Navigating Social and Technological Change in the National Statistical System

2024
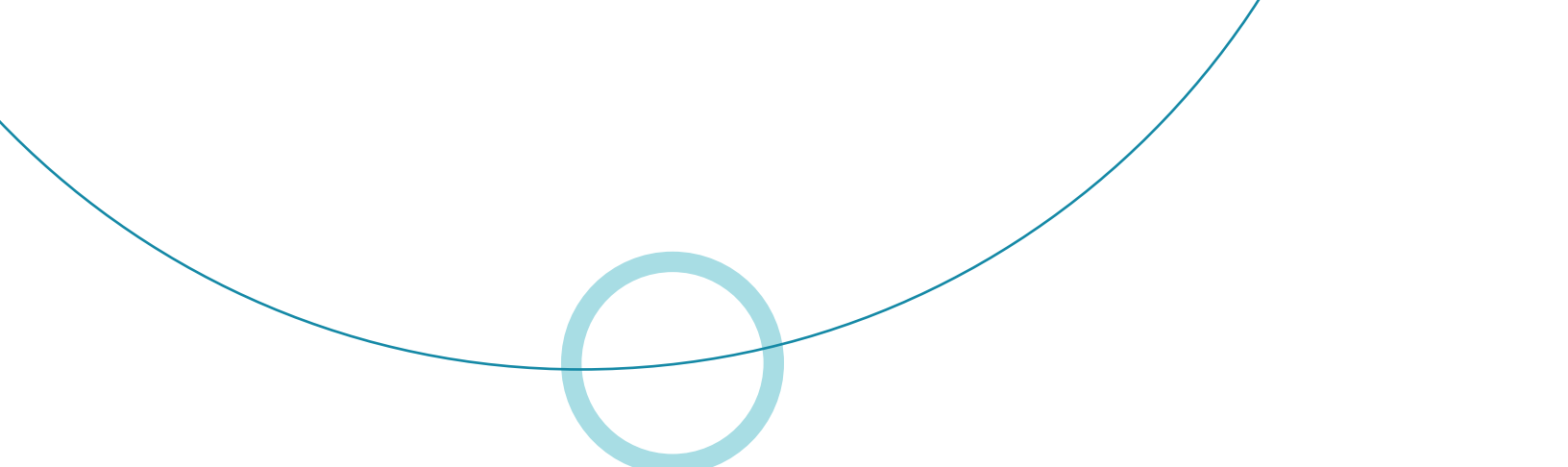
Annual Report

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Message from the Canadian Statistics Advisory Council

The world has witnessed profound economic, social and technological change over the last decade, and Canada has been no exception. In such a dynamic environment, it is paramount that the Government of Canada and Statistics Canada keep pace with change.

Good data and statistics are essential to support economic growth and ensure Canada's prosperity and well-being. Poor data lead to bad decisions with costly consequences.

To assure that Canada has trusted data and high-quality statistics, it is important that Statistics Canada continues its modernization efforts to keep pace with technological and methodological change. Their data and statistics need to reflect a rapidly changing economy and evolving society. This requires modern data science that responsibly adopts the latest technologies, analytical skills that draw on multiple sectors, and coordinated and intersectional data. Programs must be funded appropriately to keep pace with social and technological change. In the long run, decisions made with timely good data are more insightful, effective and save costs.

Official statistics produced by Statistics Canada and other data producers in the national statistical system are increasingly called into question through misinformation and disinformation. This puts their authority, legitimacy and critical role in society at risk. Leaders and experts in the public, private, academic and media sectors all have a role to play in ensuring the health of the national statistical system, including calling out the misinformation and disinformation that comes with incorrect or misleading statistics.

Clear leadership and stability are key to a strong statistical system. The Council is grateful to André Loranger, the Acting Chief Statistician of Canada (who is an ex officio member of the Council), and his excellent team for responding to our requests for information with both written and oral presentations. A timely permanent appointment is essential to ensure long-term leadership and stability as the agency responds to the changing needs of society. We offer particular thanks to Étienne Saint-Pierre, Gaëlle Miollan and Sam Ndayishimye of the Canadian Statistics Advisory Council Secretariat for their advice and assistance. We are also grateful to former Chief Statistician, Anil Arora, who offered invaluable insight and support to the Council.

Signed:

The Canadian Statistics Advisory Council

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Recommendation 1:

Foster trust and data literacy

Good data and statistics are essential to support economic growth and to ensure Canada's prosperity and well-being. Poor data can lead to bad decisions with costly consequences. This is true for everyone, including for individual Canadians, businesses and the public sector.

Official statistics produced by Statistics Canada and other data producers in the national statistical system are increasingly called into question through misinformation and disinformation, which puts their authority, legitimacy and critical role in society at risk.

Leaders and experts in the public, private, academic and media sectors all have a role to play in calling out misinformation and disinformation that comes with incorrect or misleading statistics and charts, or analyses that misinterpret them.

