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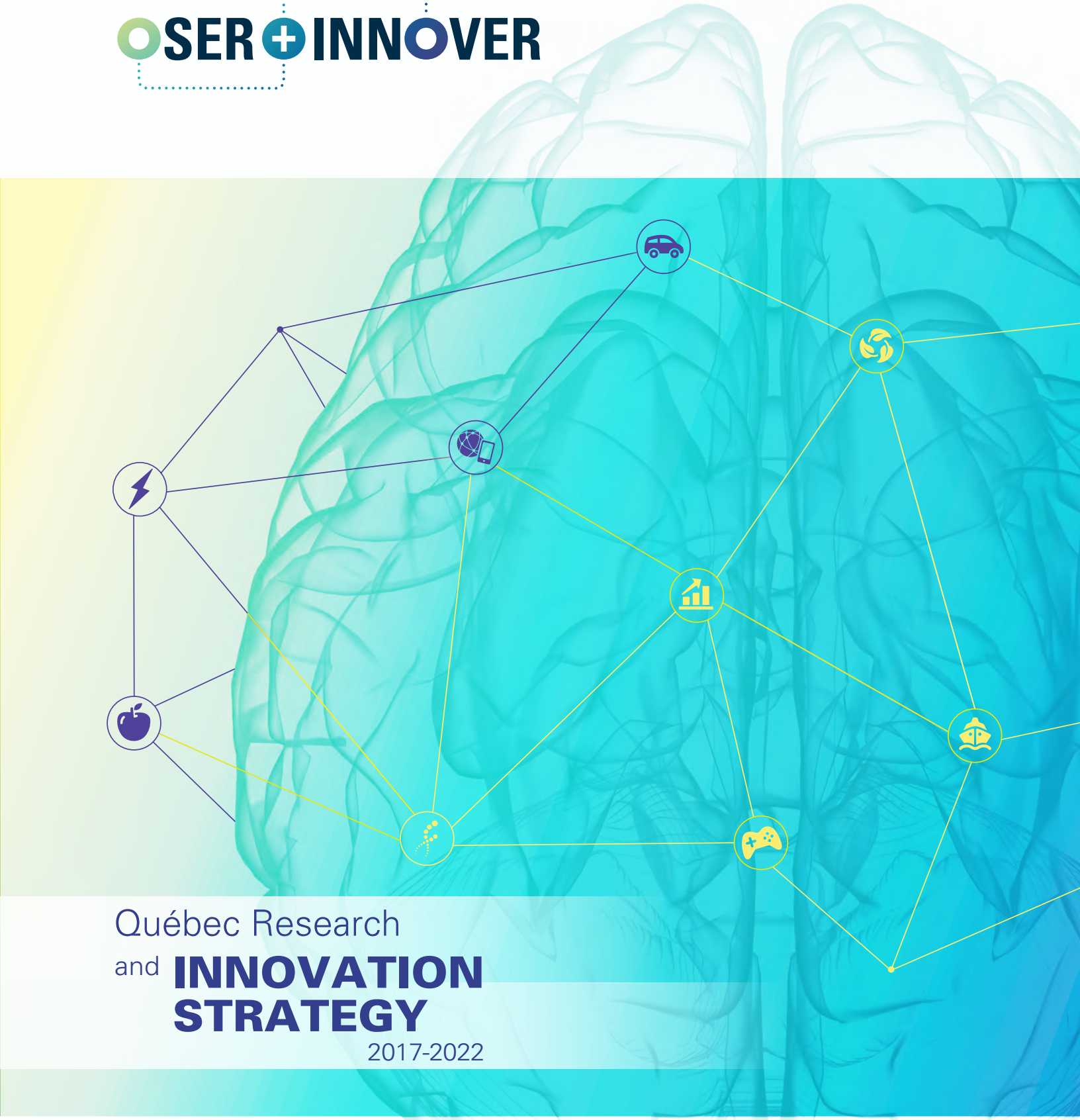

