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Research powering innovation for Canada

NRC 2024–2029 Strategic Plan

National Research Council Canada
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Canada

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Content

Executive summary

This strategic plan for 2024–2029 will guide the National Research Council of Canada (NRC) as we advance and support important research and innovation. It outlines our commitments to Canada, our partners and ourselves and focuses on significant challenges facing the country. These challenges include climate change, strengthening Canada's life sciences capacity and bolstering the competitiveness of Canadian businesses in an increasingly uncertain and complex global economy. These challenges also represent opportunities for Canada, where new knowledge, technologies and innovations secure a prosperous future for our country.

As we work toward this vision of innovation and prosperity, partnership will play an important role. Canadian innovators, industry and government must come together and use the full range of our capabilities to capitalize on opportunities stemming from the accelerated pace of scientific discovery and technological change.

Our strategic plan presents a collective vision for the NRC. It reflects a year's worth of engagement across our organization and with our stakeholders about where there are opportunities for the NRC to have impact, how we can help position Canadian industry for growth and where we are positioned to help address key challenges facing our country.

Research and innovation priorities

Our strategic plan for 2024–2029 focuses on four intersecting research and innovation priorities with specific goals:

Climate change and sustainability

Canada is taking significant steps to address climate change and increase climate resilience. In doing so, there is also an opportunity to leverage the NRC's strengths to support a prosperous green economy. We can build upon Canada's established manufacturing leadership and further the development and adoption of technologies for vibrant advanced manufacturing industries. Industry and innovators need support to develop the new knowledge and technologies required to mitigate and adapt to climate change and to seize economic opportunities. The NRC is well positioned to provide this support. We will focus our capabilities and partnerships on decarbonizing two of Canada's key industries—transportation and construction, which represent a combined 8.7% of the country's gross domestic product (GDP)—and help adapt Canada's buildings, infrastructure and communities to climate change. Through this work, we will also support industries in taking leading technologies to market to compete on a global stage.

Health and biomanufacturing

Canada's life sciences sector continues to grow, fuelled by leading talent. The COVID-19 pandemic highlighted weaknesses and gaps in this sector but also opportunities to reinvigorate and rebuild Canada's capacity in this area. Investment in life sciences research and development is increasing and the sector's contribution to Canada's GDP has steadily increased by 25% over the last 5 years.[1]

[1] Based on NAICS 3254 and 3391, which represent only a subset of the life sciences and biomanufacturing sector. Gross Domestic Product, Professional, Scientific and Technical Services – 54, Canadian Industry Statistics. Available at https://ised-isde.canada.ca/app/ixb/cis/gdp-pid/54.

A strong and resilient life sciences sector depends on discoveries continually being taken from the lab to the market and made available to improve the health of Canadians. We will contribute our expertise and unique infrastructure to increase Canada's biomanufacturing capacity and focus on de-risking and accelerating clinical adoption and commercialization of therapies and technologies that are user-centric and affordable to produce at scale. Our ambition is to grow connected biologics, biomanufacturing and distributed care industries in Canada that are competitive and that are ready to address emerging health priorities and build our industry for the future.

Digital and quantum technologies

Canada is a global leader in quantum and digital research, particularly in quantum computing, AI and machine learning. We are at a global tipping point with AI. And the coming intersection of AI, quantum and semiconductor technology creates significant opportunities for the NRC to position Canada to capitalize on the commercialization of this space. This is a growing and evolving sector, with quantum alone expected to grow to industrial scale in Canada by 2045. The NRC will focus on developing and advancing quantum and digital research and innovations toward market readiness and adoption. Through this, we will enable more productive and competitive industries and continue Canada's leadership in quantum and digital research excellence.

Foundational research

The Canadian research community, including the NRC's own researchers, needs specialized facilities and equipment to carry out scientific exploration. The NRC is the steward of Canada's participation in ground-based observatories that are critical to the astronomy community. The NRC also maintains Canada's national measurement standards, which are essential not only for scientific research but also for many activities that affect the daily lives of Canadians, such as the dosing of medicines, ensuring fair trade and setting the foundation for standards and interoperability of parts. Through this stewardship, we will continue to provide access to the world-class facilities needed to maintain Canada's reputation for scientific excellence, support emerging technologies and innovations and enhance the socio-economic well-being of Canadians. In doing so, we will continue to contribute to breakthrough scientific discoveries and innovative solutions.

Organizational priorities

Our research goals for the next 5 years are underpinned by organizational values and priorities that define who we are and that are foundational to our success. These organizational priorities help us continuously improve as a partner and an employer and drive us to make greater contributions to an innovative and prosperous Canada. These priorities are:

Health and safety

Our highest priority is the safety of our people and protecting our neighbours and environment. We will stay vigilant and nurture a culture of safety, security and protection that is part of the fabric of the NRC.

Support to business innovation

We support Canadian businesses so they can innovate and prosper. We do so by conducting research and generating valuable knowledge, funding research, providing access to research and small-scale manufacturing facilities and connecting innovators in Canada and abroad. Through the National Research Council of Canada Industrial Research Assistance Program (NRC IRAP), we provide critical funding and advice to help Canadian firms innovate and grow. We will continue to harness the full breadth of our activities and capabilities to help support business innovation and to rise to the challenge of increasing our economic impact.

Inclusive innovation

We aim to foster a diverse and inclusive workforce and workplace. We will do so while continuing to learn how best to use inclusive approaches to design our programs and services, guided by careful consideration of the different ways our work can potentially affect different groups. As part of this effort, we are committed to working towards excellence through partnership with Indigenous researchers and communities, and their Indigenous knowledge and knowledge systems.

Research excellence

Our commitment to and demonstration of research excellence is foundational to working at the leading edge of science and technology and to focusing this advantage on Canada's priorities. Research excellence makes us a sought-after partner, assures our partners we will be a dependable part of their success and lets government know our advice is based on sound science. A culture of research excellence also enriches and sustains our organization by attracting and retaining world-leading research expertise, helping create the NRC research leaders of tomorrow.

Organizational excellence

Our scientific activities, researchers and collaborations are supported by a comprehensive structure of teams and processes. These enabling functions range from procurement to program development and from communications and contracting to IT enablement and support. Within each area, we strive for excellence, as critical prerequisites for our success. Over the next 5 years, enabling functions will be key to the implementation of our process of scientific infrastructure renewal and to investments in IT. These investments will promote a secure cyber environment and allow us to incorporate intelligent digital tools into both our internal operations and our facilities renewal. The resulting enhancements will accelerate the speed of research and innovation.

Message from the President

This plan marks an important time for our organization as we drive Canadian research and innovation to address Canada's challenges and seize opportunities to secure a sustainable, inclusive, and prosperous future. During the pandemic, we rallied our people, assets and partners to answer the call of what were unprecedented challenges for Canada. This reinforced the power of the NRC as a national platform, with the people and relationships to orchestrate research capabilities, investments, and unique facilities and equipment to make a singular contribution to addressing Canada's priorities.

Although we have moved past the emergency of COVID-19, there is work to be done to ensure a safe and prosperous country for generations to come. How will we strengthen our life sciences sector to deliver benefits for Canadians? What will we do to adapt to and mitigate climate change and to transition our advanced manufacturing industries to new low- and zero-carbon products and services? How will we leverage the power of quantum and digital technologies to create more competitive, leading-edge Canadian industries? The NRC will contribute to solutions to these challenges. Through our work, we will continue to conduct and support research and innovation that contributes to a more prosperous and more resilient Canada.

The NRC's role in supporting business innovation needs to take on renewed importance. With our unique and longstanding role in the innovation ecosystem, we will leverage our activities and capabilities to support businesses as they innovate, grow their ambitions and bring new products and services to market. The NRC Industrial Research Assistance Program (NRC IRAP) has been a hallmark of business innovation for more than 70 years. It is recognized as Canada's leading innovation assistance program for small and medium-sized businesses, helping innovative firms succeed and grow. NRC IRAP will continue to support the most innovative Canadian businesses advance and commercialize new technologies. When this translates into increased demand for experts and advanced facilities to work on and test research and new technologies, the NRC will rely on its research and technical capabilities to answer the call.