The Chief Statistician of Canada should

(i)   foster informed public dialogue about the importance of quality data based on robust statistical methods for effective decision making

(ii)   raise awareness of the principles of official statistics including relevance, impartiality, professional standards and transparency across traditional media and social media

(iii)   promote and enhance Statistics Canada's comprehensive data literacy program to enable Canadians and decision makers to assess and use statistical data more effectively.

The Minister of Innovation, Science and Industry should

(iv)   promote the importance of official statistics produced within the national statistical system, including those produced by Statistics Canada, to support economic growth and ensure Canada's prosperity and well-being.

Recommendation 2:

Lead effective national data strategies

Effective national data strategies start with a common understanding among Canadians and governments of priority issues and the data required to inform these priorities. Data needs and cost assessments must be conducted for every stage of proposed projects or programs, from planning and implementation to evaluation of results, as well as identifying lessons learned and best practices. When data are shared across jurisdictions, there is a dramatic increase in the ability to plan and evaluate the benefits of programs.

The Chief Statistician of Canada should continue to

(i)   provide leadership in identifying data gaps and data-sharing opportunities across jurisdictions

(ii)   establish and lead partnerships for developing and coordinating statistical data flows at the federal level

(iii)   set data and statistical methodology standards nationwide.

The Minister of Innovation, Science and Industry should

(iv)   recognize and support Statistics Canada's leadership role in the development of national statistics and national statistical data standards as part of the **2023–2026 Data Strategy for the Federal Public Service**.

Recommendation 3:

Invest in technology and data skills

It is paramount that Statistics Canada continues its modernization efforts to keep pace with technological and methodological change. Their data and statistics need to reflect a fast-paced economy and changing society. This requires modern data science and analytical skills including data coordination, data interpretation, data visualization, geospatial analysis and computational modelling. These investments not only keep pace with change, but importantly increase efficiency and save costs in the long run. This, in turn, better meets Canada's data needs.

The Chief Statistician of Canada should continue to

(i)   invest in training Statistics Canada staff and in internships to foster data science skills for developing and using new methods and data sources.

The Minister of Innovation, Science and Industry should

(ii)   support the federal government's **2023–2026 Data Strategy for the Federal Public Service** with a whole-of-government approach to technology including cloud computing, modern data methods and responsible use of artificial intelligence

(iii)   support ongoing investments in Statistics Canada's cloud infrastructure platform to ensure that its statistical programs effectively meet the needs and expectations of Canadians

(iv)   support a whole-of-government approach to the hiring and retention of people with specialized data skills. This includes drawing from the many Canadian universities and colleges that offer programs specializing in data science, big data, artificial intelligence and machine learning.

Recommendation 4:

Effectively use artificial intelligence

The federal government is investing billions of dollars to leverage artificial intelligence to support and increase Canadian productivity through enhanced computing capabilities and technological infrastructure. For Statistics Canada, artificial intelligence is not new. The agency has been using linguistic models since the early 1990s in support of coding activities.

The decision to use machine learning and other forms of artificial intelligence for statistical purposes must consider the benefits and risks associated with security, data quality and efficiency. Not all technologies are suitable for producing statistics, and methodology should never be trumped by technology.

The Chief Statistician of Canada should

(i)   continue to explore new artificial intelligence technologies to improve the production of quality data in areas such as data imaging, data visualization and basic analysis

(ii)   engage with Canadians about the role of artificial intelligence in statistical organizations and the safeguards that have been, and need to be, put in place.

The Minister of Innovation, Science and Industry should

(iii)   recognize and support Statistics Canada's statistical leadership in helping the Government of Canada develop its artificial intelligence strategy.

1 High-quality data are central to Canada's economic success and well-being

As the world is changing rapidly and societal problems become more complicated, governments and businesses need crosscutting information that better integrates economic, social, cultural and environmental perspectives and that speaks to Canada's diverse communities. Understanding the interrelationships between societal issues leads to more effective solutions that ensure a vibrant economy and a healthy population.

High-quality data and analyses play an important role in public debate, helping government policy makers address pressing problems such as economic growth, the high costs of living, access to affordable housing and social inclusion. Canada's economic growth has slowed over recent years, with a sharp downturn during the pandemic. More disconcerting

is the declines in gross domestic product (GDP) per capita since the pandemic that represent a departure from the long-term trend in per capita growth. Much public debate has also emerged over the interrelationships between high levels of temporary migration, housing and the economy. Canadians and policy makers must also be better able to anticipate and respond to the impacts of climate change and devastating environmental events, such as wildfires and flooding.

Canada's weak productivity performance has sparked much concern because, historically, much of the long-term growth in GDP per capita has reflected sustained improvements in labour productivity. Recent studies[i,ii,iii,iv] highlight the negative implications of weaker GDP per capita for living standards and wage growth.