Québec Research and INNOVATION STRATEGY

2017-2022

Québec

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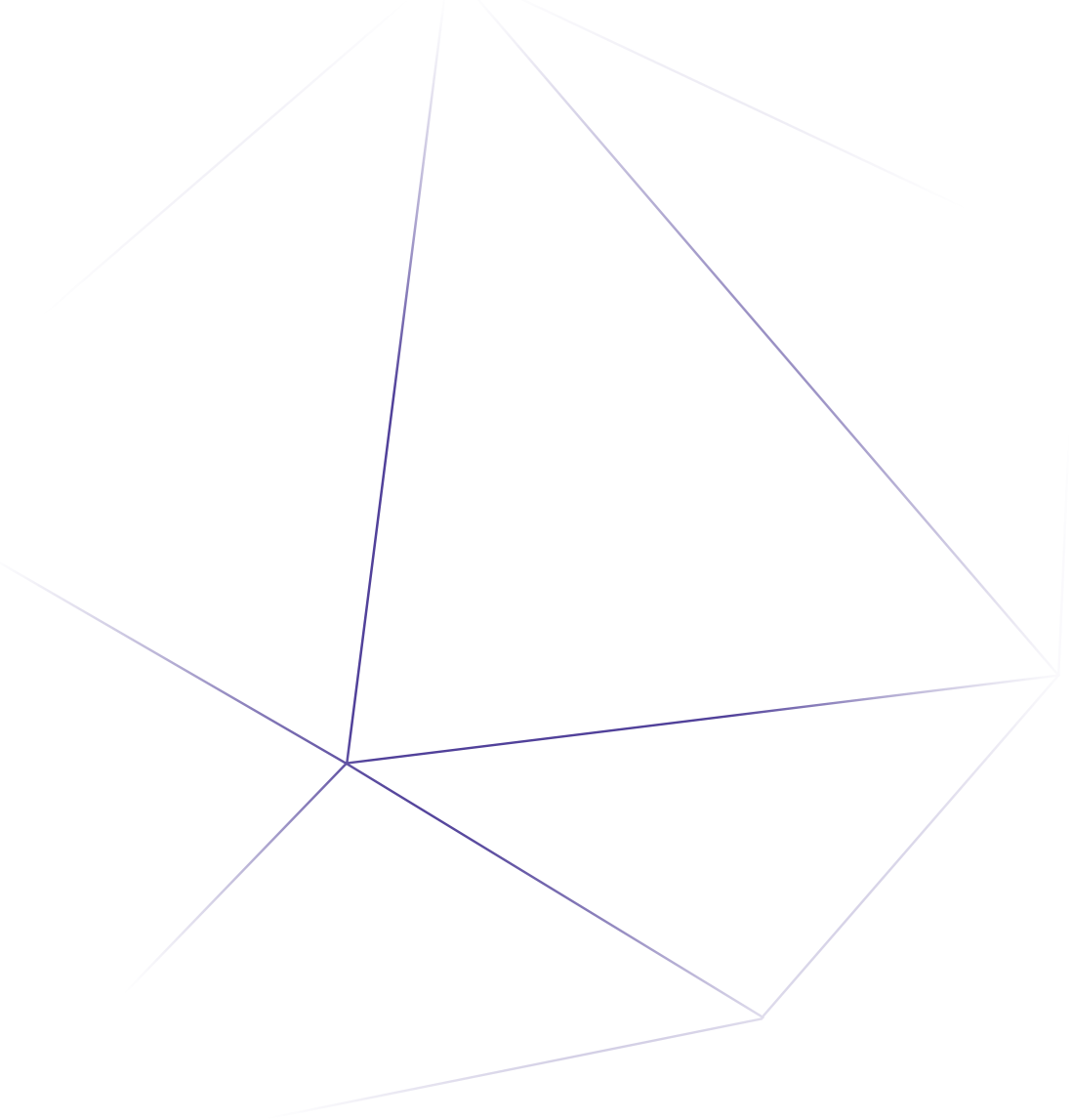


A Word from the Premier

The 21st century has brought a wave of profound change to Québec, like everywhere else in the world, the scope of which we are only just being to understand. And so the goal of our government is simple. We want to spur modernization among those industries that have long been the backbone of our economy, while encouraging the emergence of new areas of excellence. We have identified three ways to make this happen—we'll encourage our manufacturers to innovate, we'll boost exports, and we'll provide better resources for our small and medium-sized businesses.

But to dare to innovate, Québec must first invest in the right skills, resources, and processes to create an environment that fosters creative thinking and values knowledge. The Québec Research and Innovation Strategy will help make that happen. We'll be able to foster a true culture of science and innovation. We'll nurture talent and skills and groom the next generation. We'll arm ourselves with world-class research capabilities. We'll provide the right conditions and resources for good ideas to become great products, processes, and practices.

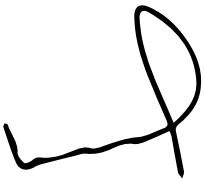
It's a lofty goal but certainly within our reach. By 2022, we want to position Québec among the top 10 research and innovation leaders in the Organisation for Economic Co-operation and Development (OECD). By 2030, we expect to be one of the world's most innovative societies, recognized as an incubator for talent and ideas, with a can-do approach to the challenges at hand.

