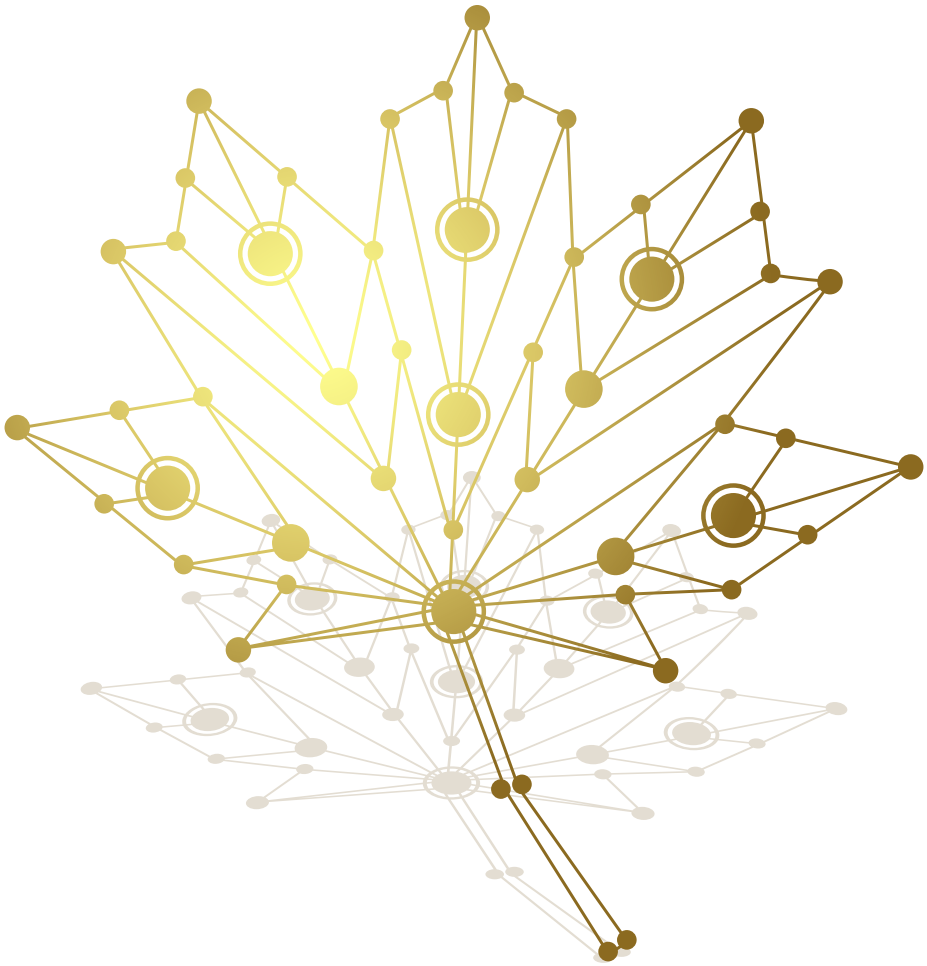
Centre for International
Governance Innovation

CIGI Papers No. 251 — April 2021

A Canadian Framework for Data Reuse

Michel Girard



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About the Author

Michel Girard is a senior fellow at CIGI, where he contributes expertise in the area of standards for big data and artificial intelligence (AI). His research strives to drive dialogue on what standards are, why they matter in these emerging sectors of the economy, and how to incorporate them into regulatory and procurement frameworks. He highlights issues that should be examined in the design of new technical standards governing big data and AI in order to spur innovation while also respecting privacy, security and ethical considerations.

In addition, Michel provides standardization advice to help innovative companies in their efforts to access international markets. He contributes to the CIO Strategy Council's standardization activities and advises the Chartered Professional Accountants of Canada on data governance issues.

Michel has 22 years of experience as an executive in the public and not-for-profit sectors. Prior to joining CIGI, Michel was vice president, strategy at the Standards Council of Canada (SCC), where he worked from 2009 to 2018. At the SCC, he led the design and implementation of the Standards and Innovation program, the Climate Ready infrastructure program, the Northern Infrastructure Standards Initiative and the Monitoring Standards in Canadian Regulations project. He managed the negotiation of standardization clauses in trade agreements including the Comprehensive Economic and Trade Agreement and the Canadian Free Trade Agreement. Previously, he was director of the Ottawa office at the Canadian Standards Association, director of international affairs at Environment Canada, corporate secretary at Agriculture Canada and acting director of education and compliance at the Canadian Environmental Assessment Agency. He holds a Ph.D. and a master's degree in history from the University of Ottawa.

Acronyms and Abbreviations

4G	fourth-generation
5G	fifth-generation
AI	artificial intelligence
API	application programming interface
B2G	business-to-government
CDOs	chief data officers
CIOSC	Chief Information Officers Strategy Council
DSTF	Data Standards Task Force
IoT	Internet of Things
IP	intellectual property
ISED	Innovation, Science and Economic Development Canada
O-RAN	Open Radio Access Network
SCC	Standards Council of Canada
SMEs	small and medium-sized enterprises

Executive Summary

Although Canada is making progress in protecting consumers against data misuse, it needs to turn its attention to enabling data reuse. The current practices and tools in place are not conducive for data sharing. This creates a significant hurdle for data scientists and statisticians as they cannot train algorithms without large data inputs. A national framework for data reuse is needed to manage risks associated with data sharing. It should include sector-based data strategies, the certification of new classes of data professionals across data value chains, common interoperability and governance standards, and a safe and secure data transmission infrastructure. As common data-sharing spaces are needed for data reuse to occur, there is an opportunity to experiment with different data-sharing models. A national data reuse framework is essential for Canada to assert its data sovereignty and become a digital society. This is why the federal government has a critical role to play.

Introduction

Canada is falling behind in the global race to assert sovereignty over data. Although governments are making progress in the battle to protect consumers against data *misuse*, we need to turn our attention to building a national framework for data *reuse*.

A number of laudable initiatives are under way to reduce data misuse. National programs are being developed to protect citizens, consumers and patients through a new digital identity framework (Treasury Board 2018). Work is slated to begin on national standards for open banking (Chief Information Officers Strategy Council [CIOSC] 2020). The federal government is implementing its federal data strategy to provide online services to Canadians (Government of Canada 2018). It recently tabled a Digital Charter giving individual Canadians the power to manage personal data collected by organizations, from small and medium-sized enterprises (SMEs) to big tech platforms alike. The government, through former Innovation, Science and Economic Development Canada (ISED) Minister Navdeep Bains, also made public statements about conducting a review of the Statistics Act as part of commitments made under the Digital Charter (ISED 2020a). A new version of the Privacy Act is being contemplated to modernize privacy protections and to help manage data sets held by federal departments and agencies (Justice Canada 2020). A new regulatory framework to monitor hate speech on online platforms will soon be tabled in the House of Commons (Silver 2021) and major investments have been announced to introduce broadband internet accessibility to rural regions of the country (ISED 2020b). Taken together, these initiatives will help level the playing field between citizens and organizations and big tech platforms.

The time has come for Canada to turn its attention to treating data as a strategic asset. It is time to build a Canadian framework for data reuse. Industry and thought leaders are calling for made-in-Canada sectoral strategies to spur data sharing between organizations. Data reuse is also required to help solve public policy problems in sectors such as education and health care. The concept of data reuse makes sense from an economic and efficiency perspective. With the right framework in place, it will be cheaper and more efficient to recycle existing data sets than to create them from scratch.

Although the government did release a Data Strategy Roadmap for the Federal Public Service, there has been no commitment to a broader Canadian data strategy. Creating a Canadian framework for data reuse is not for the faint of heart. It is about nation building. The scale of the effort will be comparable to building a railway, completing the Trans-Canada Highway or setting a national health-care system, all recognized as transformational projects in earlier periods of our national history. Canada needs a trans-Canada data highway. The federal government has a critical role to play in guiding the creation of this framework.