Economic, sociodemographic and environmental concerns are not new, but have become more complex in a technologically fast-changing and global society. Analysts need real-time and granular local data to better understand the factors impacting these issues and determine which Canadians are most affected.

High-quality data are essential for developing and implementing effective policies that support businesses and innovation, which drive economic growth. Public and private sector policies must be grounded on a strong national statistical system that Canadians can trust. This system can only be maintained if Statistics Canada and the federal government keep pace with new technologies and methods. They need to move forward and lead the way and not be left behind.

1.1 Misinformation and disinformation undermine trust in quality data

Quality statistical information is one of Canada's most valuable resources. However, it cannot be taken for granted. Good data and statistics in areas such as productivity, inflation, housing and the environment are essential to support economic growth and ensure Canada's prosperity and well-being. Poor data can lead to bad decisions with costly consequences. This is true for individual Canadians, businesses and the public sector.

Official statistics produced by Statistics Canada are increasingly challenged by misinformation with little consideration of the United Nations **Fundamental Principles of Official Statistics** that include relevance, impartiality, professional standards and transparency. Criticism of the agency and its data in social media and newsfeeds increasingly draws on unsubstantiated sources using methods that are poorly conceived.

Even more disconcerting are inaccurate statements and allegations in the media about Statistics Canada and its data, which, if unopposed, will lead to an erosion of trust in the agency and its leadership. Recent examples include criticisms of the methods used by Statistics Canada to determine the price of consumer goods[v] and the estimates of the number of temporary migrants in Canada[vi] In both cases, the ensuing debates suggest methodological flaws in these challenges to the agency's methods and statistics.[vii,viii]

In some cases, these criticisms involve misinformation, where Statistics Canada's data and statistical methods are questioned in good faith. This requires proactive strategies by the agency to respond and correct the record.

More troubling are cases of disinformation, involving deliberate attempts to mislead. Organized disinformation, when it involves official statistics, can undermine confidence in evidence-based decision making and is a real threat to Canadian democracy over time.

Fostering trust and countering misinformation and disinformation

Misinformation and disinformation are best countered through public dialogue that distinguishes good data from poor or misleading data, and which emphasizes how good data supports community well-being. This message cannot come from Statistics Canada alone.

Statistical experts and opinion leaders in the public, private and academic sectors, as well as the media, have a role to play in calling out the misinformation and disinformation. They can raise awareness about the critical role of official statistics in a

democracy and attest to how these statistics are based on high standards of impartiality, data quality, robust scientific methods and transparency.

Statistics Canada has a central role to play in helping Canadians find their way through the plethora of competing and conflicting statistics from social networks and traditional media. The agency needs to adapt the way it publishes social and economic indicators in ways that new and younger audiences can relate to and trust. The agency must ensure that quality statistical information on current topics is readily available to prevent misinformation from taking hold. The agency must also be proactive and transparent with Canadians about changes to statistical programs and methods, and indicate how they are subject to external methodological review. Within the public service, the federal government has published **Countering Disinformation: A Guidebook for Public Servants** on its portal on democratic institutions. The guidebook offers a pathway for engaging these challenges.

Experts within the agency should also continue to be proactive in countering misinformation through dialogue with publishers and media who put out erroneous or misleading statistics and charts, or analyses that misinterpret them. Collaborating with sources that have erred in good faith ensures a more effective and credible dissemination of accurate information and official statistics in the long run.

The motives behind disinformation are devious and more difficult to counter. The actions are often meant to undermine trust in democratic institutions. Simply countering with factual official statistics is not sufficient because these are readily rebuffed by the proponents of disinformation. Statistical information that does not abide by professional statistical standards should be publicly dismissed.

Fostering data literacy

Data literacy is key to recognizing and appreciating high-quality and impartial data. The agency needs to do even more outreach with its **Data Literacy Training Initiative.** This comprehensive program is tailored to different levels of expertise within government departments and the broader public. The program also provides insight on the importance of data relevance, impartiality, professional standards, confidentiality and transparency.

The agency is already very active with schools, providing teachers with **educational resources** which showcase the use of analytical and data visualization tools to explore topics such as population, housing, food and transportation. These tools provide a basis for the younger generation to build essential skills for the workplace and to appreciate the value of data as they progress through life.

In universities and colleges, more detailed and complex data sets are being made available to students through public use files and **Research Data Centres**. When instructors use these data, students can learn to discern the quality of data and analyses using more advanced statistical methods. While instructors and students also have access to Statistics Canada's data literacy training program that is publicly available on the agency's website, it is underused by the academic sector. There should be more partnerships between Statistics Canada and academia to co-develop a curriculum that keeps pace with the changing data science and analytical skills needed within the agency and government. Statistics Canada is currently working with the **Canadian Research Data Centre Network** to determine how data training may be useful in areas such as disaggregated data analysis.