Through our commitment to business innovation, we will support the success and growth of Canadian businesses that aim to be industry leaders, drive innovation and make an impact on domestic and global markets. These outcomes will help Canada's global position, grow our economy and improve the lives of Canadians.

Our capacity to support research and innovation will also increase through modernized facilities. Across the NRC, our people are energized to seize the historic opportunity of the government's 8-year commitment of $962 million to recapitalize and renew our research facilities and infrastructure. This investment provides us with an opportunity to better support our clients and partners and to increase our capacity for collaborative research. Projects will align with our vision for the future, prioritize co-investments with our partners and increase our capabilities by integrating digital tools.

Through the strategic planning process, we took stock of the world around us. We considered our strengths and those of our partners to determine where to prioritize our contribution to a prosperous, innovative Canada over the next 5 years and beyond. During a year of significant engagement, we heard from people throughout our organization and from key stakeholders across the Canadian innovation ecosystem. All of their voices have contributed to our vision for the next 5 years.

Our strategic plan is focused on challenges and opportunities in the priority areas of climate change and sustainability, health and biomanufacturing, and quantum and digital technologies. At the same time, our plan ensures we deliver research excellence in important foundational research areas.

It is my privilege to lead the NRC onward and drive execution of this plan. Our ambition is built on a foundation of leadership in research and innovation built over 100 years.

We are committed to meet the challenges of this moment, and deliver research that powers innovation for a more prosperous and sustainable future.

Mitch Davies
President, National Research Council of Canada

Introduction

Climate change, health and digital technology are areas that present both challenges and opportunities of great importance to Canada's future prosperity. To support the country's rapidly evolving innovation sector in addressing these challenges and seizing these opportunities, the National Research Council of Canada (NRC) must work more closely with its industry, academic and government partners than ever before.

This 2024–2029 strategic plan will guide us as we advance and support research and innovation that is important for Canada. It outlines our commitments to Canada, our partners and ourselves. It also reflects how the NRC will continue to evolve over the next 5 years.

Reflected in this plan is a collective vision developed through significant engagement across the NRC and with our stakeholders about Canada's key challenges and opportunities and how to approach them.

This plan is grounded in our track record of important research breakthroughs and transformative technology development, made possible by the expertise and commitment of our people. It also reflects our long history of commitment to, and connection with Canada's entrepreneurs and innovators across multiple industries.

Some of Canada's significant innovation breakthroughs came about in collaboration with the NRC, from the pacemaker and the electric wheelchair to childhood vaccines and attosecond lasers.

The NRC has supported research and innovation in Canada for more than a century and has taken on a variety of roles along the way to respond to the needs of the day. We are:

- an advisor and supporter of innovation by Canadian companies
- an ally to some of Canada's brightest minds in research in their pursuit of scientific excellence and breakthroughs
- a pioneer in research and development that has contributed to improving, changing and saving lives across Canada and around the world
- a steward of important and unique scientific facilities and equipment that help Canada align science and innovation with important priorities and challenges

Our value as a resilient, reliable partner has been fundamental to our success in these roles. Uniquely positioned at the intersection of industry, academia and government, we contribute our capabilities to partners throughout the research and innovation ecosystem to achieve more for Canada together.

As we work to ensure Canada's long-term prosperity, partnership will play an even greater role. We must come together and use all our strengths and resources to capitalize on the accelerated pace of scientific discovery and technological change. At the same time, there are multifaceted challenges on the road ahead, including mitigating and adapting to the effects of climate change, strengthening Canada's life sciences capacity, and bolstering the competitiveness of Canadian businesses in an increasingly uncertain and complex global economy.

Together with our partners, we are ready to take on these challenges and work toward achieving a more innovative and prosperous Canada.

NRC at a glance

Vision

A better Canada and world through excellence in research and innovation.

Mission

To have an impact by advancing knowledge, applying leading-edge technologies, and working with other innovators to find creative, relevant and sustainable solutions to Canada's current and future economic, social and environmental challenges.

Values

Integrity • Excellence • Respect • Creativity

People

- **4,263** total NRC full-time equivalent staff
  - **2,293** scientists, engineers and technicians
  - **269** NRC IRAP industrial technology advisors
- **542** students, postdoctoral fellowships and research associates
- **39.5%** women in NRC workforce (relative to Canadian market availability of **38.2%**)
- **87** nationalities in our workforce
- **24** laboratory sites
- **106** NRC IRAP points of service

Scientific achievements

1,222 peer-reviewed publications (2022)

1.19 field-weighted citation score on a 3 year average (2020-2022 calendar years)

83% co-authorship rate (2022) including:

- United Kingdom: **10.9%**
- Germany: **8.5%**
- Japan: **5.2%**

Patents

In 2022-23, the NRC:

- filed **267** new patent applications
- had a portfolio of **1,951** active patents (issued or pending)
  - **606** under license
  - **461** patent families

R&D clients and collaborators

- **89%** clients say the NRC helped them achieve results[2]
- **1,005** R&D projects for clients (**969** R&D clients)
- **379** active collaborative R&D projects (**116** funded collaborators)

Industrial Research Assistance Program (NRC IRAP)

- **9,690** clients
  - **3,486** firms funded
  - **6,204** firms received advisory services only
- **13,973** jobs supported
- **35%** total revenue growth of client firms – as an average compound annual growth rate (2019 to 2021)
- **21%** employee growth of client firms – as an average compound annual growth rate (2019 to 2021)

[2] Increased jobs, sales, R&D capacity and other benefits (NRC Client Satisfaction Survey)

Strategic priorities

The NRC is involved in a wide range of research and innovation activities across a broad set of areas of expertise and application. Over the next 5 years, we will focus on areas that require immediate attention and where our collective efforts can have the greatest impact.

Our plan for 2024–2029 focuses on four intersecting research and innovation priorities:

- climate change and sustainability
- health and biomanufacturing
- digital and quantum technologies
- foundational research

These areas represent the intersection of government priorities, industry needs and areas of NRC excellence. Multifaceted issues related to computing power, big data, connectivity and telecommunications, artificial intelligence (AI) and smart systems, new materials, life science technologies, and the need for new forms of low-carbon technologies all offer opportunities for innovation in the coming years and opportunities to secure Canada's future prosperity. With our partners, we can leverage our existing strengths and focus our capabilities to help address these challenges.

We recognize the dynamic nature of government priorities and the evolving nature of emerging technologies and industry needs. Therefore, while our plan will guide us over the next 5 years, it will also allow us to be agile. This will enable us to adapt and address needs and opportunities as they emerge.

This plan sets goals for each of our 4 research and innovation priorities, along with strategies that will help us increase our impact and the value we deliver to Canadians.

Our ambitions for the next 5 years go beyond innovation and economic outcomes. As an organization with more than 4,000 employees, it is equally important to foster the organizational priorities and values that are foundational to our identity as an innovator and preferred partner. To that end, this plan also focuses on strengthening our connection to industry as well as on health and safety, inclusive innovation, and research and organizational excellence. These organizational priorities will keep us on course, provide the support needed to strengthen Canada through research and innovation, and ensure we have a workforce with the capabilities and commitment to achieve our goals.