Canada Falling Behind

Recent developments in the European Union and the United Kingdom point to comprehensive, government-led initiatives to build frameworks for data reuse. They should be seen as responses to ward off US and Chinese interests from corralling and hoarding astronomical troves of data to feed their own algorithms and machine-learning tools. In the United States, big tech platforms continue

to expand their global reach under a laissez-faire, unfettered, winner-takes-all approach. Big tech platforms have acquired an almost insurmountable degree of market power, thanks to a business model based on the ownership and control of data generated by billions of users. China, through its artificial intelligence (AI) strategy and the largest investment of public resources in AI research and commercialization in the world, also aims to become a global AI superpower (Westerheide 2020). China's AI strategy, its recently released IP strategy (Schindler 2020), its upcoming China Standards 2035 plan (Kharpal 2020) and its quantum research work (Robles 2020) will become the building blocks of a seamless and centrally controlled infrastructure for data reuse. China is also capturing data from outside its borders via its Belt and Road Initiative.

These developments provide useful insights as Canada is pondering how best to approach data reuse that respects individual rights and fosters our democratic institutions.

UK National Data Strategy

In September 2020, the UK government unveiled its draft National Data Strategy. The strategy sets goals for the government, industry and the non-profit sector as the country transitions to a digital society and economy (United Kingdom 2020). It aims to unlock the value of data by setting the correct conditions to make data usable, accessible and available across the economy, while protecting people's data rights and private enterprises' intellectual property (IP). The strategy recognizes that for data to have the most effective impact, it needs to be appropriately collected, accessible, mobile and reusable. That means encouraging better coordination; enabling access to and sharing of data of appropriate quality between organizations in the public sector, private sector and third sector; and ensuring appropriate protections for the flow of data internationally.

The strategy argues that the following issues need to be addressed to set the right "data foundations":

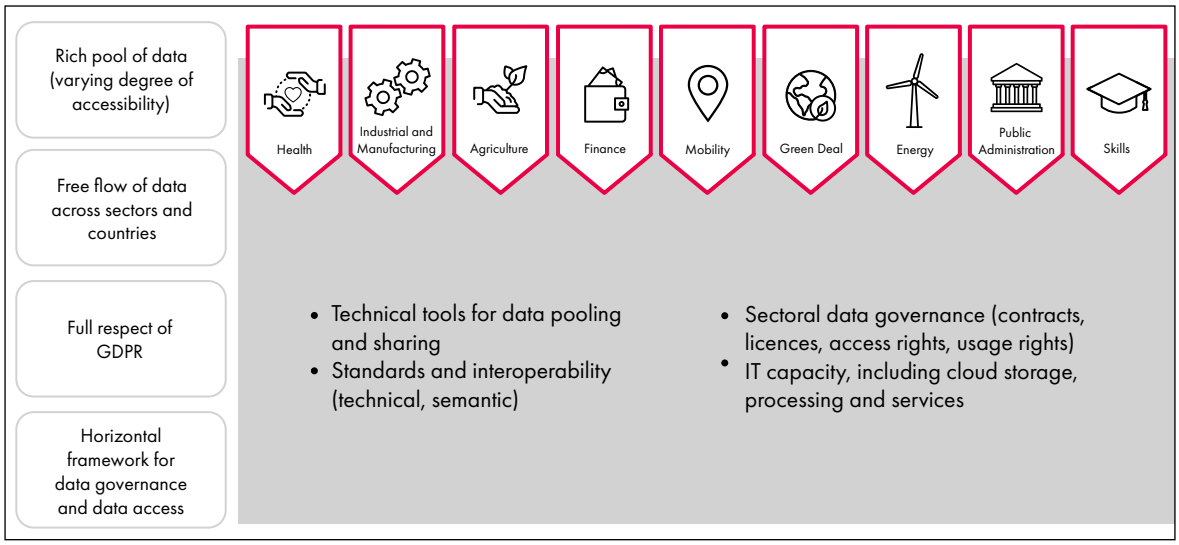
- data quality issues, including different standards for data used at all stages of the data life cycle from collection to publicly available data sets;
- the inconsistent use of metadata — where it was provided at all;
- issues with legacy systems and different, often incompatible systems for inputting and recording data at different stages of the data journey;
- a lack of resources for local authorities to deal with data issues;
- a lack of senior buy-in and leadership on data due, in part, to insufficient data/digital knowledge; and
- a lack of alignment across government.

The National Data Strategy proposes to address these issues by focusing on the development of international interoperability and data governance standards to create the right data foundations. To make progress on standardization, the strategy calls for the creation of a Data Standards Authority, which will identify and agree on a prioritized list of mandatory data standards to adopt across government. The UK strategy does not make specific commitments at this stage toward the creation of a new infrastructure for data sharing. The government is expected to submit a five-year implementation plan in 2021, which will provide more specifics on a framework for data reuse.

European Strategy for Data

The European Union recently unveiled its approach to master sovereign data. Early in 2020, it released its European Strategy for Data. Recognizing that data can transform all sectors of the economy and is crucial for AI, it proposed the creation of a common European data space and a single market for data where it can flow within the European Union and across sectors. This is needed because there is currently not enough data available for reuse to train algorithms. The strategy proposes to build new European data processing/storage solutions along with comprehensive data governance approaches to increase data sharing among companies and to make more data available overall. The strategy is to be deployed through four pillars: a cross-sectoral governance framework for data access and use; a high-impact project focused on creating European data spaces/federated cloud infrastructures; competencies (including dedicated capacity building for SMEs); and the rollout of common European data spaces in crucial economic sectors and domains of public interest.

Figure 1: Common European Data Spaces



Source: European Commission (2020d).
Note: GDPR = General Data Protection Regulation.

According to the European Strategy for Data, the success of its digital transformation over the next five years will depend on "establishing effective frameworks to ensure trustworthy technologies, and to give businesses the confidence and means to digitize." It aims at creating a single market for data that will ensure Europe's global competitiveness and data sovereignty. Common European data spaces will ensure that more data becomes available for use in the economy and society, while keeping companies and individuals who generate the data in control (European Commission 2020b).

In November 2020, the European Commission tabled the Data Governance Act to implement the European Strategy for Data (European Commission 2020a). Common European data spaces will be created to support data sharing in crucial sectors including health, the environment, energy, agriculture, mobility, finance, manufacturing, public administration and skills.

The European Union will be investing between €4 billion and €6 billion to develop data-processing infrastructures, data-sharing tools, architectures and governance mechanisms for thriving data sharing, and to federate energy-efficient and trustworthy cloud infrastructures and related services (Digital EU 2020). It published a comprehensive report from a high-level expert group focusing on business-to-government (B2G) data sharing, which sets a series of recommendations to facilitate the uptake of data sharing among organizations. B2G initiatives to share data represent a solid first step toward the broader objective of data sharing across supply chains (European Commission 2020c). New tools, such as the EU Support Centre for Data Sharing, are being deployed.[1] Taken together, these measures are expected to roughly triple the value of the data economy by 2025 to €829 billion, or 5.8 percent of GDP.

As indicated above, these initiatives are part of a broader effort to wrest digital influence from tech platforms in the United States and from China as it expands the reach of its telecommunications offerings and big tech platforms. "The battlefield for industrial data is starting now," Thierry Breton, European commissioner for the internal market, said of the proposal (quoted in Schechner 2020). "While being an open continent, we are not naive," he added (ibid.). Under the new sharing mechanism, industrial and government data used by industry could be exported overseas, but companies would need to ensure they are processed with the same protections as required within Europe. "Officials don't rule out future regulations to limit some exports in certain sensitive sectors" in order to maintain data sovereignty (Schechner 2020).