In the Canadian Statistics Advisory Council's 2023 Annual Report, the Council felt that, given the important role of data in federal programs, data and analysis training offered to federal program managers and analysts should be mandatory. The data literacy training program should also be made available to influencers, journalists, publishers and owners of both social and traditional media.

1.2 Leadership is key to the development of data across government

Statistics Canada has a key leadership role in creating environments where various data sources can be effectively and securely collected and integrated for statistical analysis. The agency is well placed to set national standards for statistical concepts, definitions and classifications, given its internationally recognized expertise in statistical methods and data standards.

The federal government's 2023–2026 Data Strategy for the Federal Public Service addresses many challenges that the Council has highlighted over the past several years. These include the need for a whole-of-government approach to program design and data stewardship for management of statistical data and data standards; embedding and appropriately resourcing data needs up front and throughout the development, delivery, monitoring and evaluation phases; and improving data literacy and digital skills across government.

These federal initiatives are ambitious and will take time to implement. They will also require adequate resources and new funding models. It will be important for Statistics Canada to play a leadership role, considering its expertise in statistical methods and in large-scale transformative management. The work is supported by the **Disaggregated Data Action Plan** that was created to support Statistics Canada's efforts to continuously identify and fill data and knowledge gaps across programs.

Intersectional approaches are needed

Too often, Canadian research on social and economic inequalities is done in silos, missing the cross-cutting issues, or intersectionality,[1] needed to truly address the country's most pressing problems.[ix,x]

For example, when studying environmental concerns, it is a challenge to obtain the information needed to understand what lands and which populations and businesses are most vulnerable. When disasters strike, timely data are required to support immediate relief and the longer-term recovery of communities. Accurate assessments of wildfires require not only satellite data to identify where they occur, but also information on the remote and rural communities affected, including First Nations reserves. This includes social and economic profiles, and data on businesses and assets to enable the proper resources to be mobilized to mitigate damages. These data

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1.   Intersectionality relates to the combination of factors that results in how groups and individuals face discrimination and privilege. These factors include age, gender identity, sexual orientation, race, ethnicity, religion and disability.

cannot be looked at in isolation. Looking at them jointly requires modernized data infrastructures, data visualization and creative analytical techniques.

Housing affordability and projected housing stock are other areas where there is demand for more intersectional information. It is important to understand the combination of factors that put certain Canadians at risk of being unable to obtain or afford adequate housing. Decisions by policy makers that are based on solid statistics and analyses are much more likely to successfully support Canadians who are most in need. This requires different jurisdictions to work with Canada Mortgage and Housing Corporation and Statistics Canada to expand the national housing database by securely linking individual records from different data sources and jurisdictions. Private sector firms, such as those in the real estate and construction industries also have valuable data holdings that could be leveraged.

Several years ago, Statistics Canada developed innovative uses of existing data through data linkage environments. The **Social Data Linkage Environment** allows for the integration of existing census, survey and administrative data files in areas such as population demographics, health, justice, education and income. The **Business - Linkable File Environment** enables analyses, such as on the factors for firm productivity, by linking business microdata from administrative and survey sources. The agency has also developed the **Education and Labour Market Longitudinal Platform (ELMLP)** in collaboration with federal, provincial, territorial and other stakeholders.

The ELMLP allows longitudinal integration of administrative data related to education, enabling a greater understanding of student and apprenticeship pathways and transitions to the labour market and to outcomes over time. These linkage environments are powerful tools to support the increased opportunities for cross-cutting and longitudinal data analytics.

Fostering data quality and statistical data standards

Statistics Canada needs to promote the importance of quality data and data standards to both data providers and users as it sets national statistical standards. Its **Quality Assurance Framework** is leading edge and forms the basis for those developed by international organizations

such as the United Nations and the Organisation for Economic Co-operation and Development.

In its quality assurance framework, Statistics Canada defines quality or fitness for use of statistical information in terms of six dimensions: relevance, accuracy, timeliness, accessibility, interpretability and coherence. Some users might appreciate a single quality rating. However, this is not practical, given that an assessment of quality depends on what the user needs the data for, and they may prioritize one of the six dimensions over another. For example, annual federal transfer payments to provinces and territories amounting to billions of dollars require economic and social indicators of the highest accuracy, while during the pandemic, Statistics Canada published more timely flash economic and employment indicators that were not as accurate as its regular monthly estimates.

2 Canada's societal issues demand greater collaboration and data sharing

An effective national statistical system is built on mutual relations and the sharing of information and expertise. Statistics Canada cannot and should not do it alone. Collaboration is needed across the public and private sectors to share data for public good. This includes partnerships across provinces, territories, municipalities, business sectors, non-profit sectors, academia, and Indigenous organizations and communities.