Together, we're going to be a part of this new economy and this knowledge-based society.

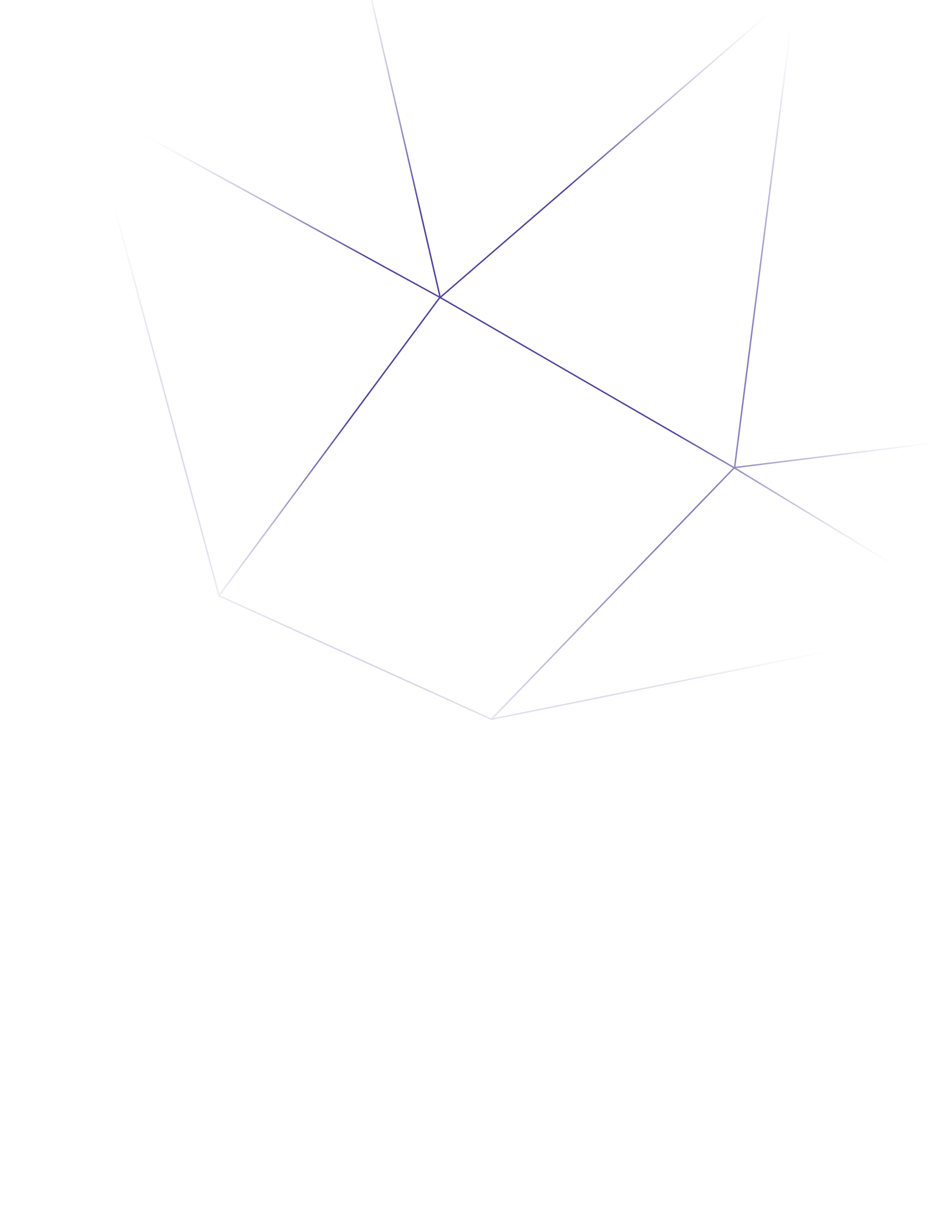
Together, we're going to turn the challenges of the 21st century into opportunities.

Together, we're going to move Québec forward along the path to change.

Premier of Québec



Philippe Couillard



A Word from the Minister of Economy, Science and Innovation and Minister responsible for the Digital Strategy

I am delighted to introduce the Québec Research and Innovation Strategy 2017–2022. This strategy is the result of extensive consultation among leading players and experts in research and innovation as well as citizens of all ages representing communities, institutions, and businesses across all regions of Québec.