Strategic plan at a glance

Research and innovation priorities

Climate change and sustainability

Accelerate the decarbonization of Canada's transportation and construction industries

Help Canada's buildings, infrastructure and communities adapt to climate change

Health and biomanufacturing

Enable the development and rapid manufacturing at scale of novel vaccines, therapeutics and other bio-products

Develop next generation precision tools/devices for distributed diagnosis and therapies and enable their clinical use and commercial adoption

Quantum and digital technologies

Advance quantum science towards viable technologies for commercialization and application in priority areas for Canada

Lead digital research and innovation to facilitate high-quality solutions to critical challenges and jumpstart industry adoption

Foundational research

Effectively fulfill our roles in national astronomy assets and measurement

Organizational priorities

Health and safety

Protect our people, neighbours and environment

Support to business innovation

Strengthen our connection to industry for greater economic impact

Inclusive innovation

Lead workplace diversity toward inclusive innovation

Research excellence

Commitment to world-leading advances in technology, research and innovation

Organizational excellence

Strive for excellence in our enabling teams and supporting business procedures

Climate change and sustainability

Climate change is affecting Canada's communities and industries in increasingly visible ways. Along with bringing the need to mitigate and adapt to these impacts, climate change also presents growing opportunities for Canada to diversify its economy and build on existing strengths to lead in emerging industries.

Industry has an integral role to play in Canada's climate response and in building a prosperous green economy. However, industry needs support to develop the new knowledge, technologies and innovations required to meet Canada's goals and to be leaders in their fields. Such developments will be crucial to reducing greenhouse gas emissions and protecting Canadians against the impacts of climate change in ways that are economically, environmentally and socially sustainable. The transition to a green economy also holds the promise of future gains for Canadian industries, including increased gross domestic product (GDP), more clean technology exports and up to 400,000 new jobs by 2030.[3]

The NRC is well positioned to provide this support. In partnership with innovators and researchers from industry, academia and government, we will employ our research strengths, expertise and infrastructure in large multidisciplinary initiatives to help discover, develop, evaluate and deploy new technologies and innovations that can address Canada's climate change priorities and jumpstart the green economy. Particular focus will be on decarbonizing key Canadian industries, as well as on strengthening the climate resilience and adaptability of Canadian communities and crops. Through this work, the NRC will contribute to Canada's transition to a prosperous green economy and to improved climate resilience. We will also help Canadian industries take leading technologies to market and compete on a global stage.

[3] 2030 Emissions Reduction Plan: Canada's Next Steps for Clean Air and a Strong Economy, available at https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030/plan.html

Goal 1

Accelerate the decarbonization of Canada's transportation and construction industries

Industrial decarbonization is critical to mitigating climate change. Canada has an opportunity to build on its strengths in manufacturing and support the transition of advanced manufacturing to low-carbon technologies. Over the next 5 years, the NRC will focus on decarbonizing 2 key industries in Canada: transportation and construction. Together with our partners, we have the critical mass, expertise and facilities to make an impact.

Canada's transportation and advanced manufacturing industries are traditionally strong but must seize opportunities to successfully transition to a low-carbon future. Aligning with recent legislation introduced around the globe will require manufacturers to reduce their carbon output and to shift to zero-emission vehicle production. To keep up with the global transition to a green economy and strengthen Canadian competitiveness, the industry will need technological solutions to overcome obstacles such as the deployment of charging and fuelling infrastructure, the supply of critical minerals for batteries and the need to develop cleaner fuels.

Construction is another traditional industry facing similar challenges in this rapid transition. Meeting Canada's 2050 net-zero target will require a paradigm shift in how industry develops and adopts new construction technologies, practices and regulations. To seize opportunities and lead globally, Canada's construction sector must accelerate the testing, adoption and scaling of innovative new methods of homebuilding that are also climate resilient.

Our longstanding and new partnerships, strong industry connections and planned investments provide an opportunity to make a difference in enabling these transitions. We envision prosperous Canadian industries, with the NRC supporting the development and implementation of green technologies and solutions.

Two of Canada's key industries are large greenhouse gas emitters[4]

Aerospace and automotive

Share of Canada's gross domestic product: **1.3%**

Share of total greenhouse gas emissions: **22%**

Construction

Share of Canada's gross domestic product: **7.4%**

Share of total greenhouse gas emissions from buildings: **13%**

[4] Distribution of greenhouse gas emissions in Canada in 2021, by economic sector. Statista. Available at: https://www.statista.com/statistics/503526/greenhouse-gas-emissions-share-in-canada-by-economic-sector/

Canadian automotive industry. Available at: https://ised-isde.canada.ca/site/canadian-automotive-industry/en

State of Canada's Aerospace Industry. Available at: https://ised-isde.canada.ca/site/aerospace-defence/en/state-canadian-aerospace-industry

Value of the industry. Canadian Construction Association. Available at: https://www.cca-acc.com/about-us/value-of-industry/

Supporting strategies

Create research and technical solutions that address barriers to the adoption of electric vehicles

We will focus on mobility electrification, including batteries and powertrains, as well as the development, optimization and safe integration of low-carbon technology and light-weighting, aerodynamics and sustainable fuel approaches. We will also leverage these efforts and technologies to advance lower-emission aircraft and marine vessels.

Fill a critical gap in the battery materials supply chain

We will work on solutions to reduce the cost of materials needed for battery production, in turn reducing the cost of vehicles. We will work to improve mid-stream processes and technologies to fill the gap between resource extraction and battery materials supply and explore battery recycling as another avenue for increasing supply chain.

Support the development and use of low-carbon construction materials and systems

We will provide the knowledge and data required to identify and develop low-carbon materials, products, services and tools, to support industrial development of low-carbon and zero-carbon construction materials. We will also improve decision support tools for economical and socially responsible low-carbon building and infrastructure, from design through to end-of-life management.

Leverage digital technologies to drive innovation and productivity in low-carbon construction

We will develop digital, fit-for-purpose solutions to empower construction professionals in the transition to low-carbon operations. This includes working with industry and academia to reduce the time required for permitting and inspections through e-permitting and virtual inspections, reduce costs for construction through digitalization and advanced manufacturing (e.g., offsite, 3D printing), and reduce costs through decreased material waste.

These efforts will support more efficient and resilient construction.

Goal 2

Help Canada's buildings, infrastructure and communities adapt to climate change

Canada's buildings and public infrastructure systems—including bridges, roads, and water and wastewater systems—are guided by codes and standards based on historical climate data. In many cases, these assets were not designed to withstand the extreme weather of today, let alone the even more severe weather anticipated in the future.

The impacts of climate change and extreme weather events are becoming more frequent and their effects on the daily lives of Canadians are intensifying. Understanding how to adapt and protect infrastructure and homes is key to developing and adopting innovations needed to create a resilient built environment.

Increasing the climate resilience and adaptability of Canada's food security is also a priority. Climate change is expected to adversely affect food production and prices, food distribution systems and certain aspects of food quality. Many crop yields are predicted to decline due to the combined effects of changes in rainfall, severe weather events, and increasing competition from weeds and pests on crop plants. Livestock and fish production are also projected to decline, with prices expected to rise in response to the decreased supply.

We strive to support a strong domestic food supply to nourish Canadians across the country and to help protect them from the elements in their homes, buildings and communities. Our work will also help create export opportunities for Canadian industries as other countries seek Canadian-made solutions to feed their communities and adapt to climate change.

Supporting strategies

Integrate climate resilience into the design of and standards for buildings and infrastructure

We will provide the knowledge needed to integrate climate resilience into design, guides, standards and codes for buildings, homes and infrastructure. This will help Canada's built environment better withstand future weather events and support the adaptation of Canadian homes to climate change.

