.

Our world class tech, entrepreneurial and research talent, our globally competitive tax rates and R&D tax credits, and our thriving business climate are simply undeniable.

We've become a globally competitive hotbed of talent and disruptive technology.

So much so, that when I go abroad to attract investment to Ontario, it's no longer a sales pitch I'm giving. It's a compelling and factual business case." [9]

In a further affirmation of blockchain's potential, the Ontario government asked businesses and the public in December 2016 to help identify and improve financial services regulations that are unclear, outdated, redundant or unnecessarily costly. According to the government, the input will be used "to help make it simpler for businesses to interact with government, innovate and grow, without jeopardizing essential standards that protect the public interest."[10] There is little doubt that wider adoption of blockchain can turn that vision into reality.



» 04

CANADA'S SHORTCOMINGS

We heard repeatedly during the course of our research that Canada must not take its nascent advantages for granted. Participants at our round-table noted repeatedly that governments, banks and other players around the world are also racing to assert leadership in blockchain technology. Without decisive action, Canada will quickly fall behind and we will lose a truly golden opportunity.

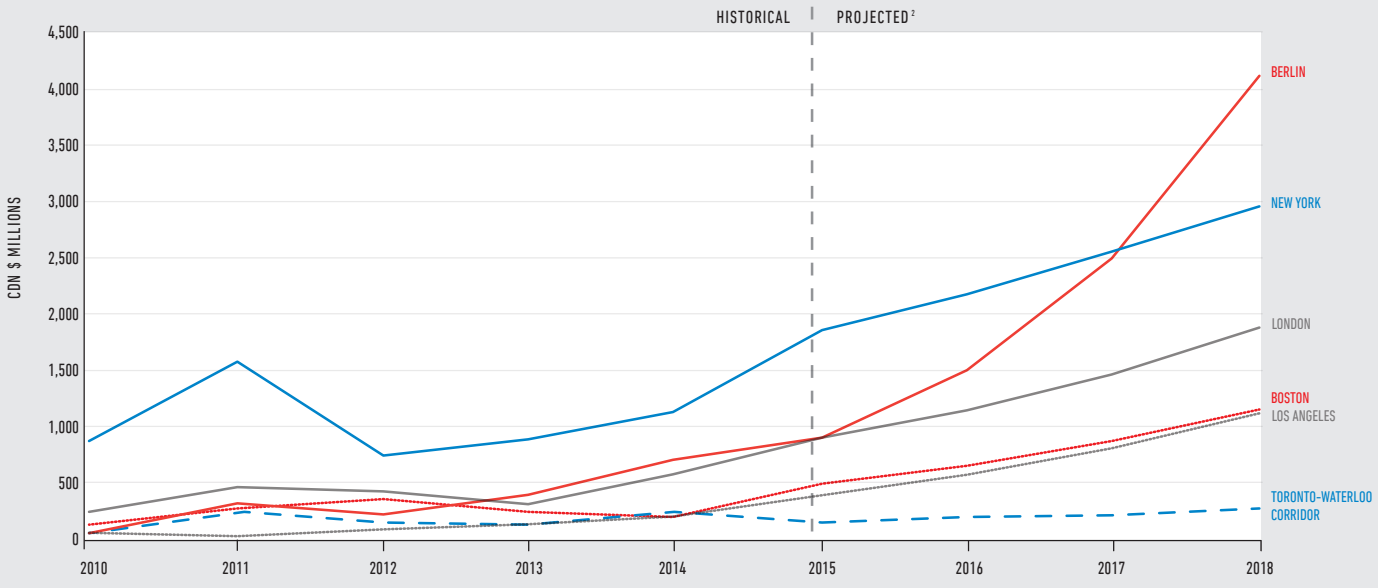
At the same time, Canada's drive to assert leadership in blockchain technology will have to overcome several hurdles. Some relate to the overall economy, and are thus more difficult to fix, but others are more specific to the financial services and technology sectors.

The NEXT Canada report notes that "Canada is losing the global competition to attract capital." In 2015, Canada attracted just 1% of global venture capital investments and about 2% of the capital invested in Europe and the U.S., well below its relative GDP. As the chart below shows, clusters like Boston and Los Angeles attracted almost three times as much venture capital investment as the Toronto-Waterloo region in 2015, and the gap is set to widen.

NEXT Canada also draws attention to the shortage of employees with hands-on experience scaling companies. A recent survey by the Lazaridis Institute found 53% of industry stakeholders cited insufficient executive and managerial talent as the primary impediment to scaling tech companies in Canada. NEXT Canada concludes: "To create the broad and deep talent pool needed to sustain a technology supercluster, bold reforms that will equip existing talent with the right skills and lead to a better access to global talent could be pursued."

Figure 2: VENTURE CAPITAL INVESTMENT: HISTORICAL/PROJECTED

CAPITAL IQ COMPANY SCREENING REPORT



1 Silicon Valley has been excluded to improve the readability and comparability of graph. Tech sector total VC investment in Silicon Valley is $7,462M in 2015 and growth multiple from 2010 to 2015 is 2.5x

2 Values projected using historical CAGR for the past 5 years

3 Largest technology firms by 2016 market capitalization

Source: Capital IQ Company Screening Report

Participants at the roundtable spent considerable time discussing these barriers. The following items reflect their views **(summary found in appendices B and C)** as well as our research findings.

A CLEAR NATIONAL STRATEGY

"The number one problem seems to be the lack of a champion for the fintech sector. At a recent meeting of 18 fintech stakeholders, the consensus was that we're lacking clear leadership from the top, especially at the federal level."

PROF MICHAEL KING
co-director, Digital Banking Lab,
Ivey Business School

"I haven't heard the narrative around the win for the consumer. We talk about post-settlement trade, and how we can streamline that. We talk about residential contracts, and how we can streamline that. It should start with consumers and how we're going to make their lives better. That's how we're going to truly transform using blockchain."

RIZWAN KHALFAN
chief digital and payments officer,
TD Bank Group

A key handicap—and one that this project is designed to address—is the absence of a clearly defined strategy for governments and other stakeholders to promote blockchain technology, and to ensure that its promise for Canada is fulfilled.

Much the same concern has been raised about other areas of financial technology. A report by the Innovation Policy Lab at the University of Toronto's Munk School of Global Affairs concluded in 2015: "Most successful ecosystems are the result of critical interventions by key actors and local leaders, often within the context of a supportive policy environment, but rarely led exclusively by public sector actors".[11] According to the study's authors, Canada's key challenge is to develop a vision of the interventions needed to cultivate and support the fintech ecosystem and to develop a strategy for what each stakeholder group can do to address them.

Roundtable participants expressed concern about Canada's tardiness in developing a blockchain strategy compared with the tangible moves made by other countries such as the U.K., Australia and Singapore. A November 2016 briefing note compiled by Prof Michael King, co-director of the Digital Banking Lab at Ivey Business School, and Amy Young of Upside Consulting, observed: "No Canadian government has taken ownership of fintech. Canada is at risk of pursuing a silo approach with multiple actors weighing in but no champion, similar to the USA and China, rather than the targeted approach of the U.K., Australia, Hong Kong and Singapore." [12]

The U.K. Treasury published a report in April 2016 compiled by Ernst & Young that compared the U.K. environment for fintech with other leading countries in the field. The Treasury responded by unveiling various commitments and actions to ensure that the U.K. develops and retains a vibrant and competitive fintech sector. A cornerstone of these measures was the creation of an industry-led panel to advise on fintech strategy and policy, and to identify specific niches where British fintechs can develop a competitive edge over their rivals in other parts of the world.

Similarly, the Australian government published a document titled *Backing Australian Fintech* in March 2016. The country's treasurer, or finance minister, made his ambitions crystal clear in the preamble: "I want to help create an environment for Australia's fintech sector where it can be both internationally competitive and play a central role in aiding the positive transformation of Australia's economy. The Turnbull government wants to offer home-grown and offshore fintech innovators an opportunity to develop and refine new products and services in the Australian market through a regulatory system that allows them to be frictionless through their scale journey while still becoming a regulatory match fit for deployment into domestic and global markets."

We have yet to hear such a decisive commitment from the Canadian authorities. Without one, we face an uphill struggle to capitalize on our many advantages.

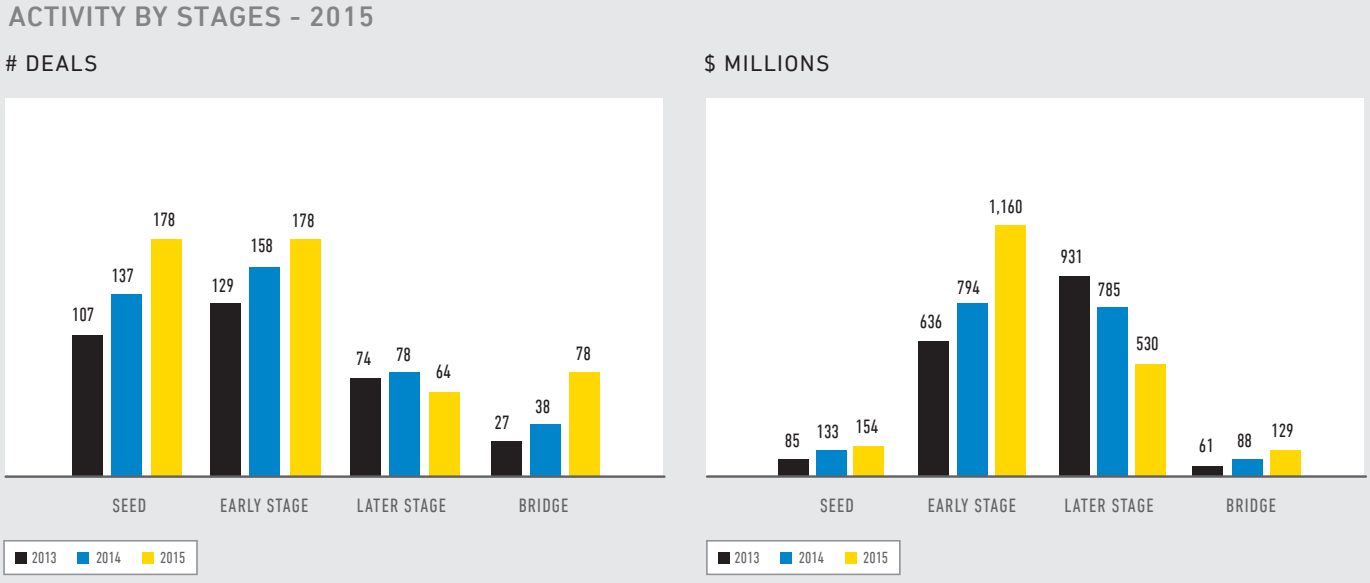
FUNDING BOTTLENECKS

"We do believe that partnering with fintech and the start-up community is a must. But in Canada, the framework has not matured to promote these partnerships, and that's a fundamental obstacle. In other jurisdictions, the industry collaboration with the fintech and start-up community is a lot more advanced. There is clearly a gap when you go from incubation to acceleration in Canada when it comes to funding, and that's another aspect of how this industry partnership is lacking."