As a first step, the strategy will help us develop a true culture of science and innovation, arm ourselves with a world-class research capability, and unlock the benefits of research and innovation. It will also help us provide the right conditions and resources for good ideas to become great products, processes, and practices.

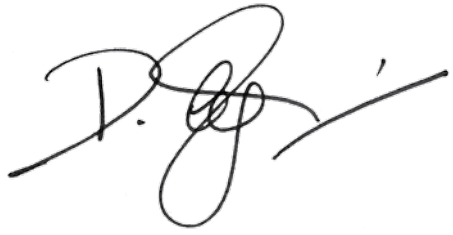
Three objectives have been identified, namely to nurture talent and skills among aspiring scientists and innovators, support researchers and innovators and thus improve research and innovation in all their forms, and increase the pace and scope of innovation commercialization, a vital step in leveraging the social and economic benefits of research and innovation.

The Québec Research and Innovation Strategy 2017–2022 reaffirms the importance of the government as a driver for change in the promotion and use of innovation, including in government contracts. It also makes a place for the principles of sustainable development, so our efforts will be consequential from an economic, social, and environmental perspective. Québec is recognized as an innovation hub that respects, nurtures, and sustains talent. Our strong partnerships must allow us to attract and retain a collaborative network of businesses, institutions, researchers, and innovators from all over the world.

Research and innovation are powerful tools that will help us modernize our economy and society through know-how, creativity, and groundbreaking new ideas.

You are key players and partners in research and innovation. Rest assured that our government will be by your side as you help us put this strategy into practice. Let's "dare to innovate" together for progress throughout Québec!

Minister of Economy, Science and Innovation
and Minister responsible for the Digital Strategy



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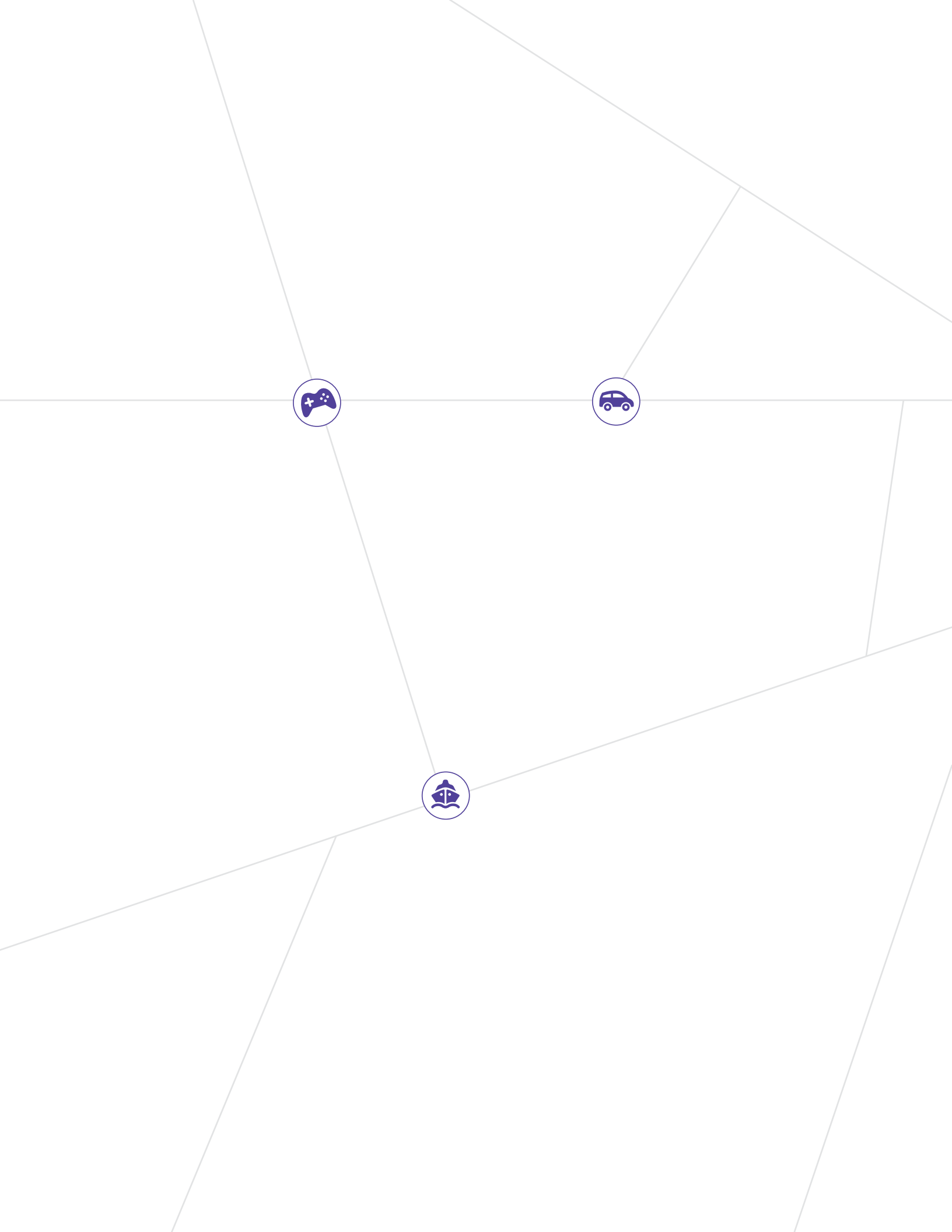