1 See https://eudatasharing.eu/.

Canadian Framework for Data Reuse

This paper argues that Canada's response to foreign data harvesting needs to go beyond applying restrictions on data misuse. It also requires asserting sovereignty, control and ownership of data collected from public, private and industrial sources in order to foster data reuse. This can only be achieved through a coherent framework composed of a number of inter-related initiatives:

- Sectoral data strategies to kick-start Canada's economic recovery post COVID-19. They have been called for by industry and thought leaders from manufacturing, agri-food, natural resources, bioscience and digital industries. The same calls for sector-specific national data strategies have been made by thought leaders in sectors delivering public goods such as health care, public health, education and smart cities.
- Data value chains — new constructs stringing together data from multiple points across existing supply chains to link data collection and labelling, data storage, and access and data analytics activities. Data value chains will spur data sharing between organizations and the implementation of sectoral data strategies.
- New professional classes to support specific segments of data value chains. In addition to data scientists focusing on the development and training of AI and machine-learning tools, Canada needs to train data engineers to focus on data collection and labelling as well as data controllers to manage data access rights and sharing centres. To ensure that valid conclusions are drawn from data and to benefit from solidly established scientific frameworks, organizations may need to turn to statisticians to obtain insights from the data.
- A standardized data governance rulebook to help organizations share and reuse data across data value chains. Standardized guidance is needed to handle cross-cutting issues such as data ownership, IP, copyright and tracking, data residency requirements, privacy and ethics. This is a prerequisite for upstream firms to share data with downstream AI-specialized firms.
- Interoperability standards to properly frame data collection, sharing, access and analytics activities and allow for data sharing across sectors.
- Common spaces for data sharing represent the most important component of the data reuse framework. The federal government has a critical role to play on that front. It can take a page from the European Union's playbook. Investments are required in data spaces supporting specific sectors in order to manage access rights and generate much-needed trust among participants.
- A fifth-generation (5G) safety code to set rules and performance requirements for the emerging infrastructure underpinning data collection, transmission and storage. This new infrastructure will be made up of billions of Internet of Things (IoT) devices, 5G networks connecting hundreds of thousands of antennas affixed to buildings, roads and other infrastructure. It needs to be safe for users and workers and it needs to be secure.
- An international data free-trade zone to allow for data sharing between like-minded countries. Canada's data reuse framework should encourage international data collaboratives while asserting its sovereignty of national data.

Sector-Specific Data Strategies

There is a strong business case for Canada to treat data as a strategic asset. Canada's annual GDP growth, like that of other Group of Seven countries, is not keeping up with other regions of the world. It needs to harness data and accelerate its transition to the digital economy in order to remain competitive. Industry and thought leaders have articulated this need across sectors for some time now. In 2017, the Government of Canada launched its Innovation and Skills Plan as a first step to position the country as a global leader in innovation. With this plan, six Economic Strategy Tables were created to foster innovation in natural resources, manufacturing, agri-food, health and biosciences, clean tech and digital industries. More than 80 industry and thought leaders were asked to describe key challenges facing their respective sectors, and to identify opportunities for growth. The final reports, tabled in the fall of 2018, present similar themes across industries, including the need to develop sector-specific data strategies and create an architecture allowing organizations to share data (Girard 2019a).

The overview report, which consolidates recommendations from the individual reports, declares: "All economic sectors must be digital sectors. Bold adoption of digital platform technologies will enable us to leapfrog other countries" (Canada's Economic Strategy Tables 2018a). Indeed, as outlined below, a strong case is being made to develop sector-specific data strategies.

Although natural resources (including forestry, energy and mines) are expected to remain central to Canada's portfolio of exports, the "Resources of the Future" report calls for the development of a Canadian data strategy for the natural resources sector to successfully integrate digitization and the IoT into supply chains. It argues that digital adoption in the United States was a significant driver behind the growth of lower cost US oil that disrupted oil markets in recent years. It recommends the installation of advanced digital sensors on oil fields and extraction equipment to boost effectiveness, lower costs and improve safety. Private sector data sharing, data pooling and AI are also proposed to enhance the competitiveness of the sector.

The "Agri-food" report points to "huge opportunities to supply the growing global demand for protein" as the world's global population is expected to reach 10 billion people by 2050 (Canada's Economic Strategy Tables 2018b, 2). But the sector needs digitization to remain globally efficient. Regarding data sharing, it notes that "Agrifood businesses are adopting digital technologies that collect large amounts of data. Data is being collected but stored in different formats and different platforms, different sectors, and also exported outside the country. This lack of interoperability inhibits the use of shared open-data platforms that provide important insights and enable new innovations to sprout up" (ibid., 15).

The "Advanced Manufacturing" report notes the continued hollowing-out of the Canadian manufacturing sector and urges for a rapid transition toward digitization. According to the report, the sector faces a stark choice: "it will either adopt technology or die" (Canada's Economic Strategy Tables 2018c, 4). However, "with the right technologies in place — robotics, additive manufacturing and big data analytics — Canadian manufacturers can spur innovation and transform the efficiency of their operations" (ibid., 2). Digital manufacturing will impact virtually every facet of manufacturing: from how products are researched, designed, fabricated, distributed and consumed to how manufacturing supply chains integrate and factory floors operate (ibid., 12).

Digitization is also featured in the "Health and Biosciences" sector report. The report calls for the creation of a national digital health strategy "that will provide a framework for privacy and data security, data governance and data sharing, and increase the information available to patients so they can make decisions about their own health outcomes" (Canada's Economic Strategy Tables 2018d, 10). The report goes on to say that "high performing, interoperable, digital systems are seen as a critical enabler of data-driven advances in health. Artificial intelligence is already being used to create patient-centric treatment plans based on a combination of data analytics and the most recent scientific studies. Digital and data transformation will increasingly play a role in finding active therapies for incurable or difficult-to-cure diseases as well as greater success in targeting specific treatments to individual patients" (ibid., 11).

The "Digital Industries" report considers data to be "the most lucrative commodity of the new global economy" (Canada's Economic Strategy Tables 2018e, 12). Data analytics and self-teaching algorithms are projected to continue to disrupt every imaginable market; however: "in the absence of clear regulations for data infrastructure and the way data is owned, collected, processed, stored, and used, firms (especially large multinationals) will make their own rules" (ibid., 12–13).

Although little discernable progress has been made on that front over the past two years, the federal government now has a unique opportunity to re-engage with key sectors of the Canadian economy on a dialogue to leapfrog digital transformation post COVID-19. A combination of members from Canada's Economic Strategy Tables, federal departments and agencies and perhaps other relevant institutions such as Canada's superclusters, could help design and deliver data strategies for key sectors of the economy and for sectors delivering public services such health care, education and smart cities.

Sectoral consultations should identify key issues or vexing problems that could be addressed by sharing data across organizations to generate new insights from AI and machine-learning tools. Participants could describe the technological,

institutional, legislative and cultural barriers to data reuse between organizations. Governments and industry could share valuable information on what data sources are available, what are popular formats to store and query data, and what systems are currently used to access data. This would help determine how to structure optimal data-sharing mechanisms and platforms. Opportunities to collect data through new technologies could be explored and priorities could be set for shared data collection initiatives. Ideally, the strategy would lead to a common vision of how each sector would operate once it has completed its digital transformation. Although they submitted their final reports a little more than two years ago, Canada's Economic Strategy Tables have not been disbanded. These organizations could play a convenor role along with relevant federal departments and agencies in coordinating such consultations.

Data Value Chains

Implementing sectoral data strategies will require the creation of a new architecture supporting data collection and grading; data access and sharing; as well as data analytics. Data value chains that cut across organizations currently do not exist. Data analytics work in Canada is almost always taking place within single organizations. The risks and uncertainties associated with data sharing between organizations — even between divisions or branches in the same organization — are seen as onerous. They are inhibiting data sharing (Girard 2020a).

The term "data value chain" describes the process of turning raw data into something of value. Ultimately, organizations use data value chains to uncover vast volumes of information spread across their operations and make it available and useful to the areas of the organization that require this intelligence.

The data value chain is similar to other value chains, such as those in manufacturing, in that it breaks down the process into various subsystems, each involving inputs and outputs. How these systems and inputs and outputs are managed affects the quality, cost and, ultimately, the profit of the final product in any value chain. However, one way that data value chains differ from other value chains is that the final product is often actionable insights rather than a tangible product or service. In 2019, Statistics Canada published a study on the value of data. In 2018, Canadian investment in data, databases and data science was estimated to be as high as $40 billion. The value of the stock of data, databases and data science in Canada was $217 billion in 2018, roughly equivalent to the stock of all other IP products (software, research and development, mineral exploration). To put the growing importance of data in perspective, in 2017 the stock of established crude bitumen reserves was just over $300 billion. The same year, at an upper limit, the value of the stock of data, databases and data science was just over $200 billion (Statistics Canada 2019).