RIZWAN KHALFAN
chief digital and payments officer,
TD Bank Group

Our research has uncovered compelling evidence that Canada lags many other countries, especially the U.S., in access to the financing needed to start up and expand successful technology companies in general, and blockchain firms in particular (see charts below). While roundtable participants generally agreed with this conclusion, the discussion suggested that lack of funding is not the prime obstacle to blockchain entrepreneurs. One problem in determining the importance of this issue is that accurate and comprehensive data is hard to come by, especially for specific technology sectors and for firms at various stages of growth.

Figure 3: FINANCING BY STAGE OF BUSINESS – 2015



Source: Canadian Venture Capital and Private Equity Association

Canadian entrepreneurs need access to several types of funding if they are to succeed in setting up a vibrant blockchain sector:

» **Angel capital.** While most angel investors do deals quietly and independently of formal groups, organized angel groups can help connect investors with deals or put together syndicated investments. These groups can also provide data that give insight into an otherwise "invisible" investment market.

A survey of 32 angel groups across Canada by the National Angel Capital Organization reported 283 investments, valued at $133m in 2015, a significant increase over the previous year. The average deal size was $1.16m, about the same as in 2014, and three-quarters of all deals were syndicated, involving capital outside the angel investment community. Ontario and Quebec made up 71% of all investments, though it is unclear how much was channeled specifically into blockchain development. [13]

» **Venture capital.** There was widespread concern in the 1990s and 2000s that a shortage of venture capital investment was hobbling Canada's efforts to promote a vibrant technology sector. The situation appears to have improved in recent years. Funding has grown steadily since 2011. According to Thomson Reuters, venture capital investment in Canadian companies reached a total of $2.5bn in the first nine months of 2016, the highest for any nine-month calendar period since 2001. The 446 deals reported between January and September 2016 were the most since 2005. The average deal size ballooned by almost 50% to $5.6m. The OECD now ranks Canada third among member countries in venture capital investment relative to GDP, behind only Israel and the U.S.

One of the biggest deals in 2016 was a $75.8m investment by several North American funds In Montreal-based Blockstream, a leading provider of blockchain technologies.

Even so, big gaps remain. Although the average venture capital investment in Canada had grown to $5.6m in the first nine months of 2016, that was still far behind most other countries, including the U.S. with an average deal size of $17.7m, the U.K. at $16.9m and Israel at $15.3m.

While the availability of seed and pre-seed financing for fintech companies has improved, there are concerns about access to later stage funding, according to the November 2016 briefing note compiled by Prof Michael King and Amy Young. The study notes that the way Canadian venture capital deals are structured is an obstacle when looking for later stage funding. Canadian start-ups are heavily dependent on U.S. venture capital for later-stage investments with the result that, in order to grow, fintech firms in Canada often need to leave the country. (The start-up drain is discussed separately below.)

» **Debt financing.** Canada's banks, credit unions and other lenders are more sympathetic to fintech start-ups than their counterparts in many other industrialized countries. Few concerns were raised at the roundtable about access to bank financing for blockchain development, although lenders often charge a sizeable risk premium. Overall, 28% of small and mid-sized businesses sought financing in 2014 and 82% of these requests were approved, according to the latest Survey on Financing and Growth of Small and Medium Enterprises, published by Innovation, Science and Economic Development Canada. Companies that own registered intellectual property are more likely to seek debt financing, and lenders are more likely to approve their requests.[14]

The Business Development Bank of Canada (BDC) could be an important source of funding for blockchain businesses. The BDC lent a total of $4.8bn in the fiscal year to March 31 2016, up from $4.7bn the previous year. Its total loan portfolio now stands at $26bn, spread among 42,000 borrowers. Almost one-fifth of its business was done in collaboration with private-sector banks and other institutions. The upward trend continued during 2016, with loans totaling $3.5bn in the six months to September, up from $2.5bn a year earlier.[15]

RISK AVERSION

"The attitude of Canadian Financial Institutions towards risk served us well during the financial crisis, but it is now costing us in terms of advancing the innovation agenda at the rate it requires to be competitive."

PEGGY VAN DE PLASSCHE
vice-president for enterprise innovation, CIBC

"There's an absolute risk aversion in compliance. It's a huge problem, and it's become more of a problem since 2008 because of the reputational needs of Canada's banks."

MAUREEN JENSEN
chair and CEO, Ontario Securities Commission

Both our research and discussion at the roundtable point to an unfortunate tendency among government and private sector players in Canada to focus on mitigating the risks of the blockchain and fintech revolution, rather than reaping its rewards.

In comments that apply as much to blockchain entrepreneurs as to the rest of the fintech sector, Michael King and Amy Young noted in their paper:

> *"Fintech start-ups find it very difficult to collaborate with Canada's leading financial institutions. Most collaborations happen at the periphery of the banks' primary management structures and are led by people who lack the executive power to make the needed procurement decisions. Similarly, there is an opportunity to improve the level of fintech expertise among incumbent firms. As interviewees contacted by the Munk team put it: 'the only way to get a contract with a Canadian bank is to have one first with a U.S. bank'. Banks and fintechs need to understand each other's strengths and constraints so they can work together to broaden available products, and create more cost-efficient means of converting Canadians into active users of fintech."* [16]

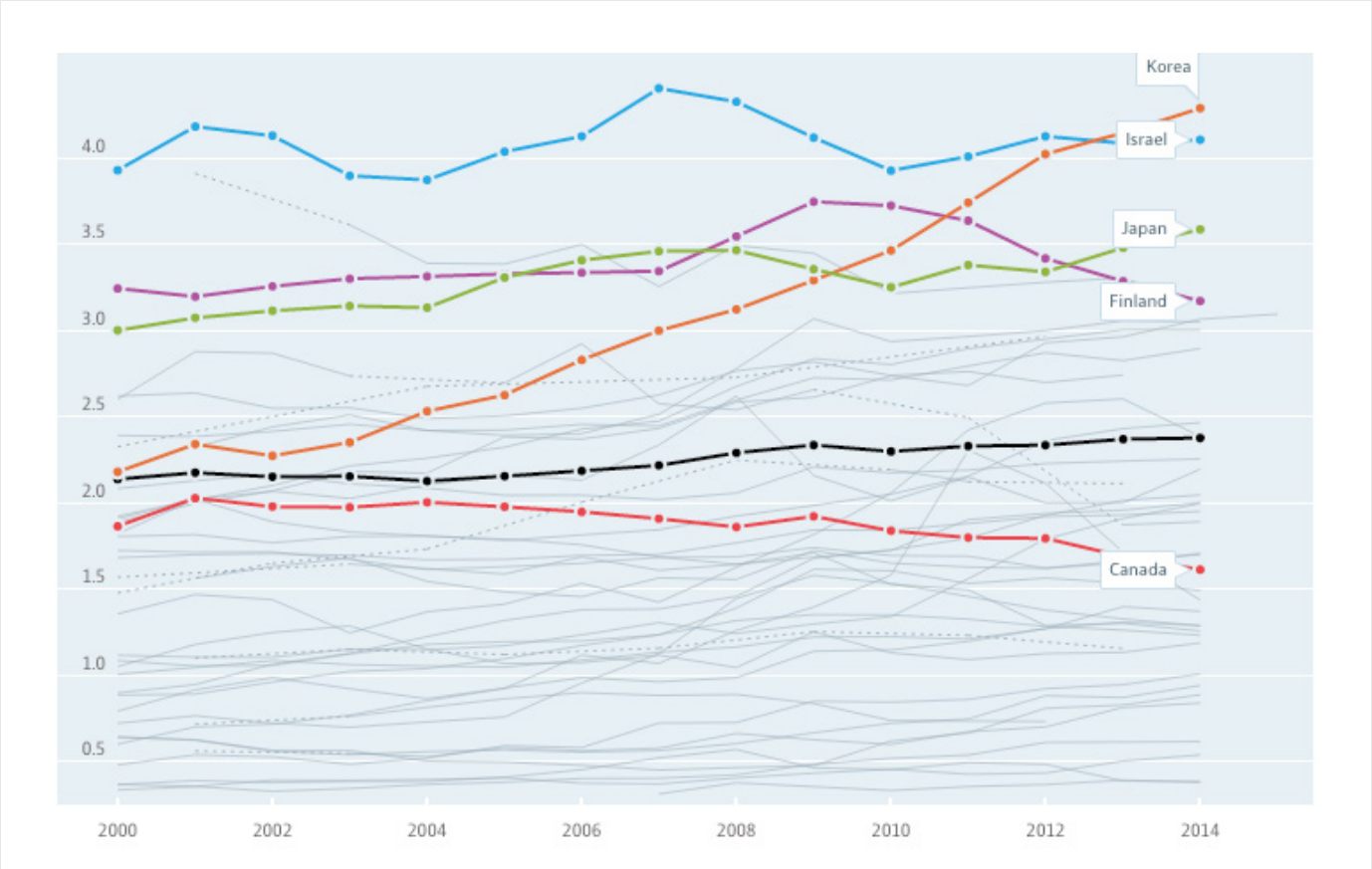
On a related front, Monica Kowal, Ontario Securities Commission vice-chair, underlined during the roundtable the importance of "seeing the world as the market opportunity, and not Canada as the market opportunity."