INTRODUCTION

This is the new the Québec Research and Innovation Strategy.[1-2]

Ambitious goals and means

With this ambitious undertaking, the government plans to devote significant resources over the next five years to making Québec one of the world's most creative and innovative societies.

The goal is for Québec to be ranked among the top ten OECD countries for research and innovation by 2022.[3]

By 2030 the government expects Québec to be one of the world's most innovative societies, recognized as an incubator for talent and ideas, with a can-do approach to the challenges at hand.

Extensive consultations

The Québec Research and Innovation Strategy is the result of extensive consultations of leading research and innovation players and experts as well as the general public.

A strategic sector of the economy

The Québec Research and Innovation Strategy ties in closely with economic activity in the province.

It covers all research and innovation activities, from basic research and experimental development to innovation and the commercialization of innovations.

Research activities are vital to growth and development in Québec. By offering solutions to major challenges, they contribute to the well-being of society and help industry thrive. Research leads to tomorrow's breakthroughs and the emergence of new ways for society to live and work. The benefits are many, and by investing in research Québec is consolidating its global position as a knowledge-based society.

Solutions discovered through research are implemented through a process of innovation. Innovation consists of defining and establishing new and improved ways of doing things. Innovation builds on the outcome of research activities, creating economic activity and jobs.

The government's economic vision

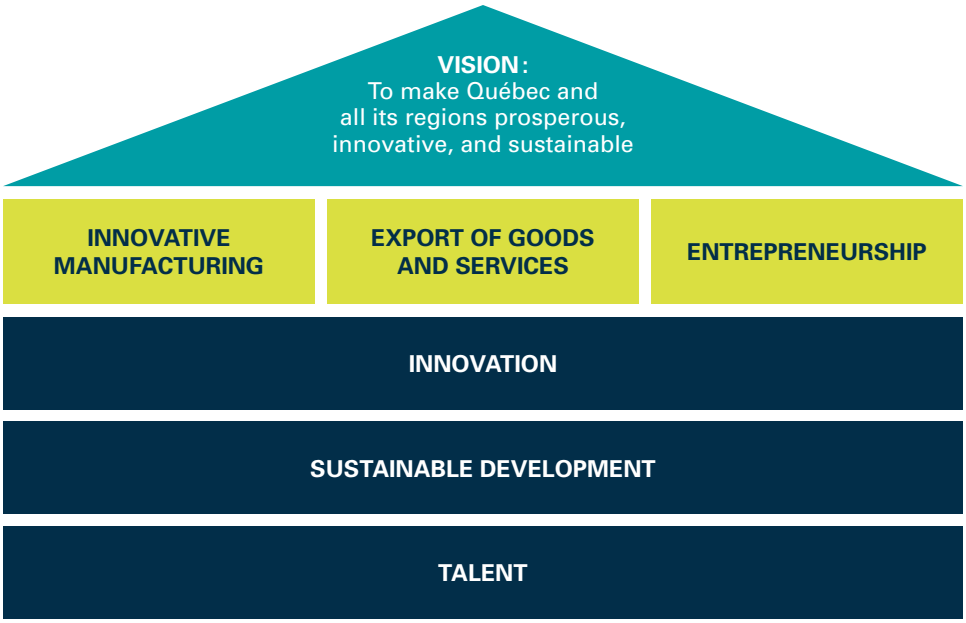
Innovation is a core component of the government's economic vision for Québec, a vision in which the entire province and all its regions are prosperous, innovative, and sustainable.