Develop nature-based solutions to protect coastal infrastructure

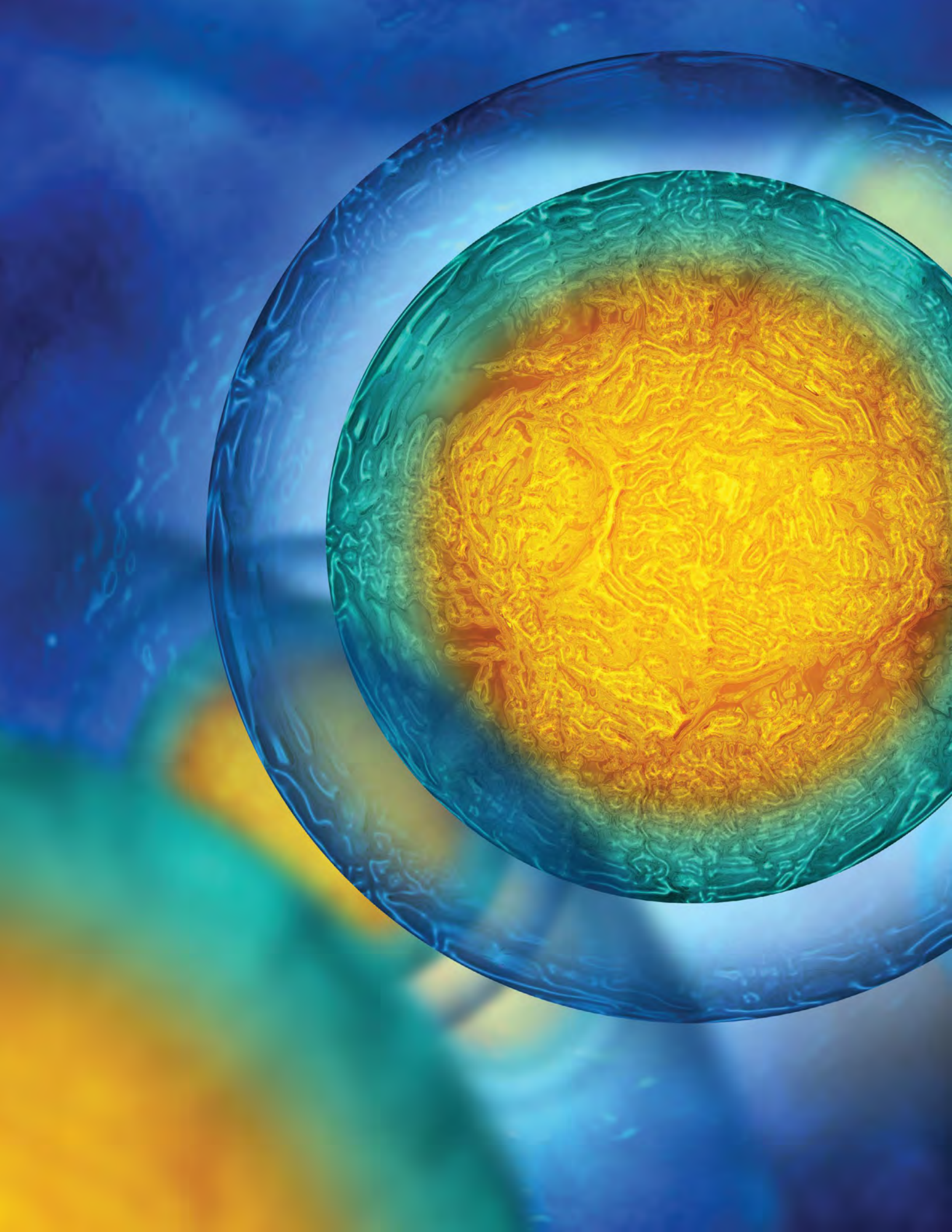
We will learn from nature and improve our understanding of the natural capabilities of beaches, wetlands, marshes, barrier islands, reefs and headlands to manage the risk of coastal flooding and erosion. These solutions are often more sustainable and adaptable to changing environments than conventional, human-made protective structures.

Support technology and data-informed approaches to climate-resilient crop design

We will advance a platform of integrated technologies to help the indoor agriculture industry accelerate crop design and develop novel engineering technologies in support of regional food production. We will also use digital tools, including simulated environment modelling and data integration, to improve the resilience of Canadian crops to climate change.

Improve the competitiveness and sustainability of ocean-derived products

We will advance technologies for sustainable climate adaptation and effective use of marine bioresources. Our focus will be on ocean health monitoring and modelling, the full use of all extracted and cultivated bioresources, and the development of high-value marine bioproducts.



Health and biomanufacturing

Canada's life sciences sector is growing, strengthened by leading talent. The COVID-19 pandemic highlighted weaknesses and gaps in the sector, such as Canada's overreliance on imports of critical health products and supplies. But it also provided opportunities to reinvigorate and rebuild the country's life sciences capacity. Research and development investment is increasing, and the sector's share of Canada's GDP has steadily increased by 25% over the last 5 years.[5] Ensuring the required expertise, resources and governance is important to maintain the sector's growth. This will also allow for a fast and effective response to the next health crisis as well as rapid advancement of cutting-edge technologies for vaccines and treatments, which can then be quickly transferred to industry for efficient, scaled-up production.

New therapies and technologies are also needed for modern and efficient health care and to build the life sciences industries of the future. Canada's health-care system is challenged with increasing demands and is heavily dependent on importing expensive medicines for many chronic and rare diseases. Reducing costs—and more importantly, increasing access to health care—requires innovative solutions and new technologies that are affordable, fit-for-purpose, manufactured domestically and deployed in a distributed care model across Canada's vast geography.

[5] Based on NAICS 3254 and 3391 which represent only a subset of the life sciences and biomanufacturing sector. Gross domestic product – Canadian Industry Statistics. Available at: https://ised-isde.canada.ca/app/ixb/cis/gdp-pid/54

A strong and resilient sector depends on continuous discoveries taken from the lab to the market and made available to improve the health of Canadians. The NRC has a unique role in Canada's collective effort to achieve this vision. We will contribute our expertise and unique infrastructure to increase Canada's biomanufacturing capacity in preparation for the next health emergency. We will also focus on de-risking and accelerating clinical adoption and commercialization of technologies that are user-centric and affordable to produce at scale. Our ambition is to contribute to the thriving biologics, biomanufacturing and distributed care industries in Canada that are ready at scale to address emerging health priorities.

Biomanufacturing goes beyond vaccines and therapeutics

Our atypical fermentation facility on Prince Edward Island specializes in the development and scale-up of fermentation processes to add value to renewable marine and agricultural bioresources. The work at this facility supports Canada's food security by helping increase the country's biomanufacturing capacity and contributing to advances in marine and agricultural bioresources.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Goal 3

Enable the development and rapid manufacturing at scale of novel vaccines, therapeutics and other bio-products

Canadian researchers are responsible for many important breakthroughs in vaccines and therapeutics, from the discovery of insulin over a century ago to the development of vaccines for polio, meningitis and Ebola. While there continues to be a strong community of academic and industry innovators focused on the life sciences here in Canada, the country has lost much of its domestic capacity to produce commercial medicines at scale. Canada's consumption of vaccines and therapeutics increased substantially in just over 20 years, from $473 million in 1997 to $4.8 billion in 2019. However, Canada imports 85% of the vaccines and therapeutics it needs today, up from the 19% imported in 1973[6].

The COVID-19 pandemic revealed Canada's biomanufacturing weaknesses at the same time as it highlighted the critical role of vaccines in effective pandemic response. Canada's approach has been to leverage its existing strengths and expertise to rebuild capacity in the domestic biomanufacturing and life sciences sector. Canada's Biomanufacturing and Life Sciences Strategy provides a blueprint to revitalize the sector and better prepare for future health emergencies by investing in research systems and the talent pipeline, growing businesses, building public sector capacity and enabling best-in-class clinical trial infrastructure.

This strategy identifies the NRC as a cornerstone of intramural research and development, providing expertise, infrastructure and other important capabilities to enable Canada's approach to creating a strong domestic biomanufacturing ecosystem. We will use this long-standing expertise and value proposition to help Canadian industry advance a robust pipeline of biologics and foster at-scale manufacturing and commercialization of those innovations in Canada.

[6] Consultation Document: Considering the creation of a new biomanufacturing capacity for Canada (2021). Available at: https://ised-isde.canada.ca/site/biomanufacturing/en/consultation-document-considering-creation-new-biomanufacturing-capacity-canada

Supporting strategies

Support accelerated development and production of Canadian-made vaccines and biologic medicines

We will accelerate the development of Canadian-made biologics, including vaccines and innovative therapies. Our new clinical trial material facility, the only public facility of its kind, will serve as a product development bridge for domestic production of vaccines compliant with good manufacturing practice (GMP) regulations and other biologics material for first-in-human clinical trials. This expertise can then be transferred to other contract manufacturing organizations—such as the new Biologics Manufacturing Centre (BMC), funded as part of the Government of Canada's investment in biomanufacturing—to produce materials for commercial products.