There is a common misconception that Canadian investors are also traditionally risk-averse, but both the data and the discussion at our roundtable belie that notion. Many participants cited the fact that Canadian investors are active in high-risk financings for mining and oil and gas companies. In particular, they noted that nearly $500 million a year is invested in flow-through share offerings. The challenge, therefore, is not to enlarge the risk appetite among Canadian investors, but rather to reorient it to fast-growing technology industries, like blockchain.

INADEQUATE R&D SPENDING

Canada's spending on research and development relative to the size of its economy has been well below the OECD average, and is still falling (see chart below). It trails countries such as South Korea, Israel, Japan and Finland. According to the OECD, Korea has jumped from roughly average in 2000 to first place in 2015, and has the industrial powerhouses—Samsung, Hyundai, LG, among others—to prove it. Israel has produced more unicorns (start-ups that have attained a market value of more than $1bn) than Canada, even though it has just one-quarter of Canada's population.

Figure 4: **CANADIAN R&D SPENDING (PRIVATE, PUBLIC, ACADEMIC, CIVIL SOCIETY) VS. OECD COMPARABLES AND OECD AVERAGE**



Source: OECD, Gross domestic spending on R&D: https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm

Whether much can be done to correct this situation has been cause for some debate. Low investment in R&D is often cited as a price that Canada pays for an open economy. Foreign investors face few barriers in taking over Canadian start-ups, and then moving much of their R&D to offices in other parts of the world, especially the U.S. On the other hand, Canadian firms could do more to advance R&D spending, in particular technology companies. Notably, of the top 10 Canadian spenders on R&D, only two are technology firms, and three are based in the U.S. [17]

POLICY AND REGULATORY IMPEDIMENTS

"We're in a weird point in time where we have this disconnect between regulators, the banking sector and the start-up technology sector. It leads to dislocation and, actually, the death of start-ups. It leads to some surreal scenarios too, where banks and institutions alike wish to work with us on a technology integration level, but can't provide us with the business bank accounts we require to run our companies, unless it is proven advantageous to those institutions."

JOSEPH WEINBERG
Paycase Financial

"There are a lot of reasons why American companies envy us. We have access to SR&ED and government grant programs. But the incentive structure is inherently different here from the U.S. My personal experience when applying for FedDev Ontario or the IBI program to get a grant is that the focus is regional economic development, not building globally competitive startups. Government sponsorship and encouragement is great, but it has to be for the right reasons."

MATTHEW SPOKE
co-founder, Nuco

There is wide agreement that regulatory barriers and government policies are a major impediment to Canada taking a leadership role in the blockchain economy. There has been no systematic study of the do and don'ts of regulation of blockchain technology. Too much is at stake to address this issue on an ad hoc basis. Without a more comprehensive approach, there remains a high risk that a socially and economically valuable industry will be strangled at birth. Regulators should encourage the blockchain industry for many reasons. However it's unclear to most what a sensible approach looks like.

Of particular concern in Canada is our at-times fragmented regulatory system, marked by the absence of a single securities regulator and strong national capital markets. The result is that national and provincial regulators have so far been unable or unwilling to lay out a coherent approach towards blockchain. At the same time, blockchain and its subset financial technologies make a national regulator an idea whose time has come.

Matthew Spoke, CEO of Nuco, noted at the roundtable: "When we interact with American investors, we often see that it's not government initiatives or university initiatives. It's rich people who have made money off previous exits. That ecosystem is lacking in Canada. Where are the formerly successful entrepreneurs from the big successes we saw in this country in the 1990s and early 2000s?"

In similar vein, Peter Pisters of the University Health Network observed that "Historically, Canadian governments evaluating a series of funding opportunities have had an aversion to making differential investments based on strategic potential. In addition, they often see the number of jobs created as the primary outcome measure for new investment. That's certainly important, but it closes off other valid economic end points and is a barrier to innovation platform and cluster development."

THE BRAIN DRAIN

The most detailed data on Canada's supposed brain drain come from studies examining the period from 1990–2000 when the Canadian dollar fell sharply and the perception took hold that large numbers of skilled workers were leaving Canada for the U.S.

A 2000 Statistics Canada study found that:

- Emigrants are more likely to be better-educated, higher-income earners and of prime working age than the population as a whole.
- During the 1990s Canada suffered a net loss of skilled workers to the U.S. in several economically important occupations. But the numbers were small in an historical sense and relative to the supply of workers in these occupations.
- While losses of highly skilled workers to the U.S. accelerated during the 1990s, so did the influx of skilled workers into Canada from the rest of the world. This is particularly true of high-technology industries where immigrants to Canada have outnumbered the outflow to the U.S. by a wide margin. In fact, four times more university graduates entered Canada from the rest of the world than left Canada for the U.S. [18]

A World Bank study of international migration by education attainment supports this evidence of a net brain gain to Canada during the 1990s, thanks to the strong influx of highly skilled immigrants

In recent years, various media outlets have perpetuated anecdotal assertions that as many as 350,000 Canadians (1% of Canada's total population) are working in Silicon Valley. But these estimates have been refuted by Dan Munro, a senior researcher at the Conference Board of Canada. According to his **work**, the real figure is closer to 19,000.

The slide in the Canadian dollar since 2014 has revived fears of a mass exodus south of the border. Jack Mintz of the University of Calgary's School of Public Policy expressed concern in a January 2016 article that a sustained low exchange rate could entice Canadians to leave for the U.S. in greater numbers. He noted that in "the years 1986-1991, almost 125,000 Canadians each year went south, rising to 214,000 in the 1996-2001 period when the dollar was quite low. As our growth improved and the dollar rose to U.S. parity after 2002, Canadian permanent and temporary immigrants to the U.S. declined to 167,000 in the 2001-2006 period." [19]

Recent upheavals in the U.S. and other parts of the world could herald a reversal in the brain drain, and even reinforce Canada's attractions as the North American hub for blockchain development. The U.K.'s Brexit vote, the recent U.S. election and low global growth could spur a new wave of economic migration with Canada as one of the main beneficiaries. Our political and economic stability as well as pro-immigration policies at both the federal and provincial levels could help attract substantial numbers of skilled workers, including those needed to sustain the growth in blockchain research and applications.

In the federal government's latest move to encourage immigration, Finance Minister Bill Morneau unveiled a global skills strategy in his November 2016 fall economic statement that sets an ambitious two-week standard for processing visas and work permits for "global talent." The initiative aims to support, among others, "high-growth Canadian companies that need to access global talent in order to facilitate and accelerate investments that create jobs and growth."

THE START-UP DRAIN

"Four Canadian cities—Montreal, Toronto, Calgary and Vancouver—have got all the ingredients that make up a typical ecosystem for fintech and blockchain. But we lag in one area. In other hubs, some champion emerges—the government, the venture capital sector, the investors, the start-up community itself. They take the lead to put that location on the map. There were two ventures in Canada that I was involved in—Monetas and Ethereum. I advised launching in Canada instead of somewhere else. But both initiatives ended up in Zug, Switzerland. When we met with the regulator and the local community here two years ago, the response was 'we don't know what you're talking about'. In contrast, the authorities in Switzerland said: 'This is fascinating. We're looking to support initiatives that will put us on the map and compete with the rest of the world. Let's work with you'."

MANIE EAGAR
CEO, DigitalFutures

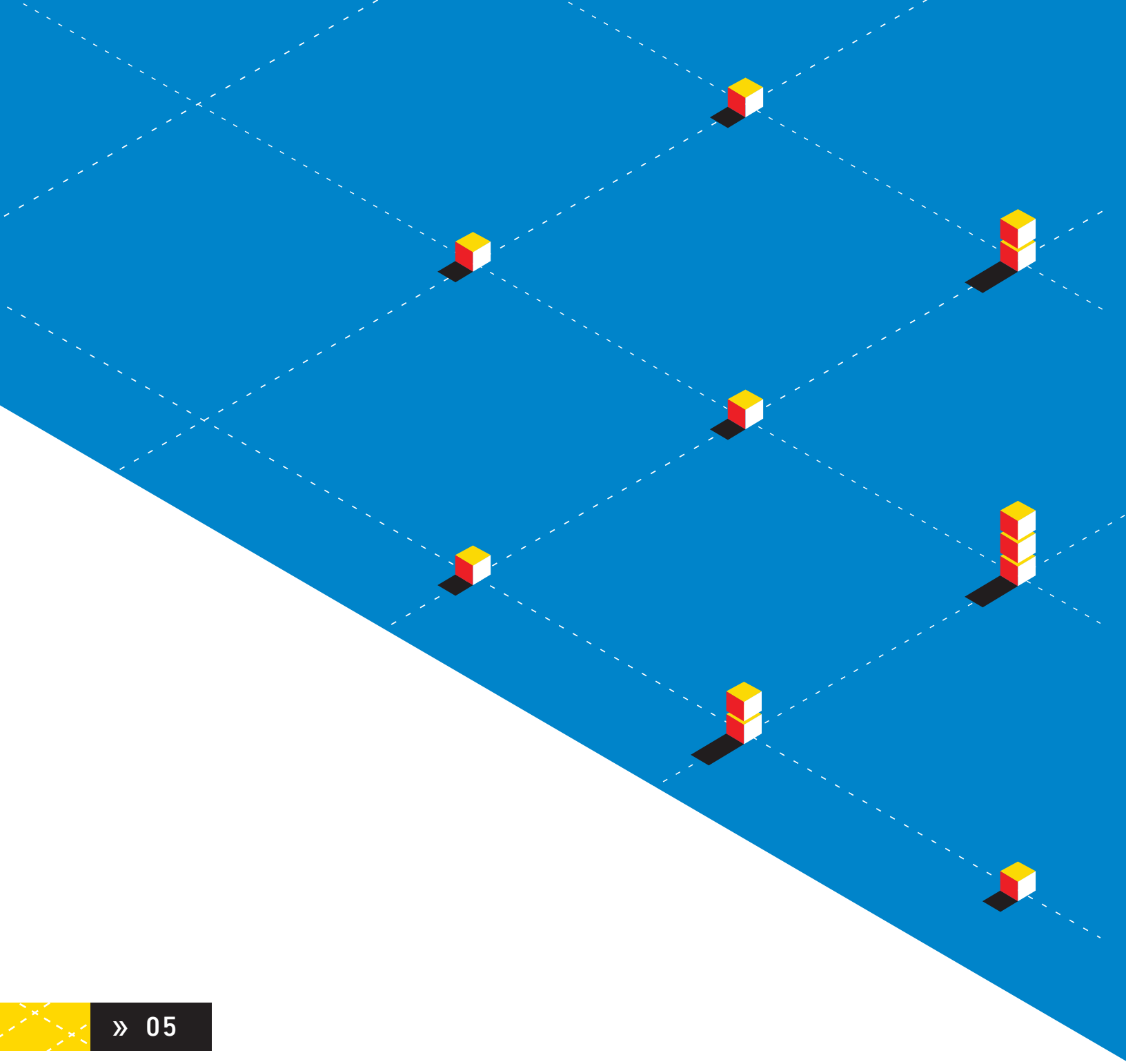
Small and mid-sized businesses do not grow into large ones in Canada as often as they do in most other industrialized countries. Too many homegrown entrepreneurs who create great firms would rather cash out than push their company to bigger and better things. Often, the result is that a promising company is sold to a foreign buyer that has little reason to promote Canada as a hub for its technology or talent.