Tagged DARE #TO PROSPER, this vision is based on three pillars for which the government has already announced or will soon announce its strategy:

- Innovative manufacturing
- Exports
- Entrepreneurship

1. The use of masculine gender includes the feminine and is employed solely to facilitate reading.
2. All statements in this document are based primarily on data from Statistics Canada or Institut de la statistique du Québec. In some cases scientific studies or observations from public consultations were also used. These sources are available on request. Write to info.economie@economie.gouv.qc.ca. You may also consult https://www.economie.gouv.qc.ca/fileadmin/contenu/publications/etudes_statistiques/innovation/tableau_synoptique.pdf
3. Appendix 1 presents an overview of Québec's research and innovation results.

FIGURE 1 **The Government's economic vision – dare #to prosper**



Innovation, a source of creation for wealth and jobs

Innovation is the engine that will drive Québec's efforts to reinvent itself. It will help Québec adapt to the new global economy while facing the great challenges of the day—changing demographics, climate change, sustainable development, the need to match skills to emerging technology, and more.

These challenges are shared by all nations. They show the importance of modernizing more traditional industries so that all regions grow and prosper, and of building local and international partnerships so that talent and effort are pooled and the best solutions are implemented.

For Québec to prosper and enjoy high quality of life, it must draw more on its capacity for innovation, its incubator of talent, and the ideas it generates.

In today's increasingly competitive and complex global economy, innovation is the key to unlocking the benefits of our creativity, research expertise, entrepreneurial drive, and technological advances. In fact, Québec's International Policy stresses how important it is to tell the world where and how Quebec excels.

Innovation boosts competitiveness and productivity. It creates products with high added value, reduces production costs and lead times, maximizes workers' skills, and extends product lifecycles.

There is also a social aspect to innovation. It fosters progress, efficiency, social cohesion, empowerment, and new social connections.

Innovation in all its forms thus creates wealth and jobs.

The Strategy: far-reaching in scope

With the Québec Research and Innovation Strategy, the government supports research and innovation in various shapes and forms.

The Québec Research and Innovation Strategy is not just about technological innovation. It addresses all forms of innovation—new social modes, new business models, new methods in distribution, marketing, and management—with the potential to make Québec a more prosperous and successful place.

The Québec Research and Innovation Strategy is for businesses and organizations seeking new methods and added value.

BOX 2

RESEARCH AND INNOVATION

Research and development

Research and development (R&D) comprises "creative and systematic work undertaken in order to increase the stock of knowledge . . . and to devise new applications of available knowledge."

The expression "research and development" encompasses three types of activity—basic research, applied research, and experimental development.

- Basic research comprises "experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view."
- Applied research is "original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective."
- Experimental development is "systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes."

Innovation

Innovation consists of new or better methods that add value.

- Inventions become innovations once they have been successfully implemented.

Innovation exists in many different forms, including process innovation, product innovation, and social and organizational innovation.

- Technological innovation in processes and products includes products and processes that use new technology as well as major technological improvements to existing products and processes. A technological innovation in processes and products occurs when the innovation is brought to market (product innovation) or used in a production process (process innovation).
- A social innovation is an idea, approach, initiative, service, product, law, or type of organization that offers something new and provides a better and more sustainable solution to a well-defined social need than those already in place. It can also be a solution adopted within an institution, organization, or community and that generates a measurable benefit for the community, not just for certain individuals. The scope of social innovation is transformative and systemic. Social innovation is a complete departure from everything that came before.

Source: OECD, *Frascati Manual*, 2015 edition.

Considerable resources

The government is devoting considerable resources to promoting and stimulating research and innovation.

By 2021–2022 the government will have invested more than $830 million in new initiatives.

- Of this amount, $585 million is set aside specifically for the Québec Research and Innovation Strategy.
- Almost $250 million will be earmarked for projects carried out under other government strategies or actions that complement the Québec Research and Innovation Strategy.

Counting the base budgets that the government has set aside for research and innovation as part of these investments, total government expenditure on research and innovation over the next five years will amount to more than $2.2 billion.

This is in addition to investment in research infrastructure (more than $490 million over the next five years) and financial aid for research and innovation (amounting to $2.6 billion by 2021–2022).

In all, the government will devote $5.4 billion to research and innovation over the next five years.

BOX 3

A TOTAL OF $5.4 BILLION FOR RESEARCH AND INNOVATION OVER THE NEXT FIVE YEARS

$830 million in new spending

To spur research and innovation in a number of cutting-edge industries, the March 2017 Québec Economic Plan provides for over $830 million in new spending by 2021–2022.