The ongoing digitization of Canada's economy is creating a tsunami of raw information. Data has become a kind of medium of exchange that flows through our economy. And as with any currency, data only has worth when there are principles about how it is valued, measured and traded. Trust is essential, thus integrity across the data value chain is therefore critical.

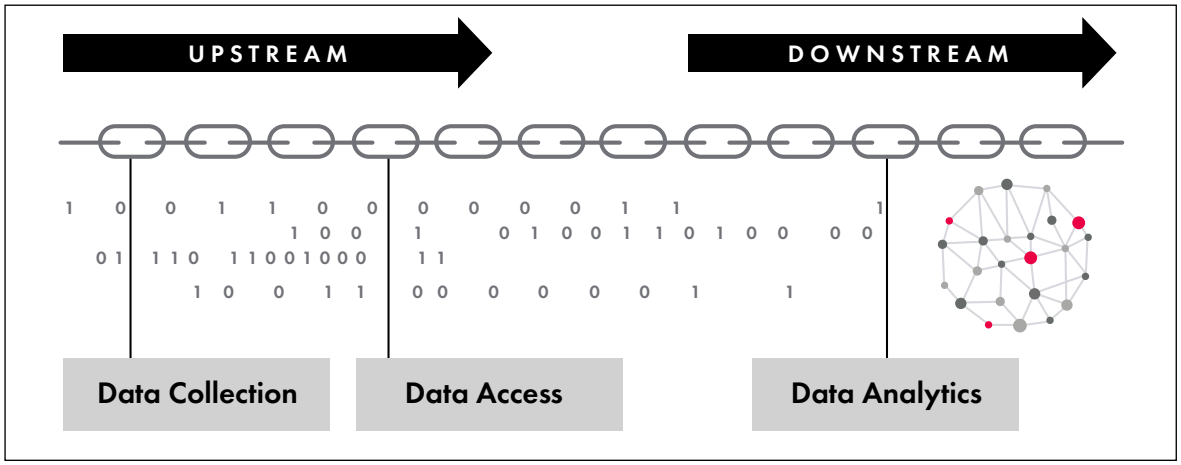
In understanding data value chains, it is helpful to consider the analogy of a more familiar value chain: oil and gas. Oil and gas value chains begin with exploration activity and test drilling and then extend across multiple subsectors (refineries, pipelines, distribution and so on); include different sorts of professionals who work at each stage (geologists, process engineers, highly skilled pipe fitters and marketers, to name a few); and require high-level oversight by professionals who can measure the value of the resource, integrate subsystems and ensure regulatory compliance.

A similar architecture will be required to create data value chains, which depend on the flow of digital information rather than the flow of oil. Data value chains are composed of three distinct types of activities: data collection and grading; data access/sharing and data analytics.

Data Collection and Grading

Activities related to data collection and grading can take place anywhere in an organization. Records, web clicks, purchase orders, financial transactions, inventories, logistics, customer interaction and data from IoT devices are routinely collected through daily operations and activities and, in many cases, treated as exhaust and not as a valuable asset. For data scientists and AI developers to take advantage of any data set, they need to understand its features, characteristics and limitations to determine if it is fit for purpose.

Figure 2: Big Data Value Chain



Source: CIGI.

Policies and procedures are needed to allow for data collection and grading to take place. Data engineers would likely be the dominant professional class managing data collection, setting up and maintaining data management systems on behalf of organizations. It is expected that the bulk of tasks associated with data value chains will take place at the collection, labelling and grading stage, but first firms need to set up such processes.

Data Access and Sharing

Data access and sharing functions are needed to make data accessible and usable. Data controllers would likely become the main professional class managing data access functions in organizations. These include the interface or platform that connects data sets with end users such as data scientists, and processes and protocols for how data will be accessed and stored. If data sharing with third parties is important, the compatibility or interoperability of platforms can become an issue. Central to interoperability is the choice of an appropriate application programming interface (API) to allow for data transmission, use, access management and tracking. In the European context, providers of data-sharing services can be managed through private sector firms and are described as providers of data-sharing services, or data intermediaries. The same flexibility will be needed in Canada. Furthermore, as Canada is a relatively small data collection market, it is likely that data sets originating from other jurisdictions will be needed to feed algorithms and machine-learning tools. International data collection platforms and data brokers will likely play an important role in collecting and sharing data for a fee.

Data Analytics

As more data is made available and accessible, it is expected that a growing number of AI consulting firms providing specialized insights to individual economic sectors or functions will enter the marketplace and offer a range of data analytics services. It is expected that data scientists and AI specialists will be the dominant professions managing the analytics functions. AI and data analytics consulting firms will be enabled to use data sets from multiple sources to create new algorithms; teach AI algorithms and generate insights to clients; embed algorithms in existing functions or processes; and use ongoing access to streaming data to offer new possibilities for the operation of machine-learning and automated decision systems. The emergence of AI consulting firms will require new approaches to IP rights in order to commercialize algorithms and reward upstream data providers.

Foundational standards can bring clarity to intended users across new data value chains, establish common parameters, allow for interoperability, and set verifiable data governance rules to establish and maintain trust between participants and with regulators.

New Professional Classes

Data value chains are creating demand for new professional classes with new competencies to perform a series of new tasks. A national framework

for data reuse should provide the necessary incentives for colleges, universities and existing professions to create and deliver a new curriculum. At the current juncture, there is no national strategy to segment, train and certify new professions involved in data reuse. Some universities offer big data courses in multiple departments. Data science programs are offered in multiple faculties. The term "data scientist" in itself is an inconsistently applied job title and professional distinction.

The new data economy needs trained and certified data engineers, machine-learning engineers and software engineers to manage data collection activities, data management systems and interfaces as well as machine-learning programming. Data engineers are needed to manage data collection, labelling and grading activities, not only for traditional data collection methods (using text, numbers and spreadsheets) but also for IoT devices, whole body communication (such as visual expression platforms) and data generated from voice commands and queries.

Assessing, testing and reporting on data quality will remain an important issue. This requires subject matter knowledge, context and considerations such as fit for purpose. Data sets need to be tested against principles such as accuracy, completeness and impartiality.

Data controllers will be needed to manage data access processes and functions and oversee compliance functions. Managing data access and sharing platforms, organizing and maintaining data dashboards, keeping tabs on data queries and ensuring compliance with data-sharing contracts as well as applicable laws and regulations will create a strong demand for data controllers. If operated strictly as a public service, this new professional category could combine competencies ranging from library sciences, contract law, privacy law and cybersecurity, as well as compliance monitoring and reporting.

Data analytics, including but not limited to AI and machine learning, is probably the most mature segment of new data value chains. Canadian universities have been successful in designing robust curriculum for statisticians for decades. Experimentation with machine learning, data science and AI has taken place over the past decades and has been led by data scientists trained in statistics.

Other expertise is required to oversee data value chains as systems, establish priorities and business cases, asses the value of data sets, integrate subsystems and ensure overall compliance to standards, procedures and regulations. Professional classes like Chartered Professional Accountants are probably well positioned to play this integration role on behalf of participating organizations. In addition, many large firms have opted to centralize data management functions under chief data officers (CDOs). These positions could be ideally suited to oversee secondary data use and data sharing across organizations.

One should expect demand for data professionals supporting data value chains to grow over time. The EU Strategy for Data estimates that the number of data professionals will double to 10.9 million workers between 2018 and 2025. Established chartered professions, such as law, engineering and accounting, could all play a role in meeting the growing demand for data professionals by expanding existing certifications or creating new specializations building on core competencies. One advantage of taking that approach is that both federal and provincial/territorial governments formally recognize these professions and their respective charters.

Data Governance Rulebook

Data value chains will only be able to operate efficiently if participating organizations adhere to a common data governance rulebook. Although each sector can design specific data-sharing rules, a more productive approach would be for governments and industry to design one rulebook that all organizations, whether private, public or not for profit, would implement as a prerequisite to sharing data. A management standard providing guidance on the development and implementation of corporate data policies could become the bridge between organizations sharing data and serve as the base for data-sharing contracts (Girard 2020a).