Contribute our capacity and capabilities to meet pandemic preparedness ecosystem needs

We will re-invest in our research and development infrastructure and leverage our research expertise and training capacity to forge new partnerships with Canada Biomedical Research Fund hubs across the country, and to enable rapid advancement of platform technologies and their high-risk projects. The collaborations will de-risk and accelerate the development of vaccines and biologics and promote their transfer to industry to address current and future health emergencies, including antimicrobial resistance.

Goal 4

Develop next-generation precision tools and devices for distributed diagnosis and therapies, and enable their clinical use and commercial adoption

Health care is the top concern of Canadians across the country,[7] with cost pressures and chronic staff shortages leading to strained resources as well as declining and inconsistent quality of care. At $344 billion in 2023, health-care spending represents a significant share (12%) of the country's GDP. Much of this spending is related to hospitals and medication.[8]

Reducing health-care system costs and increasing access to health care demands innovative solutions and the development of new, easy-to-use technologies. One innovative approach is distributed care, which improves accessibility by promoting a network of decentralized care services located closer to the patients in need. Increasing cost pressures, combined with the public health restrictions put in place to slow the transmission of COVID-19, have already pushed health-care systems toward distributed care. The ongoing success of this model depends on mass production and use of efficient, cost-effective precision tools and devices to monitor, assess and diagnose patients.

With our industry and clinical partners, we will focus on the development, clinical adoption and commercialization of precise and user-centric diagnostic technologies, facilitate accessibility at scale for diagnosis and assessment, and create new tools for patient management and therapy pathway optimization. We are aiming for a future where all Canadians—rural and urban, across all regions—have ready access to leading-edge diagnostics and therapies to improve their quality of life.

[7] Nanos Weekly Tracking, ending February 3, 2023. Nanos Research. Available at: https://nanos.co/wp-content/uploads/2023/02/Political-Package-2023-02-03-FR-with-tabulations.pdf

[8] National health expenditure trends, 2023 - Snapshot, Canadian Institute for Health Information. Available at: https://www.cihi.ca/en/national-health-expenditure-trends-2023-snapshot

Supporting strategies

Support the development and adoption of innovative point-of-care diagnostics

To enable clinical adoption and at-scale industrial commercialization, we will invest in biofabrication capacity for microfluidic devices and also build on our strong collaborations for advancing molecular diagnostics and organ-on-a-chip. Our new cleanroom infrastructure will host a pilot-level capacity for the fabrication, assembly and quality control of microfluidic devices.

Increase the affordability and accessibility of innovative therapies

We will develop and advance disruptive platform technologies for biological cell and gene therapies to accelerate discovery, development, manufacturing and translation to clinical trials of innovative precision medicine. We will coordinate a national effort to increase the affordability and accessibility of these technologies, in collaboration with academic facilities, networks, clinicians, hospital centres and other partners.

Develop user-centric digital health and virtual care technologies

We will increase our efforts for clinical adoption of our digital health and virtual care technologies to meet the growing need of an aging population to access user-centric hybrid care that combines virtual and in-person care. This includes technologies that enable remote physiological monitoring of patients to assess their health status noninvasively, which will help improve aging-in-place and accessibility to timely clinical assessment.

Quantum and digital technologies

Quantum and digital technologies are changing the world at an accelerating rate. Countries around the world are investing to develop technologies to improve economic performance, increase competitiveness and enhance the well-being and security of their citizens. The cross-cutting nature of these technologies means they will ultimately affect all economic sectors and bring significant advances to many fields.

Canada is currently a global leader in quantum and digital research, particularly in quantum computing, artificial intelligence and machine learning. We have the opportunity to translate these discoveries into commercially viable technologies and help Canadian industries adopt technologies that improve their productivity and competitiveness.

The NRC has the expertise, facilities and partnerships required to develop and advance quantum and digital research and to advance promising innovations toward market readiness and adoption. This continuum of capabilities will enable more productive and competitive Canadian industries through the commercialization and adoption of digital and quantum technologies. It will also enable Canada's continued leadership in quantum and digital research excellence.

Goal 5

Advance quantum science toward viable technologies for commercialization and application in priority areas for Canada

The quantum sector is growing quickly and is expected to reach industrial scale in Canada by 2045. Quantum applications and innovations are also expected to drive advances in areas of critical importance for Canada and beyond, including health care, climate change, transportation and cybersecurity.

The NRC will focus on developing and advancing quantum and digital research and innovations toward market readiness and adoption. Through this, we will enable more productive and competitive industries and continue Canada's leadership in quantum and digital research excellence.

Historically, Canada has been a leader in quantum science. Our country is home to a growing quantum ecosystem with university-based centres across the country and an increasing number of quantum-focused companies. Between 2016 and 2019, there was a 58% increase in quantum firms and a 59% jump in quantum-related jobs.[9] Canadian companies such as DWave, 1QBit, Xanadu and Photonic are now recognized as global leaders in quantum computing and software. Canada also boasts healthy private and public sector investments. That includes more than $1 billion from the federal government between 2012 and 2021, more than $1 billion since 2002 from private investors and provincial investments in centres of quantum leadership across the country.

[9] According to Statistics Canada analysis of quantum company data on behalf of ISED, 2022.

As other countries ramp up their investment and focus on quantum science and technology, Canada must keep pace to maintain its leadership position. Through the $360 million National Quantum Strategy (NQS),[10] Canada is building on and leveraging its strengths to translate scientific leadership into innovative, market-ready technologies with the potential for strong economic benefits.

We will orient our quantum science and technology activities to support the implementation of the NQS and its focus on sensing, computing and communications. In doing so, we will support Canada in realizing the economic potential of quantum technologies. We will also deploy our scientific knowledge, infrastructure, talent and deep connections in the quantum ecosystem (domestically and internationally) to advance technologies along the path to commercialization.

[10] Canada's National Quantum Strategy. Available at https://ised-isde.canada.ca/site/national-quantum-strategy/en/canadas-national-quantum-strategy.

Supporting strategies

Develop next-generation quantum sensors for health care, defence, transportation and environmental sensing applications