The potential cost to Canadians for programs that are based on poor or incomplete data is enormous. Even in fiscally difficult times, it remains cost-effective to modernize statistical and technical infrastructures and promote data flows that are the foundation for understanding and tackling important issues. In a context of

restraint, adaptable and creative funding is possible, especially when based on the whole-of-government approach advocated in the federal Budget 2024.

When data are shared across jurisdictions, the ability to plan and evaluate the benefits of programs increases dramatically. This requires strong governance and data stewardship models that are trusted by Canadians, that ensure their personal data are secure and that effectively produce the quality detailed data that are required.

Effective national data strategies must be grounded in shared statistical and methodological objectives. This starts with a dialogue across sectors and jurisdictions, led by Statistics Canada and other government leaders, to gain a common understanding of pressing societal issues and the data needed to address them. Data needs, data-sharing opportunities and cost assessments must be conducted for every stage of proposed projects or programs, from planning and implementation to evaluation of results and post-mortems. Concepts, definitions and representativeness of data should be examined for consistency with national standards. Methodological adjustments ensure that data across jurisdictions are comparable.

Some noteworthy collaboration initiatives:

Multi-jurisdictional data on drugs and substance abuse

The **Canadian Drugs and Substances Strategy** is a good example of multiple jurisdictions coming together to address substance use and the overdose crisis in Canada. Federal, provincial, territorial, community and Indigenous organizations collaborate with professional and regulatory bodies and health care providers. Statistics Canada is partnering with Health Canada and the Public Health Agency of Canada to develop a secure, virtual analytical environment with integrated health and socioeconomic data from across jurisdictions and diverse data providers. This initiative aims to fill critical information gaps about risk and protective factors, as well as populations most at risk for harm related to the ongoing drug and overdose crisis.

Provincial and territorial health data

Integrating data at the provincial and territorial levels adds complexity when jurisdictions become siloed, and legislation and policies create barriers to data sharing. A critical lack of integrated national health data and the need for a pan-Canadian Health Data Strategy has been highlighted by an expert advisory panel reporting to the Public Health Agency of Canada.

The Council was encouraged by the 2023 Canada Health Transfer agreements, which included support for improving data flows and developing national indicators on health care and health care workers. Statistics Canada is contributing to the federal, provincial and territorial Shared Health Priorities by developing new data that will enable annual reporting by provinces and territories on key health indicators for both children and adults. These health indicators will be disaggregated as much as possible by age, gender, urban or rural status, and income.

The potential of these data is demonstrated through data hub initiatives created by health research organizations that work with Statistics Canada, and with provincial and territorial health authorities. Linking health, socioeconomic and environmental data across jurisdictions using national standard definitions and data categories helps researchers understand the complex interplay of influences on human health,

well-being and development. The Data Access Support Hub of the Health Data Research Network and the Strategy for Patient-Oriented Research of the Canadian Institutes of Health Research are examples of good practices.

Municipalities data hub

The Centre for Municipal and Local Data has been cited in previous reports as a model for successful collaboration with Statistics Canada. It is the result of an ongoing partnership with the Federation of Canadian Municipalities. Additional funding was announced in Budget 2024 to continue and expand the data hub. This should include working to address important data gaps such as the costs of maintaining and repairing municipal infrastructures, particularly in light of devastating environmental events such as wildfires and flooding.

Municipalities are also increasingly involved in federal data strategies such as the Canadian Drugs and Substances Strategy and the Housing Statistics Portal cited by the Council in this and previous reports.

Business data lab

The Business Data Lab has been cited in previous reports as a model for successful collaboration with Statistics Canada. Since 2022, the Canadian Chamber of Commerce has collaborated with Statistics Canada to generate real-time information on business conditions and analytical insights on various topics related to the economy,

particularly for small and medium-sized businesses. In Budget 2024, the Canadian Chamber of Commerce received funds to continue and expand the data lab. Statistics Canada will continue to provide the required infrastructure to support the work of the Chamber and collaborate with them on joint initiatives.

It is important that Statistics Canada continues to explore partnership opportunities within the private sector. Establishing partnerships with large private sector organizations to share their big data holdings is challenging because of administrative, legal and fiscal factors, which are not expected to improve in the foreseeable future.

At the same time, these data have great potential to shed significant light on several issues. For example, the real estate sector holds real-time data on housing that can offer granular insights to fill gaps that would otherwise be missed, satellite data held by private sector companies can offer new information on rural communities, and partnerships between the telecom sector and Statistics Canada that integrate mobility phone data with census tract information can help to better understand commuting patterns and remote work practices.

Non-profit sector engagement

Statistics Canada has introduced a module for non-profit organizations (NGOs) in the Canadian Survey on Business Conditions. The agency has

benefited from the advice of community, business and non-profit organizations. Funding has also been available through the agency's [Disaggregated Data Action Plan](#). [The results](#) highlight the profound impact that NGOs have on Canadians' lives, as well as the ongoing significance of these organizations as vital players in a diverse society and dynamic economy.