The 2015 Compass report on international tech ecosystems saw Toronto drop to 16th place in the global rankings from 8th in 2011, and Waterloo fall to 24th from 16th. The key reason: despite one of the densest start up clusters, we are failing to scale up successful firms, and their valuations have stagnated. The opposite is true in Berlin, Tel Aviv, London, Singapore, New York and Austin, among others. The low valuations and weak growth found in Canada are generally ascribed to a shortage of capital and skills. In the latter case, concerns center on the lack of sophisticated, experienced executives with marketing, product development and finance specialties.

The most relevant study of this phenomenon that we're aware of is a 2014 paper by Jean-Marc Suret and Cécile Carpentier of Laval University. According to this paper, nearly half of the successful exits from Canadian venture capital-backed firms between 2001 and 2012 resulted in migration out of Canada. Using case studies, Suret and Carpentier suggest that these migrations are motivated mainly by the drawbacks associated with a relatively small economy, including a dearth of strategic partners and a small market for innovative products.[20]

MaRS published a study in 2013 that examined 183 venture capital-backed exits in the previous five years. It found that 25% of the start-ups were acquired by companies based in Canada, but 68% by U.S.-based buyers. While the companies that fell into U.S. hands were no longer headquartered in Canada, the MaRS study did not consider whether they left Canada entirely after their acquisition. [21]

The low conversion rate from start-ups to mid-sized or large businesses points to some deep-rooted concerns about Canada's business environment. One is access to capital at later stages of growth. Another is a culture of lower risk tolerance in corporate Canada compared to competitor countries. Both of these are examined elsewhere in this report. Peter Nicholson, formerly active in public policy and business and now semi-retired, has described this state of affairs as Canada's innovation paradox. The OECD has suggested that its member states are moving from tax incentives to more direct support to encourage innovative businesses to grow. Yet Canada relies more heavily than most other countries on tax incentives rather than direct support.



» 05

THE WAY FORWARD

Our research and the roundtable discussions produced a number of practical proposals on how to cement Canada's role as a world leader in nurturing and expanding blockchain technology.

A CANADIAN DIGITAL ECONOMY COMMISSION

Several roundtable participants urged Canada to follow the example of the U.K., Australia, Singapore, Hong Kong and other jurisdictions where governments have brought stakeholders together to develop a coordinated and coherent blockchain strategy. We would go even further, and propose that this strategy encompass the digital economy as a whole.

As mentioned above, the Tech North corridor between Toronto and Kitchener-Waterloo is already a world leader in quantum physics and artificial intelligence. Blockchain, including fintech, is ideally placed to be the third leg of the stool. Prof. King suggested at the roundtable that Canada should focus on three or four specific blockchain niches where we can add the most value, as the U.K. and Israel have done. Among the most promising options for Canada are digital ID, digital retail payments and cyber-security. The big banks have already collaborated in a shared digital payments system.

All of these areas—and perhaps others too—should form part of a thorough and urgent review of Canada's digital economy strategy.

In the early 1990s two government advisory committees were created to develop strategies for Canada and the internet – one by Ontario Premier Bob Rae (chaired by Don Tapscott), and the other by then-federal Minister of Innovation John Manley (chaired by now Governor-General David Johnston). Both engaged stakeholders from business, government and civil society to develop a strategy and action plans. In the end they contributed significantly to Canada's adoption of the internet, among other things catalyzing the opening of the telecommunications marketplace.

Now as the Internet enters a second era, it makes sense for the federal government to set up a national commission, with members representing the main stakeholders in the digital economy, namely, government, financial institutions, the research community, technology entrepreneurs, civil society and, not least, consumers.

The commission should be instructed, as part of its mandate, to come up with concrete recommendations that would enable Canada to achieve a leadership role in the unfolding Blockchain Revolution and other critical technologies such as artificial intelligence, quantum computing, the internet of things. autonomous vehicles, drones and robotics.

As a starting point, we offer the proposals below to kickstart Canada becoming the global blockchain hub.

SOLVING THE DILEMMA OF FLOW-THROUGH SHARES FOR TECHNOLOGY R&D

"Five years ago we were pretty good on early stage and late stage investing. The problem was in the middle, when companies needed funds to grow. I sense this is beginning to change, and blockchains have something to do with that. The appetite is changing. People see the future is about getting in early but also at the Series A level. I like the flow-through shares idea. There is a certain elegance to using blockchain technology to ensure that every dollar of such government tax benefits are applied to investing in technological innovation."

SHELDON LEVY
deputy minister of advanced education and skills, Ontario

"Blockchain holds big opportunities for transformation of education and in turn for entrepreneurship and innovation in Canada. A blockchain-based flow-through share approach could create the funding breakthrough we've all been seeking."

MOHAMED LACHEMI
president, Ryerson University

"We're still working with black and white regulation, but regulation needs to be built in colour with more tones. The U.K. regulates more by function, where an entity is authorized for this and that particular activity but not others. Canadian regulators are stuck applying legislation in larger boxes. We need a regulatory system that's way more flexible and nuanced. We should give regulators more choice so that they can regulate the specific functions that they want to guard against and ignore other parts that don't concern them so much."

ROSS MCKEE
partner, Blake Cassels & Graydon

Investment in Canada's mining, oil and gas, and renewable energy sectors has been spurred over the past half-century by a hugely popular financing incentive known as flow-through shares. These instruments are a special type of common share that allow eligible companies to "flow through" certain expenses to the holders of these shares. The investors are able to claim the amount as a tax deduction, rather than the company expensing it against its profits.

The flow-through scheme has proven successful. It has given countless entrepreneurs access to capital for high-risk projects, while offsetting some of the risk to investors who support them. A recent survey by Vijay Jog of the University of Calgary's School of Public Policy identified at least 1,783 companies that raised funds through flow-through share issues between January 2008 and June 2014. These companies completed financings valued at a total of $4 billion, of which flow-through shares contributed $2.5 billion—a very substantial amount by any measure. [22]

Thanks in large measure to flow-through financing, Canada is now home to more mining companies than any other country in the world. Canadian companies have conducted more exploration and development around the world than companies from any other country. As the Prospectors and Developers Association of Canada has put it: "Flow-through shares have helped make Canadian mining firms world leaders, with head offices, consultants, contractors, suppliers, legal and financial structure and other expertise – in Canada." [23]

The success of the mining and energy sectors points to the huge benefits that flow-through shares could bring to Canada's blockchain and fintech firms. Like mining and energy, Canada has a competitive edge in blockchain research and development. And like mining and energy, access to finance is the most critical missing link.

The U.S. venture capital market is valued at US$60 billion, yet Canada attracts only C$3 billion in this type of funding, less than half of what might be expected based on the size of the two economies.[24] As mentioned above, while the average venture capital investment in Canada had grown to $5.6m in the first nine months of 2016, that was still far behind most other countries, including the U.S., with an average deal size of $17.7m.

Up to now, investment in start-up technology companies has come largely from wealthy angel investors, venture capital pools and private equity funds. Extending flow-through shares to the tech sector would thus have the advantage of not only giving entrepreneurs access to a vast pool of funds, but also enabling ordinary investors to share in the rewards (and, admittedly, the risks) of an exciting investment opportunity.

The finance department has so far resisted an expansion of the flow-through share scheme, citing loss of tax revenue and the potential for abuse. Memories remain fresh of the early 2000s when companies were lining up to convert into income trusts. Ottawa's decision to close down the income trust scheme was highly controversial, and politicians and finance officials are understandably reluctant to go down the same path again.

Blockchain offers the means to avoid these unintended consequences, and provides an elegant solution to the dilemmas of ensuring and validating the investments in technology. The finance department could set up a blockchain ledger where companies would be required by law to record all the data on their flow-through share issues, including how the money they receive is spent. This would hard-code accountability into the tax-code and into the new flow through scheme. The information would be open to all—shareholders, regulators, the stock exchange and, not least, the Canada Revenue Agency, enabling them to vet and audit the use of funds in real time. It's hard to imagine a more trustworthy and transparent system.

This system ought to apply to all flow-through share issues, including in the resource industry. In addition to guaranteeing the efficacy of the program and limiting abuse, such a plan would also demonstrate the Canadian government's willingness to use new technology and be a model user, sending a strong signal to entrepreneurs that Canada is an innovator at all levels.

In summary, flow-through shares offer Canada a double-barrelled opportunity:

- A massive new source of funds to spur research and development in the technology sector, and specifically blockchain.
- A highly visible, real-time demonstration of blockchain's capabilities and benefits.