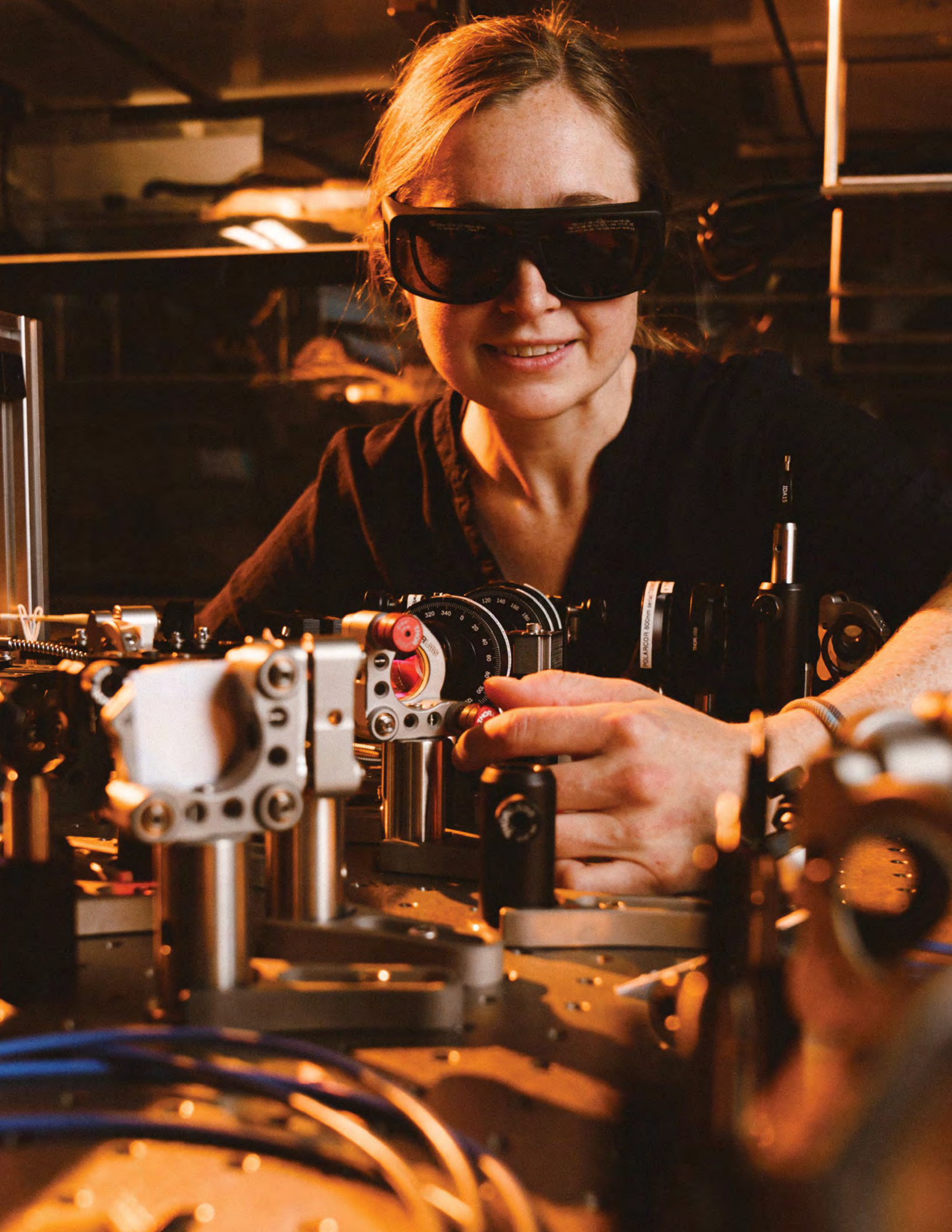
We will help develop a new generation of sensor systems that perform beyond the limits of classical physics and may be engineered and commercialized for priority application areas that benefit Canadians. This includes advancing photonic-based quantum sensing technologies and the transition of quantum systems onto chips.

Apply commercial quantum computing solutions to create ground-breaking innovations for key economic sectors

We will help maintain Canada's global leadership in quantum research and the commercialization of quantum computing applications by capitalizing on the recent progress made by intermediate-scale quantum computers available through cloud platforms. This includes developing and applying new quantum algorithms, simulations and software that harness the power of these new computing capabilities.

Build revolutionary quantum capabilities by developing interconnected quantum devices communicating at a distance

We will work to scale quantum technologies from components into interconnected quantum systems with the overarching goal of enabling secure quantum communication at a distance. These efforts will form the building blocks of more powerful quantum systems by getting heterogeneous devices to speak to each other while preserving the exchange of quantum information. Testbeds will be used to de-risk the interoperability of quantum components and inform standards.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Goal 6

Lead digital research and innovation to facilitate high-quality solutions to critical challenges and jumpstart industry adoption

Digital technologies are critical to maintaining Canada's competitiveness and productivity across a range of sectors. An estimated 70% of new business value over the next decade will come from digitally enabled platforms, and 30% of global corporate revenue will come from digital ecosystems by 2025.[11] These technologies are also transforming the speed and process of research, with faster use of data, faster computers and multidisciplinary teams leading to more rapid discoveries and technology developments. Digital technologies can also be applied to accelerate the adoption and implementation of innovations and solutions in critical areas such as climate change and health care. By 2025, it is expected that 30% of new drugs and materials will be systematically discovered using generative AI techniques.[12]

While already a leader in digital research, Canada needs to accelerate commercialization and adoption of these technologies and innovations at scale. For instance, the aerospace industries in Germany, Japan and the United States are shifting toward aircraft certification through virtual testing and digital twinning, which is significantly more cost- and time-efficient than physical testing. Canadian industries need support to realize the transformative benefits of the digital applications and technologies available to them, and how to incorporate them into their operations.

[11] Why Digital Business Models Matter, World Economic Forum. Available at https://widgets.weforum.org/digital-readiness-assessment.

[12] Top Generative AI Questions for Your Enterprise, Gartner. Available at: https://www.gartner.com/en/topics/generative-ai

While technological advances have created opportunities for increased innovation and economic growth, they also bring public policy challenges. Policies and regulations around generative AI technology must be designed to foster economic growth in the AI field while also protecting government, companies and Canadians. With its successful history in AI technology development, Canada has the opportunity to take on a leadership role with its partners and allies and develop AI tools that are productive, fair and secure.

The NRC has more than 30 years' experience in developing and deploying digital technologies that could be adapted to improve the advanced manufacturing, life sciences and transportation sectors, including the digital twins that will enhance the NRC's aerospace testing capacities. These technologies can also be used to support other national priorities. For example, our capabilities in the preservation of Indigenous languages using AI are helping to strengthen Canada's relationships with Indigenous peoples. In all these technologies, we will develop safe and responsible AI-powered solutions that align with Canadian values and those of the NRC.

Leveraging our expertise, we will work with partners to develop high-quality and fit-for-purpose solutions, support and de-risk the continuing digital transformation of industry and government, and develop and commercialize technologies that collect and use data in a way that preserves both privacy and trust.

Work toward our digital transformation

Developed in alignment with this strategic plan, our digital transformation vision will enable a digital research environment in which data are mobilized for high-quality, innovative research and solutions. Activities will also contribute to the achievement of strategic goals related to industrial decarbonization, health and biomanufacturing. The following activities include some of the key elements of our vision for digital transformation.

Supporting strategies

Integrate more digital capabilities into our facilities

We will make strategic investments in digitalization as we systematically renew our facilities. This will boost our ability to accelerate scientific discovery for the development and availability of trusted solutions as well as our ability to demonstrate to industry the transformative potential of digital technologies and applications. Specifically, digital capabilities such as sensors, data installations, and advanced computer capacity for modelling and automation will add new functionalities and possibilities to our research and development activities.

Develop trustworthy, privacy-preserving and secure AI-powered technologies

As we continue to develop digital technologies and capabilities, we will focus on research that ensures the safety and trustworthiness of AI-powered solutions. This includes research and development of encryption methods that are resilient to quantum computing threats, privacy-enhancing technologies, methods to better manage security vulnerabilities, and approaches to making robust AI systems that are safer and more transparent.

Provide services to industry and government that support digital solution adoption

We will invest in current and expanded activities and services that provide the guidance, assessments and solutions required to facilitate digital transformation by government and industry. We will lend our technical and advisory expertise for the adoption and scaling up of unique, fit-for-purpose solutions to improve their operations or products. In addition to providing digital assessments, we will also develop and provide services that focus on cybersecurity, privacy protection and responsible AI.

Foundational research

The facilities and equipment needed by our own researchers and the broader Canadian research community are key to enabling scientific exploration that leads to breakthroughs. Some infrastructure is of such scale that it requires global cooperation to develop and maintain. The NRC plays an important role in these endeavours.

We represent Canada's participation in ground-based observatories that are critical to the astronomy community. The NRC also maintains the national measurement standards that are essential to both scientific research and daily life in Canada, including the dosing of medicines, ensuring fair trade, and setting the foundation for standards. Through this stewardship, we provide access to the world-class facilities required to maintain Canada's reputation for scientific excellence, support emerging technologies and innovation, and enhance the socio-economic well-being of Canadians. In these roles, we have contributed to breakthrough scientific discoveries and innovative solutions to global challenges and accelerated the adoption of emerging technologies.