Recently, Statistics Canada has been collaborating with the NGO [Maple Leaf Centre for Food Security](#) to analyze the relationship between poverty and food insecurity. Empowering NGOs to do this kind of work is an important outcome of fostering intersectional data. The resulting article, [Food insecurity among Canadian families](#), expands the current body of knowledge on food security, showing that income alone cannot explain food insecurity. The study, which used a variety of Statistics Canada data sources, found that food insecurity stems from the interplay of various factors, including the stability of income, assets and debt, access to family and social supports, and the cost of living.

First Nations Price Index Research

Statistics Canada is providing advice and expertise to the [First Nations Tax Commission](#) (FNTC), in collaboration with the Bank of Canada and Indigenous Services Canada. They offer capacity-building support to the FNTC as it explores the measurement of price inflation in diverse and often remote Indigenous communities. This research integrates information across data sources and communities to draw initial insights and estimates of inflationary pressures. Part of the [First Nations Data Governance Strategy,](#) this initiative fills an important data gap as Reserves are not included in the national Consumer Price Index.

Indigenous-led data strategies are integral to a national data system. In previous reports,[xi] the Council has presented how First Nations, Inuit and Métis communities and organizations have been developing capacity, infrastructure and strategic frameworks to support data governance and data collection processes at both national and regional levels. The [First Nations Information Governance Centre](#) (FNIGC) and its regional partners play a leadership role in developing and implementing the First Nations Data Governance Strategy. This strategy reflects priorities for establishing a First Nations-led network of fully functioning, interconnected data and statistical service centres, or Regional Information Governance Centres. Surveys administered by FNIGC, in coordination with regional partners,[xii] cover topics such as health, early education, employment and communities. Statistics Canada provides data capacity-building support to many of these initiatives and is improving the visibility of Indigenous Peoples in Canada's national statistics.

3 Harness technology and skills to move forward and lead the way and not be left behind

It is paramount that Statistics Canada continues its modernization efforts to keep pace with rapid technological and methodological change. With new technologies, there are opportunities to access and share untapped data resources that provide needed perspectives on the issues Canadians face.

This cannot be done without a strong commitment to funding such infrastructure and promoting a whole-of-government approach to technology including cloud computing, modern data methods and use of artificial intelligence.

3.1 Performance and security with cloud technology

Residing within a secure public cloud data centre, the agency's cloud platform stores statistical information and applications for processing, as well as Statistics Canada's official data holdings. It has become a backbone for creating cross-cutting and longitudinal data sets to inform and address the country's problems. Leveraging cloud infrastructure, Statistics Canada has also created a collaboration platform that provides opportunities to coordinate information across federal departments and facilitate collaborations with provinces and territories, municipalities, private and academic sectors, and Indigenous governments and organizations.

Use of the cloud has huge potential for developing new methodologies and managing increasingly complex data. The cloud infrastructure is replacing an outdated system infrastructure centred on physical data centres. Several legacy statistical applications need modernization to fully leverage the modern cloud infrastructure in support of a new age of big data and powerful data analytics.

As cloud computing becomes more central to Statistics Canada's work, safeguarding personal information remains a top priority. Statistics Canada uses a scaled approach for authorizing access to its microdata holdings based on their sensitivity. The agency has also aligned itself with mandatory safeguards published by the Canadian Centre for Cyber Security, Treasury Board Secretariat and Shared Services Canada. [xiii]

The cloud infrastructure platform requires ongoing investments if it is to effectively meet the needs and expectations of Canadians in a sustainable way. Developing and using statistical data comes with significant costs. This not only includes evergreening and optimizing the cloud platform, but also investments to optimize Statistics Canada's systems, applications and data management infrastructure. Because Statistics Canada's microdata holdings are becoming more analytically powerful, there is a requirement for new levels of computing power. All of these costs must be planned and resourced within new models of procurement.

Remote access to microdata

Cloud computing offers enormous potential for allowing authorized researchers remote access to Statistics Canada's microdata holdings from approved office or home workspaces. A greater network of researchers creates opportunities for collaboration and data integration, leading to more in-depth statistical findings. It also broadens the community of experts able to push back on the misinformation and disinformation discussed earlier. In expanding access, the agency should ensure strategic synergies between the different modes of microdata access as presented in its **Continuum of data access**.

The agency has recently been able to provide virtual access for government researchers, and the academics they collaborate with, within the federal government cloud infrastructure. Appropriate governance and safeguards ensure protection of the confidentiality of the microdata in a virtual environment.

Offering this to academic researchers more generally has added complexity. Establishing a sustainable, secure non-government network requires new partnerships, funding and cloud computing approaches. The **Canadian Research Data Centre Network** and Statistics Canada are working with their university partners to build a virtual research data centre.