A proper data governance framework is seen as essential for senior management alignment and buy-in, and in order for all business units and departments to support digitization efforts. Yet little work has been done to guide organizations in their digitization journey. Ideally, organizations should treat data governance the way they treat quality management, through the adoption and implementation of a normative document covering all relevant aspects and allowing for periodic

assessment and certification. A data governance rulebook should provide clarity to staff within an organization regarding the following issues:

- What are the categories of data that can be covered for reuse and the categories of data that should not be shared?
- Who is accountable to manage data reuse and sharing on behalf of the organization?
- How will data ownership be handled? What mechanism can be used to assert ownership and rights over data sets, including copyright and IP methods?
- How must data collection activities be handled before secondary data use and data sharing can occur? Clear rules regarding data provenance and lineage, data attributes and metadata (information that precisely describes the features of your data), data quality and trustworthiness need to be established. Ideally, processes for data verification and labelling should also be articulated in the policy. Lastly, the policy should articulate how statements of providence or authenticity would be generated or provided to support data that is shared, sold or otherwise distributed.
- How should relevant data sets and data sources (commonly referred to as data streams) generated by the organization be accessed and shared? Some organizations will want data sets to remain where they are and not be transferred to other servers. In this case, the CDO would oversee the data access policy. This would include data access rights based on user credentials, which would likely be operationalized through data controllers (individuals and institutions who apply rules regarding data access including privacy). Another approach could be to transfer data sets to a new server or to the cloud, where access rights can be managed centrally.
- What are the parameters around data retention and eventual disposal? The use of a dedicated API as the mechanism for data sharing could be referenced in the policy. Additionally, frameworks for metadata, business glossaries and model contracts for data sharing, acquisition and selling would also be included.
- Under what circumstances can AI be used in the organization? As data is needed for teaching AI algorithms, the policy should make the appropriate linkages between data collection upstream and data access and data analytics downstream and establish processes to manage issues such as ethics, bias and explainability.
- Finally, the rulebook may have to articulate limitations regarding data residency. For example, public sector organizations may be obliged to store data sets on servers located in Canada or choose cloud providers located in Canada.

Governments have an important role to play to identify the issues that must be addressed by organizations planning to share data, designate a mechanism to develop a data governance rulebook and provide funding for training staff in organizations that wish to be part of data value chains.

Interoperability Standards

As explained in an earlier publication, standards serve as a "handshake" between various components of systems. They allow for interoperability to take place and build trust between participants in supply chains. Their use makes our devices and products work better, for example, by ensuring that the connection between a smartphone and a Wi-Fi network happens anywhere in the world. In the case of new data value chains, standards are needed to enable the transfer of data sets between various actors that are not taking place now. Millions of discrete data sets could be used as input for big data analytics. Standards can help structure and categorize shared information environments and data sets, including organizing and labelling categories of data sets to support usability, findability and traceability (Girard 2019b).

Progress is being made on that front. In 2019, the Standards Council of Canada created a data standardization collaborative. The collaborative completed an inventory of available standards nationally, regionally and internationally focusing on data governance, data collection, data access/sharing and data analytics. It also identified gaps that will require standardization efforts in the future.[2]

2 See www.scc.ca/en/flagships/data-governance.

A Canadian framework for data reuse needs an institution to manage standardization for data operations and data governance by identifying, adopting and developing standards and conformity assessment programs. As noted above, the UK data strategy will create a Data Standards Authority, which will set a list of mandatory data standards to adopt across government and coordinate future data governance standards development work. The European strategy for data will assign this work to a European Data Innovation Board. The proposed board will support and advise the commission on the governance of cross-sectoral standardization and the preparation of strategic cross-sector standardization requests. It will also assist the commission in enhancing the interoperability of data as well as data-sharing services between different sectors and domains, building on existing European, international or national standards (European Commission 2020a, chapter VI).

Common Spaces for Data Sharing

As briefly outlined above, China, the United Kingdom and the European Union are taking steps to build frameworks that will facilitate data reuse between organizations located in their respective jurisdictions. Common spaces for data sharing will be created. In China, we expect that data sharing, access and control functions will be centrally managed by the state. In the European Union, the newly tabled legislation proposes rules about the role and responsibilities of data intermediaries managing sector-specific data commons. There is scope for both not-for-profit and for-profit organizations in this new space (European Commission 2020a).

At this stage, the UK National Data Strategy does not yet provide insights as to who will manage the data commons and how, but more clarity is expected on that front in the coming months when the implementation plan is tabled.

As outlined earlier, a strong business case has been made in Canada for the development and implementation of national, sector-based data strategies. One should assume support for the creation of sector-specific value chains that could harvest and share data from multiple sources, such as industry, the not-for-profit sector, governments and academia. In order to feed Canadian AI firms with the required data sets, Canadian common spaces for data sharing will have to be created, maintained and funded:

- The choice of instrument will be predicated by the role that governments choose to play in shepherding a national framework for data reuse. Under a passive approach, governments would let the market sort itself out and build infrastructure on its own. This business-as-usual scenario will likely lead to US-based big tech platforms harvesting Canadian data and selling back insights as a service to governments and industry. Without national sectoral data strategies in place, one can expect only a few data value chains to be created.
- In a scenario of limited engagement by governments, sectoral data strategies would be developed through consultations by relevant federal departments and agencies. Voluntary, industry-led data stewardship standards and a limited number of data value chains would be created over time to solve a limited number of specific problems.
- Under a more assertive approach, the federal government would invest and possibly co-manage commons infrastructure for data access to assert sovereignty over Canadian data and directly support key sectors of the economy in the implementation of sectoral data strategies, including funding for the creation and maintenance of sectoral data collaboratives.

Data Stewardship Standards

Canada has invested billions of dollars in AI research and development. We are seeing the emergence of AI-specialized firms aimed at supporting various sectors from agriculture to banking. However, many of these firms are struggling because of a generalized paucity of available data sets that are needed to feed algorithms and machine-learning tools. In response to this, the CIOSC is in the process of developing a suite of voluntary data governance standards. Taken together, these will support the creation and maintenance of data value chains.

Regarding data sharing and access, the CIOSC's Standards Policy Committee approved in November 2020 the development of a national standard focusing on data stewardship. The main objective of the proposed standard is not to support innovation, rather it aims to fill "an immediate

need for critical infrastructure to stabilize current practice." It would specify minimum requirements for the architecture and governance of responsible data trusts, collaboratives and cooperatives, and would focus on the fiduciary stewardship, accountability and management in the collection and exchange of data. Proponents of the standard argue that without objective industry standards framing the operations of data stewardship, it will be next to impossible to extricate politics from the professionalization of this new function. The standards development process, if managed carefully, can lead to productive discussions, debate and consensus around functional and ethical standards for data stewardship. Other standards are being developed to manage additional aspects of the data commons, from localization and residency to third-party access to data (CIOSC 2020).

Over time, voluntary standardization efforts in Canada will sketch out a framework for a trustworthy data commons serving private and public sector objectives. Governments would be well served to support the development of foundational data governance standards as they are critical to enabling the digitization of Canada's society and economy. These standards can be incorporated by reference in future regulations. Governments investing in data commons projects can also incorporate these voluntary standards in procurement documents in order to accelerate their uptake by suppliers.

That being said, standards are only one of the required building blocks for effective data value chains. Significant additional investments will be needed to upgrade data-collection activities; install data-storage infrastructure; and train a new generation of data professionals to select, store and manage access to data sets. The European Union recently launched its Support Centre for Data Sharing: a web portal providing guidance and tools to facilitate data transactions between parties.

As recently outlined by Chantal Bernier (2021), various approaches can be investigated, from data trusts to regulatory sandboxes, to allow the use and sharing of data as necessary for innovation while addressing privacy risks.

As time is of the essence in the global race for asserting sovereignty to data, it makes sense to adopt a more assertive approach, for example, by bolting on data-sharing functions to existing institutions that have demonstrated capacity and scope to manage this new framework.

Using Statistics Canada for a Data-Sharing Commons

As stated earlier, one of the most important actions the federal government can take to enable data sharing is to build a data-sharing infrastructure, not unlike what the European Union is planning to undertake through its data strategy. Investments are required in data spaces serving specific sectors in order to manage access rights and generate much-needed trust among participants. One option that should be explored is to entrust Statistics Canada with the mandate to establish and run a data-sharing commons in support of key sectors of the Canadian economy. Under such a scenario, participants wishing to share data for reuse across data value chains would sign data-sharing agreements with Statistics Canada, which would act as the data controller for the data sets slated for data reuse. Through this arrangement, AI firms would be able to access relevant and necessary data sets from various sectors through one venue. Access rights and limitations could be managed by using a user credentials access system.