The Canadian Chamber of Commerce and the Toronto Stock Exchange, among others, have urged the federal government to extend the scheme to other sectors. Technology ventures have much in common with natural resources. Like mining and oil exploration, blockchain entrepreneurs need an injection of capital upfront with an uncertain payout. And while a modest investment can produce very substantial rewards, the risks are high.

The chamber of commerce has also lobbied for an "innovation box" that would encourage companies to keep their head offices and profits in Canada. Under this proposal, revenue from a blockchain application would be taxed at a preferential rate.

THE BLOCKCHAIN RESEARCH INSTITUTE

"I really like the notion of creating an institute. It's tough in government to get things going. Bringing that together in some kind of institute where you could bring people in for a day or two for some education would be really, really useful."

DAVID NICHOLL
corporate chief information officer,
Government of Ontario

As outlined above, blockchain technology is set to transform financial services, the innermost architecture of the corporation, animate the internet of things, recast the role of government, revamp our content industries, and solve important problems like the security of organizations and the privacy of individuals. New blockchain-based business models will transform most industries, and disruptors like Uber may themselves become disrupted.

It's now time to take the next step and conduct deep research into killer applications — identifying the most important opportunities for blockchain in business and government and drawing the roadmap for how to get there.

To that end, the Tapscott Group is launching the Blockchain Institute, a new, not-for-profit initiative to unlock the potential of blockchain across industries and also within the functions of organizations. The institute will operate as a research centre for projects that potentially benefit a wide range of players, and where competitive issues are not a concern.

Through a series of major research projects led by global experts, we will identify and explain key application opportunities, issues, strategies and approaches that enable companies and governments to capitalize on this emerging technology.

We will investigate the most important applications vertically by industry and horizontally by function within different types of organizations. The research will also help to ground decision-making around blockchain integration and prototyping — offering guiding principles and tradeoffs to different approaches while remaining agnostic toward technology partners.

Depending on members' requirements, **the program aims to focus on seven sectors: financial services, retail, manufacturing, telecommunications and media, technology, healthcare and government.** Scott Smith, director of intellectual property and innovation policy at the Canadian Chamber of Commerce, suggested at the roundtable that cyber-security should play a part in the institute's work, given its importance in establishing the credibility of blockchain applications.

The program and its projects will be led by many of the world's leading thinkers in the internet's second era. Program findings will be restricted to members, although top line results may be communicated openly. The institute will conduct a number of projects as outlined above, with each culminating in a report, slide

deck, data set, web site, tools, MOOC, or other device for sharing results. We will also hold a final summit, with attendance restricted to program members and faculty, where program results will be shared and discussed.

A BLOCKCHAIN CENTRE OF EXCELLENCE

"I strongly support looking for a particular utility or utility-like opportunity where we could focus a blockchain to really provide a solution, and do it as a whole sector together. That would certainly spur all the smaller blockchain businesses in this country, and it's something we could do together. That type of utility would not disintermediate the customers to these new businesses, but would allow them to build a very interesting utility and showcase the Canadian talent."

MAUREEN JENSEN
chair and CEO, Ontario Securities Commission

Roundtable participants expressed strong support for a Blockchain centre of excellence. The centre would not be disimilar to those that have helped propel many other emerging technologies. However new thinking is required. For example it would be the focal point for a cluster of blockchain-related businesses, encouraging them to feed off each other. It could also become a global centre for research and commercialization of blockchain technology.

Speakers at the roundtable noted that universities and colleges have played a much more active role in blockchain research and development in other countries than in Canada. These institutions should be closely involved in the proposed centre of excellence, and as test beds for blockchain applications. For example, a blockchain electronic voting platform could be tested in campus elections.

Work should begin immediately to learn from past mistakes and accomplishments of other such centres in Canada, and to define a plan to build one in Canada, as a focal point for the blockchain corridor.

ENGAGE GOVERNMENTS AS MODEL USERS

As this report has explained, governments can play a critical role in cementing Canada's capability and reputation as a global blockchain hub. One of the most important things governments at all levels can do is to use the new technology itself to transform its own operations. This is not just a case of government "supporting" the private sector, but should rather be seen in the context of the myriad benefits that blockchain technology can bring to the public sector and Canada as a whole.

While the blockchain's impact on business will be profound, it will have an equal if not greater impact on public institutions charged with delivering services to all citizens. The reasons are manifold: Blockchain technology has the potential to rebuild public trust in political institutions by creating more transparency and lessening the opportunities for corruption. What's more, it can help the machinery of government run more efficiently, at lower cost, and with an unprecedented level of privacy and security.

The practical applications of blockchain are almost limitless. All our official documents—birth and death certificates, marriage license, driver's license, passport, health card, land titles, status of tax payments, school transcripts, and so on—can be stored in a single blockchain identity owned by citizens. Some have suggested that the blockchain could even become a public document registry beyond any government sanction or involvement. Smart devices can be recorded in a blockchain ledger to lower security, maintenance and energy costs through automated access, lighting and temperature controls. Similarly, a blockchain can track the location and condition of government vehicles, and the safety of bridges, railways and tunnels. Without exaggeration, this technology has the potential to improve almost every aspect of a government's interaction with its citizens. Our book gives many other examples from around the world.

Consider the single impact of triple-entry accounting on government transparency and accountability. It's entirely possible, for example, that the federal auditor-general function could be replaced by real-time auditing on a new government blockchain platform. Rather than finding inappropriate expenses or waste a year later, such expenses could benipped in the bud.

As we have noted elsewhere, governments in other parts of the world have become active participants in the Blockchain Revolution. It is time for Canada's federal government, the provinces and territories, and municipalities to pull their weight if private blockchain developers are to maintain the momentum of experimentation and innovation. Having a strong domestic public sector market is critical to technology entrepreneurs and with the second era of the Internet we need governments at all levels to step up.

This is especially true along the Toronto-Waterloo corridor where, as the recent NEXT Canada concludes, a Canadian technology and innovation supercluster is already taking shape. The report estimates that such a supercluster could result in an extra $17.5 billion in gross domestic product and create 170,000 jobs. This region already contributes 17% of Canada's GDP.

A critical mass of universities and incubators are already in place to supply the needs of a growing cluster. The universities include: University of Toronto, McMaster University, University of Waterloo, Wilfrid Laurier University, York University, Ryerson University, Conestoga College, and University of Guelph. Startup incubators include: Communitech, MaRS, Velocity at University of Waterloo, DMZ at Ryerson, NEXT Canada, and Creative Destruction Lab at Rotman School of Management, along with several other University of Toronto entrepreneur centres.

The region's reputation as a hub of innovation could be bolstered by identifying a "smart city" that would implement blockchain and other cutting-edge technologies across a wide swath of its operations and services.

The smart city concept has evolved over the past decade as a way of enhancing city-dwellers' quality of life and municipal governance through the pervasive use of information and communications technologies, including emerging internet applications. The idea is to cover as wide a range of assets and services as possible, including libraries, hospitals, public transit, traffic management, water treatment plants, municipal administration, and so on. The smart cities concept has been especially popular in Europe. Amsterdam, Barcelona, Southampton, Stockholm and Tel Aviv are among the cities that have sought to implement it.

Roundtable participants singled out Brampton, north-west of Toronto, as an ideal smart city candidate. Among other considerations, the Ontario government has already indicated that the province's next university will be located in Peel region. Furthermore, Brampton is at the heart of the Toronto-Waterloo corridor, identified as the focal point of Canada's first technology supercluster. Such a project would also enable Canada to show off a real-life model of the main benefits that blockchain technology can provide beyond the financial services sector.

As a starting point for such an initiative, the mayor and city council would instruct each municipal department to come up with an action plan for incorporating blockchain in its processes. Among other things, this city could pioneer a distributed power grid and an open energy market, manage all government services such as tax collection using blockchain, and handle civic affairs through e-voting and digital identity A pilot project would be implemented. Funds would be earmarked for training, and technology businesses in surrounding areas would be invited to attend workshops outlining the city's needs and their potential contributions.

PROTECT AND EXPAND ACCESS TO THE U.S.

"One of my priorities each day is working to advance access to the U.S. and other markets. The opportunity for Canada to lead the blockchain revolution hinges on ensuring, protecting, and expanding access."

CHRYSTIA FREELAND
Minister of Foreign Affairs,
Government of Canada

"We need to better understand how U.S.-based venture capital firms work and operate. Those firms don't like to travel. If you're a life sciences venture capital firm based in Boston or the Bay area, there's really no reason to travel to Toronto because you have ready access to risk capital and highly experienced executive talent. Our efforts need to be restructured around how to attract risk capital to Canada, and how to create the right kind of tax structure, incentives and immigration policy to support the opportunity created by the U.S. election."

DR PETER PISTERS
CEO, University Health Network

"We need to build start-ups for the U.S. market, and then think of the Canadian market. Don't be the Canadian Tire trying to find a way into the U.S. market after building a great thing here."

DAVID PATTERSON
CEO, Northwater Capital

Building an innovation economy in Canada does not mean isolating ourselves from the rest of the world. Indeed, now more than ever, we must build bridges and strengthen ties to key markets, expand our trading partners, and work constructively with foreign governments. Given Canada's relatively small domestic market, it is vital for the blockchain community to have continued—and even expanded—access to the U.S. The U.S. is by far the largest source of financing for blockchain start-ups, the biggest market for their products and, outside Canada, the biggest supplier of talent for blockchain and other fintech ventures.

Maintaining strong links with the U.S. will be especially critical over the next few years if President Donald Trump carries through on his protectionist campaign rhetoric. Mr Trump has vowed, among other things, to renegotiate the North American free trade agreement, impose a border-adjustment tax as part of a wide-ranging tax reform, and tighten immigration rules. While Canada is by no means the main target of these initiatives, they are bound to raise challenges for cross-border trade, investment and other areas of cooperation.

Canada's technology leaders will need to pull out every stop to remind U.S. policymakers as well as their suppliers and customers of the ties that bind the two neighbours. For example, the University of Waterloo is one of the main recruiting grounds for U.S. tech giants such as Google and Microsoft.