There is also demand from private sector researchers and non-profit think tanks to have access to the agency's microdata holdings for statistical research purposes. Their research is important to support business innovation and productivity in Canada, as well as intersectional research on issues such as housing, immigration and poverty. As Statistics Canada expands remote access to a broader set of users, additional governance and accountability structures are needed to ensure the safeguarding of personal information.

Improving the scope of census data

The Census of Population and the Census of Agriculture are Canada's primary sources of national local-area data that can be compared across the country. To meet the increased demand for more granular and integrated data, the Census of Population has replaced census questions with administrative data on income and immigration. The Census of Agriculture has also used administrative data to replace questions on revenue, expenses and operating arrangements. In 2021, census data on cannabis farms were produced entirely based on administrative data. Statistical models ensure census data consistency and quality.

The agency is currently researching an increased use of administrative data for the Census of Population. Referred to as a combined census, administrative data already provided to other government departments could, under certain conditions, be used for the purpose of enumerating the population.

At the same time, alternate data sources are being explored to replace questions on maple taps, labour, operator characteristics and greenhouses in the Census of Agriculture.

Leveraging innovative modelling techniques and robust administrative data linkage methods would lessen the burden of participation for Canadians and contribute to the long-term efficiency and sustainability of the censuses. It would also enable contingency strategies when faced with collection challenges such as natural disasters.

Addressing declining response rates

Statistics Canada surveys provide important demographic and socioeconomic characteristics and lived experiences that are not available from other data sources including the census. While the census continues to have a very high response rate (98%), the long-term decline in social survey response rates was exacerbated by the pandemic.

The low response rates for voluntary surveys are particularly disconcerting, as collection response rates for the Canadian Social Survey, the Canadian Community Health Survey and

the National Travel Survey are all below 50%. Canadians have become much harder to reach. There is also fatigue from a continuous stream of surveys from both the private and public sectors. Statistical agencies around the world, as well as private research and analytics firms, are facing this challenge.

As downward pressure on survey response rates is unlikely to ease in the future, Statistics Canada must find ways to account for this in its survey designs and preserve the valuable information that only these surveys provide.

For the mandatory Labour Force Survey, the agency is taking advantage of modern technologies and platforms which can be used to better reach Canadians and provide them with options for responding online.

For its voluntary surveys, Statistics Canada is developing leading-edge methods that integrate the agency's census, administrative data and web-based statistical data with survey data. The benefits are numerous. Survey output on communities and vulnerable populations is becoming timelier and more detailed, and there is reduced respondent burden.

In this welcome groundswell of modernization, it is important to ensure that technology is there to support and not drive methodological design.

3.2 Role of artificial intelligence in statistics

Canada is considered a world leader[xiv] in a technology that is gaining attention globally—the development and use of artificial intelligence.[2,xv,xvi] According to the International Monetary Fund (IMF),[xvii] artificial intelligence can increase productivity, boost economic growth and lift incomes. However, it can also eliminate jobs and widen inequality. Canada ranks high in the IMF's AI Preparedness Index of countries based on their digital infrastructure, human capital, labour policies, innovation, integration and regulation.

At the same time, without sustained investment in this technology, Canada runs the risk of quickly falling behind.[xviii] In **Budget 2024**, the federal government announced investments of $2.4 billion to build computing capabilities and technological infrastructure for Canada's world-leading artificial intelligence researchers and to help businesses increase their productivity by leveraging artificial intelligence solutions. The government is holding public consultations[xix] this year to seek input on proposed artificial intelligence initiatives.

The decision to use machine learning and other forms of artificial intelligence for statistical purposes must always consider the benefits and risks with regard to security, data quality and efficiencies. Statistical data produced using artificial intelligence is only as good as the information it uses. Not all technologies are suitable for the production of statistics, and methodology should never be trumped by technology.

Improper use of artificial intelligence when collecting data can lead to an erosion of trust and disengagement of citizens. As this touches the heart of Statistics Canada's core values of trust and privacy of information, the agency has been very active in advocating for the proper use of artificial intelligence by governments when dealing with data.

Statistics Canada assesses artificial intelligence from two perspectives. The first ensures that their economic, social and environmental indices, data and analyses consider the impact of artificial intelligence. The agency has several initiatives underway, including measuring the value of data in the System of National Accounts. The second is leveraging the technology in the production of official statistics. For Statistics Canada and other national statistical offices, modelling and artificial intelligence are not new. The agency has been using linguistic models since the early 1990s in support of coding activities as computer algorithms and statistical models perform automatic and interactive coding tasks. This has led to more efficient data processing and an improvement in data quality.

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2. Artificial intelligence is a technology that enables computers to simulate human intelligence and problem-solving capabilities. The Organisation for Economic Co-operation and Development defines an artificial intelligence system as a machine-based system that infers, from the input it receives, how to generate outputs such as predictions, content, recommendations or decisions that can influence physical or virtual environments.