Taking on these responsibilities appears consistent with the Statistics Act, where Statistics Canada has the duty to "collect, compile, analyse, abstract and publish statistical information relating to the commercial, industrial, financial, social, economic and general activities and condition of the people." It also has the duty to "promote and develop integrated social and economic statistics pertaining to the whole of Canada and to each of the provinces thereof and to coordinate plans for the integration of those statistics."[3]

In the data-driven economic era, data has never been more valuable, and the data that resides within firms represents a valuable asset — for firms, for innovation and for the public good — yet at this point most data is scattered and not treated as an asset, leaving a valuable resource untapped. Volumes and varieties of data are necessary for technologies such as AI and the collection of data that is residing in firms could be enormously beneficial for the development of data analytics. Indeed, this point is featured in the proposed changes to federal personal

3 See https://laws-lois.justice.gc.ca/eng/acts/s-19/fulltext.html.

privacy legislation in Bill C-11, which has provisions for the sharing of data for "socially beneficial purposes" although it limits this sharing only to specified public institutions or an organization mandated by such an institution.[4]

In many respects, taking on this role would be a continuation of the services that Statistics Canada already provides and is an area where it has world-renowned expertise. It would take the data that firms have agreed to share via agreements, aggregate it and make it available publicly under conditions set out in the contract. Statistics Canada is currently managing data collaboratives, for example, the Canadian Research Data Centre[5] network with its Microdata Access Portal,[6] to provide access to social, economic and health data such as publicly accessible microdata files.[7] It could also make de-identified microdata available to firms and individuals subject to safeguards as set out in the contracts.

Statistics Canada has a number of well-established safeguards in place:[8]

- By law, Statistics Canada cannot hand over anyone's personal information — not to the police, the Royal Canadian Mounted Police, the Canada Revenue Agency or even the courts.
- Final results are carefully screened before release to prevent published statistics from being used to derive information.
- The Statistics Act contains very strict confidentiality provisions that protect collected information from unauthorized access:
  - Statistics Canada uses state-of-the-art tools, software and processes that prevent disclosure and ensure the confidentiality and privacy of individual data.
  - Statistics Canada does not share personal information with other organizations, unless consent is given.
  - Statistics Canada employees are responsible for ensuring the security of confidential information.
- Statistics Canada has a long-established experience of data stewardship and is internationally recognized as being part of the world leaders in multiple aspects of data issues and data techniques.
- Statistics Canada has developed and used proven directives, guidelines and frameworks in matters of data quality, collection, ethics, privacy, confidentiality and transparency.

To carry out the data collection and dissemination requires substantial expertise. A sizable proportion of Statistics Canada staff is already engaged in data labelling, cataloguing, storing and access control functions, which are at the core of a data-sharing commons. In addition, Statistics Canada has embarked on a transition to become an active data steward. It is investing in the infrastructure needed to access, share and generate insights from data, including cloud technologies and real-time remote access to third-party users. Statistics Canada is conducting pilot projects to use alternative data sources, such as IoT sensor data, scanner data, GPS position data, Earth observation data and crowdsourcing (Arora and Medhora 2020). These new data sources are expected to play a critical role in addressing issues identified by sectoral data strategies.

In summary, Statistics Canada appears to have the necessary skills, protocols and experience to run the data commons. Moreover, Statistics Canada is the only existing organization that could realistically quickly set up the commons that will be essential to help drive innovation in Canada and to keep Canada from falling further behind in the collection and use of big data.

There are some potential issues that may need to be addressed:

4 See Bernier (2021).

5 See www.statcan.gc.ca/eng/microdata/data-centres.

6 See www.statcan.gc.ca/rdc-cdr/eng/user/login.

7 See https://crdcn.org/data.

8 See www.statcan.gc.ca/eng/trust.

- Statistics Canada's enabling legislation may have to be amended to allow for the creation of a data-sharing commons that can be accessed by third parties. The data envisaged here is akin to the term information. It would be a combination of structured and unstructured data. This may require changes to deal with "big" data collected from or by firms since Statistics Canada can only mandate the collection of existing data records, which implicitly assumes some structure to the data. To the extent that such issues interfere with existing data collection responsibilities, consideration could be given to the creation of a Data Commons Centre in the same spirit as the Research Data Centre program.

- Currently, under existing Statistics Canada guidelines, microdata is only available to vetted researchers. The types of occupations that would need access would likely need to be broadened since an important goal is to allow the data to be used by firms to get the benefits of big data sets. One option would be to make data available to data stewards in firms who would be tasked to ensure that guidelines for data use are respected and enforced. In addition, the purpose of the proposal is the voluntary sharing of data among firms that participate in the commons. As data analytics become more widespread, it is likely that the demand to use the data may also become more widespread, including from firms that do not have data and those that may not be part of the commons, for example, data analytics firms that could provide services to firms in the commons.

- The data commons envisaged in this paper would see the data ultimately reside at Statistics Canada. This does not have to be the case. Data could remain with firms but be managed by Statistics Canada with data-sharing arrangements among firms. The technology exists for the secure sharing of data between firms and Statistics Canada. New technologies to encrypt information and perform calculations on data by third parties without having decrypted data (also called homomorphic encryption) could be considered.

- As the value of large data sets becomes more obvious, there may be additional demands for mandatory compilation of such data. Similarly, as the regulatory frameworks adapt to the digital economy, the need for new and different types of data will inevitably become necessary. For example, one option being considered by the Canadian government is a regulator for social media platforms to deal, among other things, with transparency of their operations. The regulator would require substantial amounts of information from the social media platforms. Statistics Canada could be the designated body to collect this information, a recommendation also recently made by the Canadian Commission on Democratic Expression (2021). Given Statistics Canada's world-renowned expertise in standard setting, it could also help to define the standards for the collection of such data.

Data from Government

One important issue that needs to be addressed is the role that the federal government will play in making public data available for data reuse. On the one hand, it recognizes that data is an asset. In its 2018 Data Strategy Roadmap, it proposes actions to ensure that it collects the data it needs to support policy, programming and regulatory objectives. It also recognizes the importance of ensuring that government-held data can be combined with data from other sources so Canadians can unlock its value (Government of Canada 2018). Progress has been made on sharing government data through the Open Government Portal, an essential starting point to design an interoperable data-sharing system in Canada.[9]

On the other hand, draft federal privacy legislation, as described in a recently published consultation document, calls for limits on data collection and data sharing between departments and agencies. The principles articulated in the document are not consistent with the goal of data reuse. Federal departments and agencies already collect information from Canadians to deliver programs and set public policies. Information may only be collected for specifically identified purposes and personal information can only be shared with other federal departments and agencies under limited conditions. This has created data silos across the federal government that

9 See https://open.canada.ca/en/open-data.

prevent the government from using all available data to solve problems for public benefit.

The federal government has a unique opportunity to take a leadership role and establish a balanced framework to facilitate data sharing. Data integration is needed to support open data policies and to feed algorithms and machine-learning tools. As indicated above, AI needs large quantities of data to generate new insights. More data can also reduce the potential for unintended biases. Data sharing between federal departments and agencies can help meet public needs, improve the delivery of public services and result in more informed decisions.

In order to generate new insights to help solve problems of public interest, governments, including provincial and territorial governments as well as other interested stakeholders, will need to work together. Sharing data controlled by governments through a clear access rights process is key to success. A modernized Privacy Act should manage privacy not by limiting data collection, but by encouraging data sharing and reuse while closely managing access rights. With that in mind, there should be a focus on establishing an appropriate framework for managing data access (Justice Canada 2020).

5G Safety Code

5G infrastructure, composed of 5G networks and billions of IoT-connected devices, is slated to become the backbone of the new digital economy. This explains why 5G has emerged as one of the most important strategic areas of international technology competition, from an economic and a national security perspective. 5G networks and IoT-connected devices could be used by foreign powers to collect data from users without their consent. 5G network equipment manufacturers could cripple networks over time by deliberately delaying important upgrades or by disabling them through hacking attacks (Girard 2021).