Goal 7

Effectively fulfill our roles in national astronomy assets and measurement standards to maintain Canadian scientific and technology leadership

Astronomy is one example of how we support foundational science, both through the research we conduct and through the facilities we manage and operate for use by the scientific community. Canada is a recognized world leader in astronomy research and technology and home to unique research, development, innovation and testing capabilities as well as incredible talent. Over the past decades, Canadian astronomers have made many important technological breakthroughs like advanced optics, composite radio reflectors and digital signal processing systems. They have also made many important discoveries, from fast radio bursts to exoplanets.

To continue this pursuit of excellence, researchers need access to a range of world-class facilities in strategic locations across the globe. Under the *National Research Council Act*, we are mandated to operate and administer Canada's national observatories. As part of this role, we also manage Canada's participation in international ground-based facilities and provide merit-based access to these observatories for Canada's astronomy research community.

Metrology is another example of our foundational research, beginning with the determination of measurement standards through to the application of those standards. Precise measurements are essential for medicine, trade, technology and engineering—areas that contribute to health, prosperity, quality of life and environmental protection.

The NRC and Measurement Canada form Canada's national measurement system. We act as the country's national measurement institute and under the *National Research Council Act*, we steward Canada's practical standard realizations of the International System of Units (SI). In this capacity, we work with the national measurement institutes of other countries to redefine the base system of measurements. We also work with other organizations around the world to provide metrology research and services that help transform ideas into market-ready technologies of benefit to society, the economy and the environment.

Membership in the Square Kilometre Array Observatory (SKAO)

The NRC's membership in this global radio astronomy observatory with 16 partner countries will enable transformational science about the universe, exploring questions such as how and when the first stars and galaxies were formed and how planets form. As a member, Canada will establish an SKAO regional data centre, and the NRC will provide in-kind contributions for the telescope.

Supporting strategies

Provide Canadian researchers with access to world-class astronomical observatories and expert support

We will provide on-site observatory staff and distributed operations for Canadian observatories, including maintaining a unique site for community radio telescopes. We will also provide large-scale scientific computing infrastructure as well as specialized astronomy data management expertise and support for instrumentation development projects. In addition, we will help maintain Canadian excellence in astronomy and physics by enabling the meaningful participation of Canadian researchers in international observatories and collaborations.

Design, build and deploy new and innovative astronomical instruments

We will work with academic and industry partners on cutting-edge designs that enable the community to perform research. We will look to apply the findings from successful collaborations with industry in other sectors to advance astronomy and foster business innovation. At the same time, we will work with industrial partners to adapt technologies initially developed to advance research in astronomy and astrophysics for use in other industries.

Advance leading-edge measurement science to define the International System of Units

We will conduct strategic research to advance unit realizations, dissemination methods and measurement solutions, aiming to push the boundaries for international metrology. This includes playing a leading role in the approved international roadmap for the redefinition of the SI second by advancing our research on portable optical clocks. To advance the digital transformation of metrological infrastructure, we will also establish a machine-understandable digital framework for data representation.

Develop new measurement standards to accelerate the adoption of emerging technologies

We will develop new measurement standards and instruments to provide the foundation needed to support Canadian priorities. These include measurements and standards for next-generation power electronic modules and rapid charging stations for electric vehicles as well as standards for emerging quantum technologies.

Committing to excellence

The NRC's mission is to advance science and technologies to find innovative solutions for Canada. How we approach our work and the values that underpin our everyday activities are equally important. These organizational priorities and values give our work focus, help us continuously improve as a partner and as an employer and drive us to make greater contributions to an innovative and prosperous Canada.

Over the next 5 years, we will continue to emphasize the key organizational priorities that have made us who we are and remain foundational to our success.

Health and safety

Protecting our people, neighbours and environment

We are involved in a variety of research areas, each of which present their own set of health and safety considerations. These range from employee health and protection to animal safety, from radiation safety to hazardous materials management. As an organization, we need to stay vigilant and continuously work to meet the highest standards for health and safety.

We strive to maintain a safe work environment, but we know we need to continuously improve. Our efforts over the next 5 years will be aimed at fostering a culture of safety and vigilance that is woven into the fabric of the NRC. Our objectives are threefold:

- we will provide all NRC employees with the training and tools needed to apply the highest level of safety in their work
- we will be a model for safe workplaces
- we will be a leader in environmental practices

During the past year, we assessed the current state of our health and safety culture and identified opportunities for improvement. We will carry on with this work by keeping communication lines open, sharing knowledge and focusing on learning what we need to do better. These efforts will include creating targeted information and awareness campaigns, training, monitoring, and applying effective oversight. In the communities in which we operate, we will strive to be an even better neighbour by continuing to assess, monitor and manage risks and by remediating contaminated NRC sites to reduce potential environmental and human health risks.

Our intention is to deepen our culture of excellence for health, safety and environmental stewardship, and to place health, safety and environmental considerations at the forefront of planning for all new activities at the NRC.

Support to business innovation

Strengthening our connection to industry for greater economic impact

Supporting Canadian businesses in their efforts to innovate and prosper is central to what we do. Examples of these efforts include:

- conducting research, generating valuable knowledge and securing new Canadian intellectual property that leads to new products and services for Canadian companies
- providing access to small-scale manufacturing and other facilities to develop, prototype and scale up new technology
- connecting Canadian innovators to leading research and development expertise and facilities
- enabling cross-sector partnerships and collaborations in Canada and abroad
- providing vital funding and advice to advance innovative research and development projects

The 2022 federal budget recognized the NRC's importance to Canada's innovation ecosystem and challenged us to increase our economic impact. This challenge has been central to our strategic planning process, including how we can improve our engagement with Canadian industry and better support companies in the commercialization of their technologies and innovations.

NRC IRAP has played a considerable role in the success of Canadian business innovation over the past 75 years. Touching close to 10,000 firms per year through funding, advice and connections, NRC IRAP support has resulted in significant success for small and medium-sized enterprises, both domestically and internationally. NRC IRAP will play an integral role in our approach to supporting business innovation.

Elements of the NRC's approach to increasing engagement and economic impacts include:

- using the full breadth of our capacity, expertise and connections to support and stimulate Canadian business innovation
- further leveraging our Challenge programs as collaborative platforms to strengthen our ties with universities, colleges and Canadian companies, and to advance projects with vast market potential
- being the partner of choice for Canadian small and medium-sized enterprises by increasing access to our assets and providing them with the specialized expertise, scale and resources they need to take technologies to market
- focusing on leveraging the untapped potential of our proprietary technologies and patents, further increasing the impact of our research achievements for Canadians

Strengthening connections with our international partners for greater collaboration, export opportunities and to position Canada as a global player is also an integral part of our business engagement plan. We will focus on priority countries and identify greater opportunities to collaborate in strategic areas including electric vehicles, climate change and semiconductors.

Through these efforts, we aspire to work with the most innovative firms in Canada, be a connector for knowledge translation and technology adoption, and facilitate the commercialization of technologies that will position Canada as a leader in innovation.

Inclusive innovation

Leading workplace diversity toward inclusive innovation

We recognize the importance and benefits of working in a diverse and inclusive environment. Cultivating cultural understanding brings acceptance, empathy and growth. As a research and innovation organization, the NRC understands that diversity also enhances the quality of our work. It has been proven time and time again that diversity unlocks innovation—and that the most innovative enterprises tend to be the most diverse.

We are only as good as our people, so we are committed to the growth and development of everyone working across our organization. By upholding this commitment, we will make the NRC a workplace of choice recognized for its inclusive culture of growth and excellence. The NRC will be a place where people can pursue passions, explore possibilities and develop the skills that are indispensable to our partners and critical to advancing excellence.

Over the past few years, we have made important progress on building an even more diverse and inclusive workforce. We have reached or exceeded a level of representation for women and racialized persons that reflects labour market availability, and we will continue to work to attract and retain more diverse people, including persons with disabilities and Indigenous persons.

But building a diverse workforce is only the first step. Over the next 5 years and beyond, we will pursue inclusive innovation. This approach moves beyond the internal focus of creating an inclusive workforce and workplace to also focus externally on how we conduct our work and our impact on diverse communities.