The OSC's Maureen Jensen suggested at the roundtable that Canada also look at closer collaboration with other like-minded countries, such as the U.K., Australia and Singapore, as a way of promoting our blockchain expertise internationally. The OSC is already in talks with Australia and the U.K. on an arrangement that would enable blockchain businesses licensed in Canada to secure fast-track regulatory approvals in Australia and the U.K.

EDUCATION AND CULTURAL CHANGE

"We hear from companies trying to raise financing that they're asked: 'Why are local buyers not buying from you?' We need to see the world and not just Canada as a market opportunity. Don Drummond did a report for the Ontario government a few years ago, and one of the issues that his work points to is that the incentive strategy across government is for Canadian companies to stay small. So being small is rewarded. That government policy spills over into our cultural identity and that's something we need to tackle."

MONICA KOWAL
vice-chair, Ontario Securities Commission

"What we're seeing is that there is quite a bit of funding in terms of growth capital in Canada, but the missing ingredient is mentorship. What we've been encouraging at the bank and with our peer groups, at many of the other banks, is to provide mentorship to these companies so that they can understand how we can transform these models."

DUBIE CUNNINGHAM
vice-president for innovation and digital banking, Bank of Nova Scotia

Revolutionary new products and services often run into early skepticism, even mockery and hostility. Entrenched interests resist change, and established leaders are often the last to embrace the new, if they ever do.

Blockchain is no exception. It has already brought dislocation, conflict, confusion and uncertainty, and is sure to bring more. This is especially true in Canada, where regulators and policy-makers have tended to favour stability over innovation. The 2008 financial crisis, when Canada's bank regulators were widely lauded for their conservative stance, has reinforced the cautious approach.

However, skepticism and resistance could cost Canada dearly if they hamper our drive to lead an exciting new technology that shows signs of being as transformative as the computer, the smartphone or the internet. The NEXT Canada report warns:

> *Despite its strong positioning, the equity value of the (Toronto-Waterloo) corridor's tech companies lags far behind those of peer cities like Chicago, Boston, Berlin, and Singapore. Catching up, if not surpassing them, might require bold ideas, a concerted effort, and leadership across public and private sectors alike.*

Among roundtable participants, Nuco's Matthew Spoke urged regulators to take a more welcoming approach towards new technologies such as blockchain. He urged that their default position should be one of encouragement and experimentation, rather than skepticism.

The good news is that attitudes are starting to change. An ever-growing body of expert opinion has come to appreciate the potential for Canada, and southern Ontario in particular, to become a leading light in the blockchain and fintech revolution. The many sources cited for this report (see end-notes below) are a clear sign that the ball is rolling.

Especially encouraging is that regulatory bodies are actively exploring the emergence of blockchain to enhance the financial welfare of businesses and consumers, prevent abuse, and bring transparency into the financial system and economy as a whole. The federal government and the province of Ontario are increasingly supportive of efforts to capitalize on Canada's strengths to bolster the fintech sector. For example, Ontario published a report by a panel of experts in June 2016 that charts a course for the province's workforce to adapt to the needs of a technology-driven knowledge economy.[25]

We believe that much more can, and should, be done to spread the message that blockchain is here to stay. Governments could play a valuable facilitating role by encouraging universities and colleges to make blockchain and other cutting-edge technologies part of their curriculums. They can help organize conferences. They can use a variety of media platforms to advertise the benefits of blockchain and their commitment to it. The digital economy commission mentioned above would be an excellent starting point to dial up the volume on blockchain.

Another effective way of moving the Blockchain Revolution forward would be to promote the development of specific testing grounds for the technology. One might be a university and/or college where students interact with faculty, have access to records, financing, share information, and need secure communications. Lessons learned from this experience could be used to highlight the value of the technology to other sectors of the economy.

We challenge a Canadian university or college to be the first in the world to base their operations on blockchain. Such a move would generate excitement and illuminate blockchain's real application potential. Similarly, we challenge Canada's big five banks to test and implement the technology through a common application.

The commission and the other proposals in this report, if adopted would go a long way towards creating the awareness, educational and cultural conditions for the blockchain revolution to fulfill its potential in Canada.

We're confident that these steps will dispel any lingering skepticism about the potential of blockchain and other new technologies. But we cannot afford to be complacent, and time is not on our side. Canada's leading position in the Blockchain Revolution could quickly evaporate as other hotbeds around the world race ahead. The time to act is now.

The second generation of the internet is an irresistible force that, one way or another, will make itself felt in almost every facet of our daily lives. We dare not turn our backs on it. Working together as Canadians, let's seize this once-in-a-generation opportunity to lead the world.

PROJECT LEADERSHIP

The blockchain corridor project is led by Don Tapscott, author of 16 widely read books about the digital revolution in business and society dating back to 1981. He is CEO of The Tapscott Group, an Adjunct Professor at the Rotman School of Management and Chancellor of Trent University. The research director is Alex Tapscott, CEO of Northwest Passage Ventures, a venture capital investor in blockchain companies. He is active in many strategic initiatives in this space including by the International Monetary Fund, The World Economic Forum and Elections Canada. Together they are the authors of the book **Blockchain Revolution: How the Technology Behind Bitcoin is Changing Money, Business and the World.**

Jenna Pilgrim is the research associate and Jody Stevens the research administrator.

PROJECT FUNDING

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APPENDIX A:
DECEMBER 19 2016 ROUNDTABLE PARTICIPANTS

NAME	TITLE	COMPANY
Bill Morris	President & Senior Managing Director, Canada	Accenture
Andre Salvi	Managing Director, North American Emerging Markets and Parterships	Bank of Montreal (BMO)
Jake Gilbert	Partner	Blake, Cassels & Graydon LLP
Christine Ing	Partner	Blake, Cassels & Graydon LLP
Ross McKee	Partner	Blake, Cassels & Graydon LLP
Domenic Presta	Associate	Blake, Cassels & Graydon LLP
Jackie Shinfield	Partner	Blake, Cassels & Graydon LLP
Scott Smith	Director Intellectual Property and Innovation Policy	Canadian Chamber of Commerce
Peggy Van de Plassche	VP Enterprise Innovation	Canadian Imperial Bank of Commerce (CIBC)
Sevaun Palvetzian	CEO	CivicAction
Michael Tang	Partner and Head of Global Digital Transformation & Innovation	Deloitte
Iliana Oris Valiente	Strategy and Execution Lead & Co-Founder at Rubix by Deloitte, Blockchain Strategist	Deloitte
Manie Eagar	CEO (DigitalFutures), Chairmain (Blockchain Association of Canada)	DigitalFutures, Blockchain Association of Canada
Chrystia Freeland	Minister of Foreign Affairs	Government of Canada
Alain Beaudoin	VP Policy, Partnerships, and Performance Management, Federal Economic Development Agency for Southern Ontario	Government of Canada
Mitch Davies	Senior Assistant Deputy Minister, Strategic Policy Sector	Government of Canada
Philip Jennings	Associate Deputy Minister, Natural Resources	Government of Canada
John Knubley	Deputy Minister, Innovation, Science and Economic Development	Government of Canada
Mark Lehman	Executive Director, Federal-Provincial-Territorial Secretariat, Department of Innovation, Science, and Economic Development	Government of Canada

APPENDIX A:

DECEMBER 19 2016 ROUNDTABLE PARTICIPANTS *(CONTINUED)*

NAME	TITLE	COMPANY
Giles Gherson	Deputy Minister, Ministry of Economic Development and Growth, Ministry of Research, Innovation & Science	Government of Ontario
David Nicholl	Corporate Chief Information Officer	Government of Ontario
Mei Burgin	Cloud and Blockchain Marketing Leader, Canada	IBM
Debbie Landers	VP Innovation Investments for Watson Analytics, Canada	IBM
Andrew Kriegler	President and CEO	Investment Industry Regulatory Organization of Canada (IIROC)
Robert Watson	President and CEO	Information Technology Association of Canada (ITAC)
Michael King	Tangerine Chair in Finance, Co-Director, Scotiabank Digital Banking Lab @ Ivey	Ivey Business School at the University of Western Ontario
Xavier Debane	VP Innovation	Manulife
David Patterson	Chair and CEO	Northwater Capital
Alex Tapscott	CEO	Northwest Passage Ventures
Matthew Spoke	CEO	Nuco
Maureen Jensen	Chair	Ontario Securities Commission
Monica Kowal	Vice-Chair	Ontario Securities Commission
Joseph Weinberg	CEO	Paycase Financial
Stephanie Choo	Senior Partner	Portage Ventures
Alex Graham	Managing Director, Global Investment Baking & Head, Communications, Media & Technology	Royal Bank of Canada (RBC)
Mohamed Lachemi	President	Ryerson University
Dubie Cunningham	VP Innovation	Scotiabank
Rizwan Khalfan	EVP Chief Digital and Payments Officer	Toronto Dominion Bank (TD)

APPENDIX A:

DECEMBER 19 2016 ROUNDTABLE PARTICIPANTS *(CONTINUED)*

NAME	TITLE	COMPANY
Charles McCarragher	AVP Legal (Technology)	Toronto Dominion Bank (TD)
Chris Owen	VP Enterprise Shared Platforms, Blockchain	Toronto Dominion Bank (TD)
Don Tapscott	CEO	The Tapscott Group
Jenna Pilgrim	Project Manager, The Blockchain Research Institute	The Tapscott Group
Michael Kousaie	Head of Business Development, Technology	TMX Group
Peter Pisters	President & CEO	University Health Network (UHN)
Sunny Ray	Co-Founder & President	Unocoin

APPENDIX B:

ROUNDTABLE RESPONSES - CANADIAN BLOCKCHAIN ECONOMY OBSTACLES*

QUESTION:
Early stage financing is a significant obstacle for blockchain companies

POLLING RESULTS:

AGREE	15 (47%)
NEUTRAL	06 (19%)
DISAGREE	11 (34%)

QUESTION:
Second stage support (acceleration, scaling etc.) is a significant obstacle for blockchain companies

POLLING RESULTS:

AGREE	20 (63%)
NEUTRAL	06 (19%)
DISAGREE	06 (19%)

QUESTION:
Relatively low R&D spending in Canada is a significant obstacle to building the blockchain economy in Canada

POLLING RESULTS:

AGREE	23 (68%)
NEUTRAL	04 (12%)
DISAGREE	07 (21%)

QUESTION:
Procurement rules and practices are a significant obstacle to building the blockchain economy in Canada

POLLING RESULTS:

AGREE	22 (67%)
NEUTRAL	05 (15%)
DISAGREE	06 (18%)

QUESTION:
Lack of Government support is a significant obstacle to building the blockchain economy

POLLING RESULTS:

AGREE	19 (63%)
NEUTRAL	04 (13%)
DISAGREE	07 (23%)

QUESTION:
Regulatory Barriers are a significant obstacle to building the blockchain economy

POLLING RESULTS:

AGREE	22 (67%)
NEUTRAL	07 (21%)
DISAGREE	04 (12%)

* Note: For further clarity of group consensus, the response categories of "Somewhat Agree" and "Strongly Agree" have been combined to form "Agree", and the response categories of "Somewhat Disagree" and "Strongly Disagree" have been combined to form "Disagree."