Of this amount, $585 million is set aside specifically for the Québec Research and Innovation Strategy.

The breakdown under the Economic Plan (2017–2018) is as follows:

- An additional $180 million to encourage research and innovation in higher education institutions
- $115 million to support research organizations
- $190 million for new initiatives to encourage innovation and support the next generation of scientists
- $100 million to create an artificial intelligence supercluster

These amounts include an extra $420 million over the next five years and new projects totaling $165 million in the 2016–2017 budget.

A further $248.6 million will be spent on Québec Research and Innovation Strategy priorities, through other strategies and government actions.

The money will be used to

- implement the Life Sciences Strategy ($117.5 million);
- encourage innovative manufacturing ($48.5 million);
- stimulate innovation in forestry ($45.5 million);
- encourage ocean and mining research ($21.8 million and $6 million, respectively); and
- promote research in public policy ($9.3 million).

Much has already been done

These amounts are in addition to the significant investments the Québec government has already made in research and innovation and that are already contributing to this strategy:

- $1.4 billion over five years already included in the Ministère de l'Économie, de la Science et de l'Innovation (MESI) budget and related to this Strategy
- Just over $490 million invested in research infrastructure under the Québec Infrastructure Plan
- $2.6 billion over five years in tax support for research and innovation

Four major challenges

With the Québec Research and Innovation Strategy, the government is calling on Québec to face the challenges ahead.

Talent and skills development

The first challenge is talent and skills.

Research and innovation depend on people and their talent.

With the advent of new technology, and especially digital technology, people need a much greater aptitude for processing information and require cross-disciplinary skills and qualifications.

To ensure a better match between the needs of innovative companies and available training, it is important to stimulate curiosity and develop a culture of science and a culture of innovation.

This means we must increase the ability of all Quebecers to contribute to innovation and encourage them to base decisions on scientific knowledge. There is a need for education at all levels and all stages of life, starting with early childhood. Innovation can transform society only if the public understands and adopts the technological and social innovation available to it.

Support for research and innovation

The second challenge is support for research and innovation, whether governmental, industrial, or any other form of innovation.

Government research

In terms of government research, research clusters must remain competitive and research infrastructure must offer the required level of quality.

Cross-sector and multidisciplinary research can address major societal challenges, but requires access to competitive, adequately funded infrastructure where partnerships are welcomed.

International partnerships are the norm today for collaborative projects. To stay competitive, Québec researchers must be connected with the best teams and world-class consortiums.

Industrial research and innovation

In terms of industrial research and innovation, we must boost social and organizational innovation within businesses and organizations to make it easier to adapt business models.

Organizations and businesses must fine-tune their work cultures and adopt more flexible and cooperative approaches to adapt to changes in technology and undertake big projects.

- Adapting to technological standards is one of the ways businesses retain their market share. Including SMEs in collaborative research partnerships and R&D carried out in cooperation with other countries, provinces, and jurisdictions heightens the appeal of the partnerships to foreign investors.
- There are still very few areas where colleges and universities collaborate with the private sector.
- Incentives for public support of research remain limited in terms of sharing expertise with businesses or transforming research results into innovative products.

The transfer and commercialization of innovations

The third, not inconsiderable challenge is the transfer and commercialization of innovations.

Québec must make better use of investment in research and innovation and the related social and technological spinoffs.

The strength and vitality of the innovation chain depends on the relationships between the players involved. Strong relationships can motivate businesses to make better use of existing resources.

Due to market diversification and the fast pace of innovation, businesses and organizations need more support to succeed in innovative projects.

Different types of partnerships have led to a new form of open innovation that may create the right conditions for organizations to evolve and businesses to grow.

Promotion and demonstration platforms can make it easier to transfer research results and open up more options for the commercialization of innovative products.

Overall improvement of the research and innovation system

The last challenge is the integrity of the research and innovation system and the quality of interaction between players and key partners.

The research and innovation system will improve if available resources and existing mechanisms are put to full use.

The government's action under the Québec Research and Innovation Strategy seeks to address each of these challenges.

The objectives

The Québec Research and Innovation Strategy is based on three objectives that correspond to the challenges set out above.

Nurturing talent and skills, and preparing the next generation

The first objective is to nurture talent and skills, and prepare the next generation.

Competition, market requirements, and the rapid ongoing development of technology mean skills have to be constantly updated.

To this end, the government has adopted a series of measures to increase the ability of individuals and institutions to make decisions based on scientific knowledge, boost enthusiasm for science and innovation, and promote talent and skills for the greater benefit of society.