China is now seen by many as a threat to the security of democratic nation-states. Recent reports from US officials state that telecommunications hardware manufacturer Huawei maintains backdoors to access sensitive and personal information in systems it builds and maintains around the world (Brandom 2020). Huawei is now the world's largest manufacturer of 5G networks equipment and services.

Canada's framework for data reuse needs a safe and reliable data collection, transmission and distribution infrastructure. Governments and industry should set the bar regarding the overall security of 5G network and connected devices. Perhaps the most important issue to address is the development and adoption of enforceable cybersecurity standards. New standards are needed to ensure that the data carried by 5G infrastructure as a whole is safe from unauthorized access and that IoT, transmission and routing devices can withstand intrusion, manipulation and hacking.

New distributed networks made possible by 5G and edge computing will create new cybersecurity vulnerabilities. The main reason why fourth-generation (4G) networks are less vulnerable to intrusions is because there is a clear demarcation between core networks and radio access networks at the edge. With 5G, however, the core and the edge will be blended. And much of the core's traditional functions under 4G will be pushed to the edge "to reduce latency: speeding up communication to enable new functionalities such as autonomous vehicles and telemedicine, where a millisecond lag can be a matter of life and death" (Rasser and Riikonen 2020, 6).

The upcoming 5G infrastructure will therefore need to be secured seamlessly and many components in the chain will have to be rethought because they are not currently designed with cybersecurity in mind (Girard 2021). Ideally, governments would agree to work with industry on standards that outline minimum requirements covering emission security, physical security, transmission security and cryptographic security. New developments in quantum technologies may also require the deployment of new cryptographic protections across the entire infrastructure.

Emerging health and safety concerns associated with 5G towers and other transmission equipment will need to be addressed as well. There is a growing number of incidents involving public protests and acts of sabotage around the world, sometimes fed by online conspiracy theories and dubious science. These concerns cannot be ignored. Without a social licence to operate, efforts to deploy the 5G network could be thwarted. Standards asserting acceptable health and safety requirements for 5G transmission equipment for users as well as for workers in the industry would help alleviate these concerns. The standards development process is inclusive. It encourages the participation of

interested stakeholders in technical committees and working groups, including industry, regulators, academics, experts and consumers.

Third-party certification of equipment to stringent performance standards could change the dynamics of the debates around the safety of 5G transmission equipment by certifying that equipment uses non-ionizing radiation following rigorous testing. For example, the US Department of Defense sponsored studies looking at the use of millimetre wavelengths as a non-lethal weapon. Active denial technology uses very high frequency millimetre wavelengths, above 94 GHz, to produce a burning sensation that penetrates the skin but stops when the individual moves out of the beam. Standards development organizations such as the Institute of Electrical and Electronics Engineers, the 3rd Generation Partnership Project and the International Commission on Non-Ionizing Radiation Protection used this research to set safety limits for the use of 5G millimetre wave, which are well below these levels. These actions need to be widely communicated and supported by regulators and industry alike (Reardon 2020).

The federal and provincial/territorial governments could work together and spur the development of a 5G Safety Code. Safety codes are defined as a series of rules and objectives applying to a particular sector. They cover installation and maintenance of products and infrastructure in a wide range of sectors, including electrical, plumbing, oil, gas, buildings and communications infrastructure. Most of them have been in place since the 1950s to protect users, workers, nearby residents and the environment. In Canada, these normative documents are often incorporated by reference in regulations and are updated regularly to reflect the introduction of new technologies and address emerging safety issues. A federal government's commitment to work with stakeholders and accredited standards development organizations to develop and then implement a safety code for 5G would help create a social licence to operate through a productive dialogue aimed at setting the bar when it comes to the health, safety and security of this new technology. Provincial and territorial regulators routinely participate in the maintenance of safety codes covering traditional sectors of the economy and could include such a code in their regulatory framework, notably in labour codes and occupational health and safety regulations.

Open Standards for 5G

Given security issues associated with the deployment of new 5G networks, governments and industry have an opportunity to decentralize the manufacturing, installation and maintenance of relevant equipment and infrastructure. The market is currently dominated by a handful of service providers using proprietary solutions to manufacture non-interoperable equipment. Different approaches could foster more competition, increase innovation and possibly lower the price of 5G equipment. The Open Radio Access Network (O-RAN) organization proposes an approach that is gaining traction in the United States. It aims at creating open standards to spur the manufacturing of 5G modular equipment with open interfaces, allowing for interoperability of equipment across multiple vendors and supply-chain diversity. Standardization of security can be applied to supply chain participants, and systems can be designed to allow for end-to-end encryption.[10]

Allowing 5G service providers to use equipment designed and operated according to O-RAN standards could have significant impacts on Canada's telecommunications sector. One of the documented benefits of standardizing parts, components, products and systems is that it allows for a shift of the mode of competition from product differentiation to price competition. Standardization defines the central capabilities of a given technology — capabilities shared by all products regardless of company or country of origin. It also allows for interoperability and interchangeability between elements in systems and components in products. Where the capabilities are identical, the ability of providers to differentiate the standards-compatible products rapidly declines. Competition thus becomes defined by price as the standardized technologies can be seen as commodities (Girard 2019b).

Open-source standardization combined with stringent cybersecurity requirements and third-party certification of systems, products and components could open the door for Canada's manufacturing sector to compete once more in the telecom manufacturing sector by leading in the design and production of safe 5G products, components, software and systems.

10 See www.o-ran.org/.

International Data Free-Trade Zone

It is clear that Canada would not gain by building a virtual wall around its data reuse framework. Data sharing and reuse and the creation of international data collaboratives among nations sharing similar values are goals that must be pursued (Leblond and Aaronson 2019). In the absence of a collective will to manage data governance under a United Nations body, the creation of a Data Standards Task Force (DSTF) has been proposed (Girard 2020b). The organization would be entrusted with a dual mandate: the development of interoperability standards to create data value chains and the creation of data governance standards. The ultimate objective of the DSTF would be to help create a "single data zone," where trustworthy data could circulate freely between participating jurisdictions sharing similar values. Canada could also spearhead the launch of the DSTF with like-minded countries through the implementation of regional free-trade agreements such as the Canada-United States-Mexico Agreement, the Canada-European Union Comprehensive Economic and Trade Agreement or the Comprehensive and Progressive Agreement for Trans-Pacific Partnership. Upcoming Group of Twenty meetings may offer an opportunity to make progress on this issue.

Next Steps

As outlined above, Canada will benefit by taking an integrated approach to the development of a national framework for data reuse that respects individual rights and fosters democratic institutions and values. The framework should rely on a suite of measures that protect citizens from data abuse, national sectoral data strategies and a 5G infrastructure that is safe and secure.

The approach taken by the United Kingdom in developing its national data strategy could be replicated in Canada. A policy paper outlining the broad strokes of the UK data strategy was submitted by the Honourable Oliver Dowden, secretary of state for digital, culture, media and sport, for a three-month public comment period. The United Kingdom made a decision a few years ago to entrust the country's digital strategy to a department within the government that is accountable for its development and implementation. Once comments are collated, it is expected that the United Kingdom will table legislation and announce funding to create new institutions and standards aimed at facilitating data reuse.

As stated above, a national framework for data reuse should be seen as a nation-building initiative. For voluntary data reuse to work in Canada, institutions will need to design a framework that reinforces social solidarity and democratic values. Implementing it will require vision, commitment and resources. The federal government should consider the creation of a stand-alone agency focusing on digital transformation through data reuse in Canada. New legislation, regulations, funding, program management and coordination across federal departments and agencies, provinces, territories, Aboriginal governments as well as key sectors of the economy will be required. It should also seriously consider entrusting the data-sharing commons to Statistics Canada as a way to kick-start the creation of Canada's data reuse framework.

Author's Note

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Works Cited

Arora, Anil and Rohinton P. Medhora. 2020. "Now More than Ever, the World Needs Data Stewards." Opinion, Centre for International Governance Innovation, October 12. www.cigionline.org/articles/now-more-ever-world-needs-data-stewards-0.