APPENDIX B:

ROUNDTABLE RESPONSES - CANADIAN BLOCKCHAIN ECONOMY OBSTACLES* *(CONTINUED)*

QUESTION:
Access to talent and retention of talent are significant obstacles for blockchain companies

POLLING RESULTS:

AGREE	18 (58%)
NEUTRAL	06 (19%)
DISAGREE	07 (23%)

QUESTION:
Entrenched Legacy Cultures, Systems etc. are a large obstacle for business and/or government transformation

POLLING RESULTS:

AGREE	29 (100%)
NEUTRAL	00 (0%)
DISAGREE	00 (0%)

QUESTION:
Immigration policy is a significant obstacle to building the blockchain economy in Canada

POLLING RESULTS:

AGREE	15 (48%)
NEUTRAL	06 (19%)
DISAGREE	10 (32%)

QUESTION:
Difficulty of Canadian companies penetrating global markets is a significant obstacle to building the blockchain economy in Canada

POLLING RESULTS:

AGREE	10 (37%)
NEUTRAL	06 (22%)
DISAGREE	11 (41%)

* Note: For further clarity of group consensus, the response categories of "Somewhat Agree" and "Strongly Agree" have been combined to form "Agree", and the response categories of "Somewhat Disagree" and "Strongly Disagree" have been combined to form "Disagree."

APPENDIX C:

ROUNDTABLE RESPONSES – ACTION ITEMS: WHAT IS TO BE DONE?*

QUESTION:
Tax incentives for early stage and second stage investment through R&D flow through to startups

POLLING RESULTS:

AGREE	23 (74%)
NEUTRAL	04 (13%)
DISAGREE	04 (13%)

QUESTION:
Create an innovative box to keep people and IP in Canada, through tax incentives etc

POLLING RESULTS:

AGREE	21 (72%)
NEUTRAL	05 (17%)
DISAGREE	03 (10%)

QUESTION:
Canada needs a national blockchain strategy - created by government, private sector, & civil society

POLLING RESULTS:

AGREE	26 (81%)
NEUTRAL	01 (03%)
DISAGREE	05 (16%)

QUESTION:
Launch a blockchain SmartCities initiative

POLLING RESULTS:

AGREE	14 (47%)
NEUTRAL	12 (40%)
DISAGREE	04 (13%)

QUESTION:
Create a blockchain centre of excellence in Toronto

POLLING RESULTS:

AGREE	23 (82%)
NEUTRAL	04 (14%)
DISAGREE	01 (04%)

QUESTION:
Incentives to get blockchain into university curricula - developing blockchain courses, goal to create the 1st university degree in blockchain

POLLING RESULTS:

AGREE	25 (86%)
NEUTRAL	02 (07%)
DISAGREE	02 (07%)

* Note: For further clarity of group consensus, the response categories of "Somewhat Agree" and "Strongly Agree" have been combined to form "Agree", and the response categories of "Somewhat Disagree" and "Strongly Disagree" have been combined to form "Disagree."

APPENDIX C:

ROUNDTABLE RESPONSES – ACTION ITEMS: WHAT IS TO BE DONE?* *(CONTINUED)*

QUESTION:
Encourage syndicated research into opportunities, use-cases, & applications - all based in Canada

POLLING RESULTS:

AGREE	24 (80%)
NEUTRAL	02 (07%)
DISAGREE	04 (13%)

QUESTION:
Build a partnership with another nation on blockchain initiatives. (e.g. UK, Australia)

POLLING RESULTS:

AGREE	24 (80%)
NEUTRAL	05 (17%)
DISAGREE	01 (03%)

QUESTION:
Create a Canadian advisory council on regulations in the blockchain age

POLLING RESULTS:

AGREE	26 (87%)
NEUTRAL	01 (03%)
DISAGREE	03 (10%)

QUESTION:
Was this an interesting and productive meeting?

POLLING RESULTS:

AGREE	25 (89%)
NEUTRAL	01 (04%)
DISAGREE	02 (07%)

* Note: For further clarity of group consensus, the response categories of "Somewhat Agree" and "Strongly Agree" have been combined to form "Agree", and the response categories of "Somewhat Disagree" and "Strongly Disagree" have been combined to form "Disagree."

APPENDIX D:

BLOCKCHAIN OPPORTUNITIES BEYOND FINANCIAL SERVICES

In addition to the transformation of financial services cited in the report, every industry is a candidate for deep change. These are documented at length in our book **Blockchain Revolution**. For example:

RETAIL

During the first generation of the Internet, retailers collected consumer data to drive business. But when these firms get hacked, it's the consumers who bear much of the burden of stolen credit card and bank account information.

All of this is because we are asking hammer salesmen at Home Depot to store the same personal information as a bank in order to give a consumer some rewards points. Blockchains offer a powerful authentication tool to consumers, adding a new type of digital consent which could radically change the consumer-retailer relationship. But what does this new relationship between consumer and retailer look like? What are the implications for the infrastructure we're currently relying on for the consumer-retailer relationship?

Blockchains could make the retail experience more private and secure for the user while also offering a richer experience. Consider this: you are walking down the street, your mobile device advises you that the dress you have been looking at is available at the Gap. Walk into the store and the dress, in your size, is waiting for you. After trying it on, you scan it and the payment is complete. But you've got other things to do, so the dress finds its way to your house before you get home. In addition to increasing operational efficiencies and environmental monitoring, retailers will be able to personalize products and services to identify customers as they pass by based on their location, demographics, known interests, and purchasing history – provided that those customers opened their personal data to retailers on the blockchain. The world of big data in retail is giving way to the world of bigger, smaller, and more personalized data — with informed consent.

For example. Walmart, the world's biggest retailer, is preparing a pilot project with partners in the U.S. and China that will use blockchain to track shipments of pork in China and fresh produce in the U.S., the Wall Street Journal reported in December 2016. The pilot is seen as a major test of blockchain technology outside the financial services industry. It will draw in farmers, packers and shippers who have had little experience with blockchain up to now. The blockchain distributed ledger will replace paper files, and speed up supply chain processes at much lower cost. Walmart's partners are IBM and Tsinghua University in Beijing. A Deloitte survey published in mid-December found that 42% of companies in consumer goods and manufacturing plan to spend at least US$5m each on blockchain technology in 2017. The survey covered 308 executives at companies with annual revenues of at least US$500m.

Overstock.com, a well-known online retailer, issued a series of preferred shares using blockchain in December 2016, with full approval from the U.S. Securities and Exchange Commission. About one-tenth of the US$10.9m raised from existing shareholders came from shares traded on a blockchain platform developed by an Overstock.com subsidiary. Shares traded on the blockchain platform settle almost instantly, versus several days on a traditional stock exchange. Blockchain also prevents unauthorized investors from trading shares they do not own.

MANUFACTURING

With blockchain, manufacturing-intensive industries can give rise to planetary ecosystems for sourcing, designing, and building physical goods, marking a new phase of peer production. Combined with other new technologies such as three-dimensional printing, manufacturing will move closer to the user, bringing new life to *mass customization*. Soon, data and rights holders can store information about any substance from human cells to powered aluminum on t While the blockchain's impact on business will be profound, it will have an equal if not greater impact on many of our public institutions charged with delivering services to all citizens. The reasons are manifold: Blockchain technology has the potential to rebuild public trust in

political institutions by creating more transparency and lessening the opportunities for corruption. What's more, it can help the machinery of government run more efficiently, at lower cost, and with an unprecedented level of privacy and security

The practical applications of blockchain are almost limitless. The police will no longer be able to withhold evidence of undue use of force, and evidence cannot go missing when it can all be logged and tracked on a blockchain. All our official documents—birth and death certificates, marriage license, driver's license, passport, health card, land titles, status of tax payments, school transcripts, and so on—can be stored in a single blockchain. Some have suggested that the blockchain could even become a public document registry beyond any government sanction or involvement. Smart devices can be recorded in a blockchain ledger to lower security, maintenance and energy costs through automated access, lighting and temperature controls. Similarly, a blockchain can track the location and condition of government vehicles, and the safety of bridges, railways and tunnels. Without exaggeration, this technology has the potential to improve almost every aspect of a government's interaction with its citizens. Our book gives many other examples from around the world.

This technology is also a powerful monitor of the provenance of goods and their movement throughout a supply network. Indeed, manufacturers and other consumers of raw materials struggle with $300 billion/year in global supply chain fraud and leakage. Tracking assets on a blockchain would reduce counterfeit goods and materials on the market, make fraud more difficult and streamline border crossings. Consider that over one billion dollars/day passes across the US-Canada border. As the World Economic Forum has estimated, even a 50% reduction in supply chain barriers at global borders could increase global GDP ***six times*** more than the elimination of all tariffs around the world – a huge opportunity for businesses and governments alike.

A look at the flow of goods in manufacturing leads to insight into how profound the implications are for the blockchain revolution. A contract is said to be a meeting of the minds. Blockchains are already being used to create smart contracts in manufacturing because they're becoming meeting places for digital relationships. These relationships are not just for supply chain management, but at the same time for trade financiers, certification organizations, and customs agents.