More recently, Statistics Canada is leveraging new technologies and cloud platforms to use machine learning and large language models at various stages of data visualization and data production. They are being used to predict crop yields, perform basic tabular analysis and engage with Canadians through chatbots. The agency does not use artificial intelligence to infer statistical estimates because the technology has not proven to produce quality statistics.

A notable initiative is the **Canadian Coroner and Medical Examiner Database**. Machine learning is being used to organize data collected from provinces and territories into coherent data sets, as each jurisdiction has its own method for classifying data. This has improved the national data available to analysts to better detect trends in mortality over time and allow medical examiners and coroners to understand growing hazards.

Statistics Canada should continue to help the Government of Canada develop its artificial intelligence strategy. The agency plays a key role in the **AI and Data Governance Standardization Collaborative**, an initiative led by the Standards Council of Canada that brings together industry, government, Indigenous organizations, civil society, academic and research bodies, pan-Canadian organizations, and standards development organizations. On the international front, the agency leads big data and data science expert groups that are identifying and addressing common challenges encountered when incorporating machine learning into the production processes of organizations.

The agency should share its expertise with Canadians on the role of artificial intelligence in statistical organizations and the safeguards that have been and need to be put in place. The dialogue with Canadians would enhance trust in the agency and inform future use of artificial intelligence technology.

3.3 Attracting and retaining data science and modern analytics skills

Keeping pace with changing technology and statistical methods requires modern data science and analytical skills, including data coordination, data interpretation, data visualization, geospatial analysis and computational modelling.

Statistics Canada needs data scientists, methodologists, economists, sociologists and environmentalists with these skills to gather, analyze and report on large amounts of data. Applying data visualization in the early stages of survey design and development introduces novel concepts and dimensions to the statistical outputs. As the

agency uses more unstructured data forms, they are required to develop statistical formulas and computer algorithms that transform unprocessed data into quality statistical information. The agency's subject matter experts must have strong multidisciplinary training that integrates mathematics, statistical concepts, computer science and data visualization to develop statistical measures that best inform societal issues. In addition, machine learning requires more advanced statistical and methodology probability theory, computer algorithms and neural networks.

These skills are in high demand, and it is a challenge for Statistics Canada to keep up with other departments and the private sector in attracting and retaining workers with these competencies. As part of the 2023–2026 Data Strategy for the Federal Public Service, there should be a whole-of-government approach to hiring and the retention of specialized data skills. This includes drawing from the many Canadian universities and colleges that are now offering programs that specialise in data science, big data, artificial intelligence and machine learning. This also means partnering with universities, so their programs keep pace with the agency's specific needs. To be effective, incentives to attract new and experienced specialists could also be considered by Statistics Canada and the public service.

There are too few partnerships and internships between Statistics Canada and the private sector. More could be considered, though this would require additional funding. Disparities in compensation between the public and private sectors may also present challenges.

Successful use of cutting-edge data science tools in the federal sector are user focused and accessible across different devices and operating systems.

Natural Resources Canada's web portal on Canadian minerals and metal statistics is an example of the power of data visualization to introduce and facilitate understanding of a topic. The portal complies with government accessibility standards and is functional across user platforms. Statistics Canada has created interactive dashboards and data hubs such as the International trade monthly interactive dashboard and the Gender Diversity and Inclusion Hub, which have improved access to detailed and multi-sourced data. The agency needs to invest more in this direction to improve on the design, usability, interactivity and performance of data products across user platforms, leveraging the power of visualization tools. Government of Canada budget constraints and hiring ceilings are a challenge that hinders these objectives.

4 Keeping the momentum

Over the past few years, the agency has made important investments in cloud technologies, data analytics and remote access to its data holdings. Its methodologists and analysts are expanding their expertise to work with new types of data, such as satellite imagery, web-based data, bio-specimens and water waste.

Continuing this work is not possible without ongoing investments by the federal government and recognition of Statistics Canada's leadership role that are in line with the **2023–2026 Data Strategy for the Federal Public Service**.

The importance of data is echoed in the federal **Budget 2024**, where Statistics Canada data are cited in the analysis of issues Canadians face, including housing, health, food and crime. The budget proposes new monies for continuing the work of Statistics Canada, in partnership with Canada Mortgage and Housing Corporation and the Canadian Chamber of Commerce,
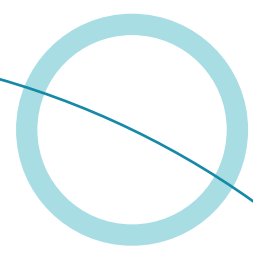
in creating the data hubs described as best practices in the **Council's 2023 Annual Report**. There are also funds to support disaggregated statistics to highlight the diverse lived experiences of different groups, including women, Indigenous people and racialized groups.

The incoming Chief Statistician will have the important task of running Statistics Canada and maintaining the agency's momentum on pursuing modernization,partnerships and trusted statistical leadership.

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