Bernier, Chantal. 2021. "Governance for Innovation and Privacy: The Promise of Data Trusts and Regulatory Sandboxes." Opinion, Centre for International Governance Innovation, February 9. www.cigionline.org/articles/governance-innovation-and-privacy-promise-data-trusts-and-regulatory-sandboxes.

Brandom, Russell. 2020. "Feds claim Huawei can snoop on mobile networks." The Verge, February 11.

Canada's Economic Strategy Tables. 2018a. *The Innovation and Competitiveness Imperative: Seizing Opportunities for Growth*. September. www.ic.gc.ca/eic/site/098.nsf/vwapj/ISEDC_SeizingOpportunites.pdf/$file/ISEDC_SeizingOpportunites.pdf.

———. 2018b. "Agri-food." September. www.ic.gc.ca/eic/site/098.nsf/vwapj/ISEDC_Agri-Food_E.pdf/$file/ISEDC_Agri-Food_E.pdf.

———. 2018c. "Advanced Manufacturing." September. www.ic.gc.ca/eic/site/098.nsf/vwapj/ISEDC_AdvancedManufacturing.pdf/$file/ISEDC_AdvancedManufacturing.pdf.

———. 2018d. "Health and Biosciences." September. www.ic.gc.ca/eic/site/098.nsf/vwapj/ISEDC_HealthBioscience.pdf/$file/ISEDC_HealthBioscienc.pdf.

———. 2018e. "Digital Industries." September. www.ic.gc.ca/eic/site/098.nsf/vwapj/ISEDC_Digital_Industries.pdf/$file/ISEDC_Digital_Industries.pdf.

Canadian Commission on Democratic Expression. 2021. *Harms Reduction: A Six-Step Program to Protect Democratic Expression Online*. January. Public Policy Forum. https://ppforum.ca/wp-content/uploads/2021/01/CanadianCommissionOnDemocraticExpression-PPF-JAN2021-EN.pdf.

CIOSC. 2020. "National Standards of Canada Standards Proposal: Data governance: Responsible data stewardship." November. https://ciostrategycouncil.com/wp-content/uploads/2020/11/CIOSC_Standards-Proposal_Data-Stewardship_v1.pdf.

Digital EU. 2020. "Shaping Europe's Digital Future." February. https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/shaping-europe-digital-future_en.

European Commission. 2020a. "Proposal for a Regulation on European data governance (Data Governance Act)." November 25. https://ec.europa.eu/digital-single-market/en/news/proposal-regulation-european-data-governance-data-governance-act.

———. 2020b. "A European Strategy for Data." November 25. https://ec.europa.eu/digital-single-market/en/european-strategy-data.

———. 2020c. *Towards a European strategy on business-to-government data sharing for the public interest.* https://ec.europa.eu/digital-single-market/en/news/experts-say-privately-held-data-available-european-union-should-be-used-better-and-more.

———. 2020d. "A European Strategy for Data." Presentation to CEPS Brookings Forum on AI Cooperation by Yvo Volman, Head of Unit G1 — Data Policy and Innovation, DG CNECT, European Commission. October 29.

Girard, Michel. 2019a. *Standards for the Digital Economy: Creating an Architecture for Data Collection, Access and Analytics.* CIGI Policy Brief No. 155. Waterloo, ON: CIGI. www.cigionline.org/publications/standards-digital-economy-creating-architecture-data-collection-access-and-analytics.

———. 2019b. *Big Data Analytics Need Standards to Thrive: What Standards Are and Why They Matter.* CIGI Paper No. 209. Waterloo, ON: CIGI. www.cigionline.org/publications/big-data-analytics-need-standards-thrive-what-standards-are-and-why-they-matter.

———. 2020a. *Helping Organizations Master Data Governance.* CIGI Policy Brief No. 163. Waterloo, ON: CIGI. www.cigionline.org/publications/helping-organizations-master-data-governance.

———. 2020b. *Data Standards Task Force for Digital Cooperation.* CIGI Policy Brief No. 162. Waterloo, ON: CIGI. www.cigionline.org/publications/data-standards-task-force-digital-cooperation.

———. 2021. *Standards for a Secure 5G Infrastructure.* Wilson Center and CIGI Policy Brief. Washington, DC, and Waterloo, ON: Wilson Center and CIGI. www.cigionline.org/publications/standards-secure-5g-infrastructure.

Government of Canada. 2018. *Report to the Clerk of the Privy Council: A Data Strategy Roadmap for the Federal Public Service*. Ottawa, ON: Government of Canada. www.canada.ca/content/dam/pco-bcp/documents/clk/Data_Strategy_Roadmap_ENG.pdf.

ISED. 2020a. "Bill summary: Digital Charter Implementation Act, 2020." ISED, November 23. www.ic.gc.ca/eic/site/062.nsf/eng/00120.html.

———. 2020b. "Universal Broadband Fund and Telesat low Earth orbit capacity agreement." ISED, November 9. www.canada.ca/en/innovation-science-economic-development/news/2020/11/universal-broadband-fund-and-telesat-low-earth-orbit-capacity-agreement.html.

Justice Canada. 2020. *Respect, Accountability, Adaptability: A public consultation about the modernization of the Privacy Act*. Ottawa, ON: Justice Canada. November.

Kharpal, Arjun. 2020. "Power is 'up for grabs': Behind China's plan to shape the future of next-generation tech." CNBC, April 27. www.cnbc.com/2020/04/27/china-standards-2035-explained.html.

Leblond, Patrick and Susan Aaronson. 2019. *A Plurilateral "Single Data Area" Is the Solution to Canada's Data Trilemma*. CIGI Paper No. 226. Waterloo, ON: CIGI. www.cigionline.org/publications/plurilateral-single-data-area-solution-canadas-data-trilemma.

Rasser, Martijn, and Ainikki Riikonen. 2020. *Open Future: The Way Forward on 5G*. Washington, DC: Center for a New American Security. July. https://s3.us-east-1.amazonaws.com/files.cnas.org/documents/Open-Future-The-Way-Forward-on-5G-final1-min.pdf?mtime=20200811091437&focal=none.

Reardon, Margaret. 2020. "Is 5G making you sick? Probably not." CNET, July 30. www.cnet.com/news/is-5g-making-you-sick-probably-not/.

Robles, C. J. 2020. "China Quantum Computer Now 10 Billion Times Faster than Google's Sycamore Prototype!" Tech Times, December. www.techtimes.com/articles/254729/20201204/china-quantum-computer-now-10-billion-times-faster-googles-sycamore.htm.

Schechner, Sam. 2020. "Europe Doubles Down on Data Protection to Ward Off Silicon Valley, Chinese Influence." *The Wall Street Journal*, November 25. www.wsj.com/articles/europe-doubles-down-on-data-protection-to-ward-off-silicon-valley-chinese-influence-11606300456.

Schindler, Jacob. 2020. "Xi lays out national IP strategy in speech to top party leadership." IAM Media, December 3. www.iam-media.com/law-policy/xi-lays-out-national-ip-strategy-in-speech-top-party-leadership.

Silver, Janet E. 2021. "Regulation of online hate speech coming soon, says minister." iPolitics, January 29. https://ipolitics.ca/2021/01/29/regulation-of-online-hate-speech-coming-soon-says-minister/.

Statistics Canada. 2019. "The value of data in Canada: Experimental estimates." July 19. Ottawa, ON: Statistics Canada. www150.statcan.gc.ca/n1/pub/13-605-x/2019001/article/00009-eng.htm.

Treasury Board of Canada. 2018. "Canada's Trusted Digital Identity Vision." www.canada.ca/en/treasury-board-secretariat/corporate/news/canada-trusted-digital-identity-vision.html.

United Kingdom. 2020. *National Data Strategy*. Policy Paper. Department for Digital, Culture, Media & Sport. December. www.gov.uk/government/publications/uk-national-data-strategy/national-data-strategy#fnref:23.

Westerheide, Fabian. 2020. "China — The First Artificial Intelligence Superpower." *Forbes*, January 14. www.forbes.com/sites/cognitiveworld/2020/01/14/china-artificial-intelligence-superpower/?sh=69c9df302f05.

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