Blockchains are allowing for the coupling of the flow of goods and money. Some of the motivation for this coupling is deep tier financing. Here, the visibility and transparency in a supply chain extends through the manufacturing process from the financiers to the consumers. Visibility established through a blockchain is drawing financing to satisfy ethical consumption habits. Among other things this means financing activated in the fight against sweat shops, slavers, counterfeiters, or fraudsters.

MEDIA

Today, content creators do not receive their fair share of the value they create as the system for managing IP rights is fundamentally broken. Consider the newspaper industry that is in a chronic crisis. This is a huge social problem leading to the fragmentation of public discourse, and the challenges facing journalists to make a living for their work.

This goes for songwriters and recording artists who now receive only financial crumbs at the end of the process. For example, in the past a platinum song that sold a million singles would earn the songwriter about $45,000. Today, if a song receives a million streams online, the songwriter makes $35 – about enough to get a nice pizza. With new blockchain based digital rights management systems, content creators are empowered, controlling how their music is played, remixed, and licensed, and they get to choose how and when they're compensated. Blockchain removes the need for many intermediaries such as record labels, agents and other third parties, who for so long have controlled the industry for the sole reason that they been around for so long.

The Bitcoin blockchain created the world's first inherently digital property where value can be protected. Before Bitcoin, the concepts of digital and scarcity was antithetical. Anything digital could be copied. Media industries are still coping with the Internet of Information and its treatment of all data as bits and bytes, sold wholesale by monthly packages consumed in gigabytes.

What the coordination and combination of technologies that make up a blockchain has created is some piece of digital code that is uncopiable, unique. All of the sudden, we live in a world where something digital, by being unique, can be traded as digital information of value. While many see this as relevant to finance, intellectual property as an institution also has an opportunity to grow as a result of the type of digital property blockchains have created.

THE TECHNOLOGY INDUSTRY

The technology industry is about to be disrupted in ways few could have anticipated. Consider the Internet of Things (IoT): by some estimates within a few years there will be hundreds of billions, perhaps trillions, of internet-connected devices doing everything from driving us around to monitoring our health to generating power, from heating our homes to organizing our affairs. These devices will need a native digital medium to communicate value and sensitive data securely, at zero-cost and at lightning speed. Indeed, the internet of everything will need a ledger of everything to ensure continuity and coherency.

There's also the legal character of these machines to consider. Picture, for example, using a trusted source of real-world data (an oracle of sorts) to supply information in a smart contract (eg. An IoT thermometer in a shipping container tied to a shipping insurance contract).

Any centralized client-server with accounts or log-ins for authentication of the IoT sensor would be at risk of all the same hacking vulnerabilities of the digital infrastructure we use today. Denial-of-service attacks and account information breaches would weaken the use of these tools. These vulnerabilities pose complex questions as we integrate machines into our responsibilities and obligations.

The push transaction of a machine authenticating itself through the possession and use of a private cryptographic key is a useful form of consent. It avoids the issues presented by a centralized account administrator. Identity and authentication established this way promises to satisfy the legal character machines need to participate in these contracts, integrating them into the Internet of Value.

Or how about the sharing economy? Companies like Uber and Airbnb and others have come out of nowhere to capture the imagination of people everywhere, but they are not real sharing models at all. In fact, they are successful simply because they don't share — they aggregate excess capacity through a centralized intermediary and re-sell it to a willing market. Oddly enough, it turns out that blockchain can replace a lot of those functions – and everything from identity and reputation to contracts and payments can be radially simplified. With a distributed application, you could have a true sharing economy model where those who create value are fairly compensated for the value they create.

Because a blockchain can process both static data (a database) and dynamic data (transactions), it represents an evolution in systems of record. Such a system of record can navigate and manage the many relationships and state changes of property being used in yet unimagined commercial ways.

HEALTHCARE

The healthcare system in many countries is under extreme strain, where every stakeholder, from healthcare providers to insurers, drug companies and most of all patients, all suffer as a result. Though there are many culprits, the root of the problem is our industrial-age thinking about delivering healthcare, where data is hoarded, patients are assumed to be ignorant, and where healthcare is only available when you're in the system. This leads to costly and ineffective care. Blockchain promises to change that. We can fix healthcare by basing it on a set of new principles — collaboration, openness, and integrity, and where the patient co-creates their own data with full transparency into it.

Patients and frontline health care providers are separated by a labyrinth of relationships between jurisdictions, professional services, specialists, and other providers. The digital processes used are really for the logistics of handling paper documents. There are several paper trails per doctor-patient or patient-provider interaction, and lots of data entry duplication.

The process is the same as before anyone had ever heard about a computer, except the information moves into separate data silos much faster. In short, a lot of time and effort goes into managing data between organizations. Another way to put this is that we used to expend energy maintaining databases. The invention of blockchains means we can move beyond the simple custodianship of a database and turn our energies to how we use and manipulate databases — less about maintaining a database, more about managing a system of record.

GOVERNMENT AND DEMOCRACY

While the blockchain's impact on business will be profound, it will have an equal if not greater impact on many of our public institutions charged with delivering services to all citizens. The reasons are manifold: Blockchain technology has the potential to rebuild public trust in political institutions by creating more transparency and lessening the opportunities for corruption. What's more, it can help the machinery of government run more efficiently, at lower cost, and with an unprecedented level of privacy and security

The practical applications of blockchain are almost limitless. The police will no longer be able to withhold evidence of undue use of force, and evidence cannot go missing when it can all be logged and tracked on a blockchain. All our official documents—birth and death certificates, marriage license, driver's license, passport, health card, land titles, status of tax payments, school transcripts, and so on—can be stored in a single blockchain. Some have suggested that the blockchain could even become a public document registry beyond any government sanction or involvement. Smart devices can be recorded in a blockchain ledger to lower security, maintenance and energy costs through automated access, lighting and temperature controls. Similarly, a blockchain can track the location and condition of government vehicles, and the safety of bridges, railways and tunnels. Without exaggeration, this technology has the potential to improve almost every aspect of a government's interaction with its citizens. Our book gives many other examples from around the world.

Blockchain presents governments with four huge opportunities. The first is to harness this technology to rewire the economy for innovation. Blockchains will not simply disrupt every industry – they will dramatically lower barriers to business creation. This hints at the beginning of a new relationship between government and the private sector. From the beginning, blockchain developers have seen regulatory compliance regimes establishing the boundaries of certain relationships as a business opportunity. Blockchain-based markets can authorize transactions according to the regulatory regime of the marketplace. Food safety certification can be established using a blockchain as a digital system of record. In short, new and interesting opportunities exist for the private sector to formalize relationships prescribed by laws and regulations.

Anyone can build value in this global economy, and governments should consider what role they can and should play to achieve this goal. The second opportunity is to reconfigure government for greater transparency and accountability to citizens. Government should do far more at less cost, with more input from citizens. The third is to design the preconditions for everyone to succeed. Rather than re-distributing wealth, we could pre-distribute wealth, democratizing the means by which citizens generate wealth in the first place. Finally, what are the implications of blockchain for the democratic process, and how can we help overcome the crisis of legitimacy of democratic institutions. This also forces an existential question for governments. Because the technology's capacity is to secure relationships in the digital world, there are implications for a concept inherent to relationships in the physical world: the idea of jurisdiction itself is under stress.

This is occurring at all levels of government. For example, the **city of Rotterdam** is working with Deloitte and the US-based Cambridge Innovation Centre to develop a blockchain platform for housing transactions. The first step is to record rental contracts on a blockchain. Once that phase is complete, the project will tackle monitoring of rental payments. Deloitte said in a statement that "by implementing additional blockchain applications in the real estate industry, transaction times and costs can be reduced further. Furthermore, it enables decision makers to use data analysis for making future investment decisions on selling, buying and constructing real estate."

CENTRAL BANKS

The Bank Of England Proposes Digital Fiat Currency (aka Britcoin): In the weeks leading up to and following the BREXIT vote, Mark Carney laid out a bold vision for the future of the UK and Global economy with based on blockchain and fintech. Perhaps the most radical proposal he made was to suggest the UK explore adopting a fully digital pound. He reasoned that since transaction are increasingly digital, that money itself ought to be too.

The Bank outlined three reasons this was a good idea:

1. **Cost and Efficiency.** Moving everything to a native digital medium for money reduces the reliance on third party intermediaries, because digital transactions can clear and settle peer to peer instantly (like a transaction in cash). Reduces friction and costs. Good for banks. Good for consumers.
2. **Inclusion and Performance.** We could build a financial services industry that does more and is more inclusive. How about bringing the 2.5 billion unbanked people into the economy? The basics of retail banking – savings and loans- ought to be a free commodity available to all. Smart countries will move quickly. Bank of England suggested in a report that if just 30 percent of transactions in the pound sterling were doing this way, that would add 3 percent to the GDP.
3. **Transparency and Risk Reduction:** Reduce settlement risk – trade might fail. Reduce counterparty risk- your counterparty doesn't have the funds to satisfy their obligation. Reduce systemic risk because regulators and central bankers will have better information and can respond to crises.

SOCIETAL OPPORTUNITIES

There are countless broader opportunities for society as a whole. Consider the case of Climate and Planet Stewardship.

With the emergence in 2015 of the Sustainable Development Goals (SDGs) and the Paris Agreement as the new global framework for addressing climate change, this enormous momentum is being manifested with an unprecedented diversity of initiatives and innovative models integrating environment, society and economy. Although developed country governments led the way during the 1990s and 2000s, that leadership has turned to stagnation, and in some cases—notably the US—possibly going into reverse, action is being focused at the sub-national level by a multitude of non-state actors such as cities and companies. Several of these non-state actors are starting to use digital technologies suchas IoT devices and big data analytics to enable better measurement and verification of sustainability performance. However, the existing market infrastructure for sustainability issues, such as carbon markets, faces a plethora of challenges such as fragmentation, non-fungibility of market instruments, difficulty scaling—among many other challenges—that is limiting non-state actors to be able to monetize their sustainability performance. Blockchain technology has the potential to overcome many of these challenges, as well as enable non-state actors to create new strategies and business models from their data and stakeholder networks.

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