Sustainable change can happen only through a collective, ongoing commitment across the NRC. This includes supporting all employees and leaders to learn, reflect and adapt, ensuring we all contribute to an inclusive, barrier-free workplace where everyone feels welcome, respected and valued. We will also learn to use inclusive design approaches to conceptualize and develop our interdisciplinary programs and services, carefully considering the different ways our work can potentially affect different groups.

Indigenous engagement is a significant aspect of our commitment to inclusive innovation. Over the next 5 years, we will work to increase both our capabilities and our opportunities to undertake meaningful engagement with Indigenous peoples and communities. This will help inform our business and research practices, and support the representation of Indigenous peoples in our workforce and in the broader research and innovation system. As the NRC operates sites across Canada, we acknowledge the diversity of Indigenous territories and communities where our research and innovation activities are conducted. Accordingly, our commitment to Indigenous-inclusive innovation is responsive to the distinctiveness of Indigenous peoples with whom we engage all across Canada.

This past year, the NRC has engaged experts and resources to help guide us on the journey to making this vision a reality. Some of our commitments on this journey will include:

- building intentional relationships and partnerships with Indigenous researchers, innovators, communities, organizations, businesses and governments
- advancing equity and reconciliation through collaboration and partnerships centred on Indigenous priorities
- bridging knowledge systems to enhance existing research and operations

Progress in these areas will bring us closer to being inclusive and representative of Indigenous peoples and help us achieve excellence through partnerships with Indigenous researchers and communities.

Inclusive innovation reinforces our organizational values

Integrity

Behaving ethically, honestly and objectively at all times; being impartial and transparent with colleagues, collaborators, stakeholders, clients and the people of Canada; and exercising sound stewardship of our resources.

Excellence

Pursuing excellence in all that we do—in our research and innovation, in our collaborations, in the execution of our programs, in our support to firms and in the delivery of our common corporate services.

Respect

Valuing and respecting the knowledge, expertise and diversity of our colleagues, collaborators, stakeholders and clients and their ability to have an impact on Canada and the world.

Creativity

Harnessing our imagination and our passion for scientific excellence, exploration and innovation to generate new knowledge, new technologies, new business processes and new collaborations for a better NRC and a better world.

Research excellence

Research excellence refers to our commitment to achieving world-leading advances in technology, research and innovation. It is a commitment to achieving high rankings on comparative measures of impact, using both established and progressive assessments. We strive for excellence in all that we do to create outcomes of the highest quality that lead to impact.

Our commitment to and demonstration of research excellence assure our partners that we can be a critical, dependable part of their success and lets government know that our advice is based on sound science. A culture of research excellence also enriches and sustains our organization by attracting and retaining world-leading research expertise, helping to create the NRC research leaders of tomorrow. Collaborators worldwide will increasingly seek to work with our research experts and access our unique and modern facilities, resulting in collaborations that are highly ranked on traditional metrics and produce powerful narratives of innovation for Canada.

Achieving this vision requires a sustainable culture of excellence as well as a pattern of beneficial research outcomes and impacts. Our vision will be enabled by our people, facilities and collaborations, and how we collaborate and communicate as an organization both internally and externally. Guided by our Chief Science Officer and the President's Research Excellence Advisory Committee, and with input from experts across our organization, we will grow and sustain research excellence by:

- fostering the career development of world-leading researchers
- increasing the exchange of ideas and providing time and opportunities for innovation
- enabling world-leading research and innovation through facility renewals
- creating collaborative opportunities with world-leading researchers in Canada and internationally
- creating space for the cross-pollination of ideas by enhancing researcher interactions
- promoting multidisciplinary collaborations across the NRC, academia, industry and government
- communicating our results and the impacts of our work internally and externally, which will reinforce research excellence as a key success factor for the NRC, strengthen our collective pride in enabling this research and promote our success to Canadians and the world

A commitment to research excellence will ensure we produce high-quality innovations as we achieve our strategic goals. It will further ensure the sustainability of the NRC as an engine for advancing research, technology and innovation.

Organizational excellence

A comprehensive structure of enabling teams and supporting business procedures—serving functions ranging from procurement to program development and from communications and contracting to IT enablement and support—rarely receive recognition equal to that of our research and innovation endeavours. But they are just as critical to our success. Continuing to improve these functions will be vital to advancing our research and innovation priorities over the next 5 years.

Over the last 5 years, we have made many changes that have helped us grow in the roles of partner and innovator. Initiatives like our Challenge programs and collaboration centres have allowed us to work more effectively with government, academia and industry, while providing more opportunities for scientific discoveries and technological advances.

In the spirit of continuous improvement, the 5 years ahead will see the next phase in our evolution, most notably the renewal of our infrastructure. Our national laboratories and facilities are foundational to our success and to the success of our partners. From astronomical observatories in British Columbia and photonics fabrication facilities in Ottawa to biomanufacturing facilities in Montreal and ocean tide simulators in Newfoundland and Labrador, the NRC manages and operates highly specialized equipment and infrastructure that have been instrumental in many scientific advances. We will make strategic investments enabled by an investment of nearly $1 billion from the Government of Canada to ensure our facilities remain on the leading edge of research and technology development. To deliver on this new investment, we will streamline our processes and leverage our increased authority in procurement to ensure we can operate at the speed of our partners.

Renewing our facilities will also help us reach our goal of reducing greenhouse gas emissions by 70% by 2030 and, in doing so, contribute to the Government of Canada's greening objectives. In addition to reducing the carbon footprint associated with the facilities themselves, we will purchase clean electricity as well as zero-emission or hybrid vehicles for our light-duty and executive fleet. Infrastructure renewal also provides an opportunity to make our physical spaces more inclusive and accessible, identify barriers and align design decisions with the *Accessible Canada Act*.

Finally, our ongoing investments in IT will ensure a strong and secure cyber environment, allowing us to work efficiently with government and businesses because they will trust in the security of our processes. We will incorporate automation and other digital tools into our internal operations, allowing us to move at the speed of business in our industrial partnerships. On the research front, we will renew our facilities with digital-powered tools and solutions that expand our capabilities and allow us to accelerate the speed at which we conduct research and innovation with our partners and for our clients.

Achieving our vision

Guided by the collective vision captured in our 2024–2029 strategic plan, we will forge ahead to achieve our goals and objectives. Because there is more than one path to success, our plan allows us the flexibility to adapt to unforeseen circumstances and opportunities that may emerge over the next 5 years. Whatever those may be, the plan will continue to guide us forward to better support our clients and partners and foster a more prosperous and innovative Canada.

We are also aware of risks that have the potential to affect our operations and the impact of our work. The escalation of international tensions and the potential increase of malicious cyber activity require increased attention on both research security and cyber security. Increased global competition for research talent and an aging population reinforce the importance of progressive human resources practices and proactive succession planning. We will also see new opportunities emerge. While our plan provides us with the flexibility to adapt, we will undergo periodic assessments to remain focused on important areas and aligned with Canadian priorities.

At the end of the plan's 5-year period, we will consider success as having results and impacts under each of our goals, as well as having contributed to the following outcomes for Canada:

- successful transition to a prosperous, productive and competitive green economy and improved climate resilience
- connected biologics, biomanufacturing and distributed care industries that are competitive, ready to address emerging health priorities and grow to industrial scale
- improved competitiveness through the commercialization and adoption of digital and quantum technologies
- continued access to world-class facilities and infrastructure for astronomy and measurement sciences

Over 5 years, success will also be measured by having upheld our values and grown stronger as an organization and as a partner for Canadian innovation. We will have seen growth in the areas of inclusive innovation, research excellence and organizational excellence, and we will have fostered a culture of the highest standard in health and safety.

Through our research and innovation activities, we will also have helped secure and grow Canada's sustainable industrial economy, make Canadian society and the economy more resilient, and put the country on a path for increased prosperity.