Increasing Québec's research capacity and supporting innovation in all its forms

The second objective is to increase Québec's capacity for all forms of research and innovation.

Research and innovation require significant resources. The government must participate in funding and encourage partnerships with other countries or provinces in order to share research costs.

Under the Québec Research and Innovation Strategy, the government is devoting additional funds to research at all stages as well as to scientific entrepreneurship.

The government is supporting researchers and innovators as a means to spark new and exciting ideas. It is also investing in collaborative research and innovative projects featuring horizontal innovations and partnerships that benefit multiple sectors of the economy. The government will also provide access to and funding for competitive infrastructure.

Increasing the pace and scope of innovation transfer and commercialization

The third objective is to increase the pace and scope of innovation transfer and commercialization.

The government plans to increase funding and support for the entire innovation chain, from research to marketing,

and is taking action in four different areas: bolstering the innovation commercialization ecosystem, encouraging the early adoption and integration of innovation to create new businesses and foster growth, supporting plans to commercialize innovations, and maximizing the transfer and benefits of social and technological innovation.

"Inspirational projects"

These three objectives will be achieved through support for "inspirational projects"—new research and innovation projects with special missions, particularly in sectors with high growth potential or with the potential to address certain societal challenges.

BOX 4

A STRATEGY FOUNDED ON EXTENSIVE CONSULTATION

Innovation is a key priority for the government of Québec and must also be a priority for all players in society.

A four-stage consultation

The Québec Research and Innovation Strategy stems from extensive consultations carried out in four stages in fall 2016.

Regional task forces

Nine local research and innovation task forces provided input on the needs in each individual region.

The aim of these regional task forces was to engage community leaders in drawing up the Strategy, help us understand the specific context of each region, and identify concerns and opinions in the research and innovation ecosystem.

Public consultation

Public consultation was carried out through the "Objective: Innovation" online platform. Quebec residents could use the platform to submit their ideas and suggest potential solutions to boost innovation. We collected many comments and received almost one hundred briefs.

A specific effort was made to get young people involved.

- The Imagine competition was set up to encourage young people to share their ideas, suggestions, and vision of what needs to be done to create the innovative Québec of tomorrow: "If you had special powers, what would be your plan for making Québec even more innovative in the future?"
- A special "Youth Perspective" meeting to seek input from young people was also held. The goal was to encourage discussion between community youth groups and the government in order to find out what young people think about research and innovation.

Codevelopment workshops

Two codevelopment workshops were held with the research and innovation community. The topics discussed were science and innovation culture and the importance of social innovation.

The first workshop was organized in partnership with Réseau québécois en innovation sociale and the second with assistance from Association francophone pour le savoir and Association pour le développement de la recherche et de l'innovation du Québec.

These consultations took place in a climate of dialogue, openness, and transparency and against a backdrop of open innovation. As a result, potential solutions for a variety of issues could be shared more efficiently, and ideas and concepts were discussed in depth. A variety of key partners contributed to the discussion.

An advisory committee and consultation with the government

In addition, to ensure the next strategy draws on best practices, the ministry is assisted by an advisory committee made up of about 20 experts from different backgrounds related to research and innovation in Quebec.

Lastly, all government ministers involved in research and innovation were consulted under the remit of the Interministerial Committee on Research and Innovation.

Other groups were consulted as well, including representatives of the strategic clusters, centers, and special-interest networks of Fonds de recherche du Québec.

BOX 5

GOVERNING PRINCIPLES

The Québec Research and Innovation Strategy will be implemented in compliance with the following governing principles:

Revitalized innovation chain

The entire innovation chain, from basic research to commercialization, will be revitalized by

- studying research and innovation in all their forms;
- supporting market-pull and technology-push approaches;
- encouraging partnerships and improved integration within the research and innovation ecosystem; and
- ensuring that assessment and monitoring measures are included from the start in all programs and actions providing direct aid for research and innovation, to guarantee accountability.

Simplified procedures

Procedures will be simplified and the main parameters of government support programs for businesses will be harmonized to eliminate program overlap and make it easier to obtain aid at a given stage of a research and innovation project.

- Access to all programs will be through a single organization, Entreprises Québec, to facilitate program delivery.
- The calls for proposals will stress desired outcomes and focus on research capabilities, challenges, and existing strengths, to ensure the best projects receive support.

A vision that's both local and international

Analysis will be supported by a vision that is both local and international, given that research and innovation have no borders and that organizations and businesses must address the regional or global aspects of markets.

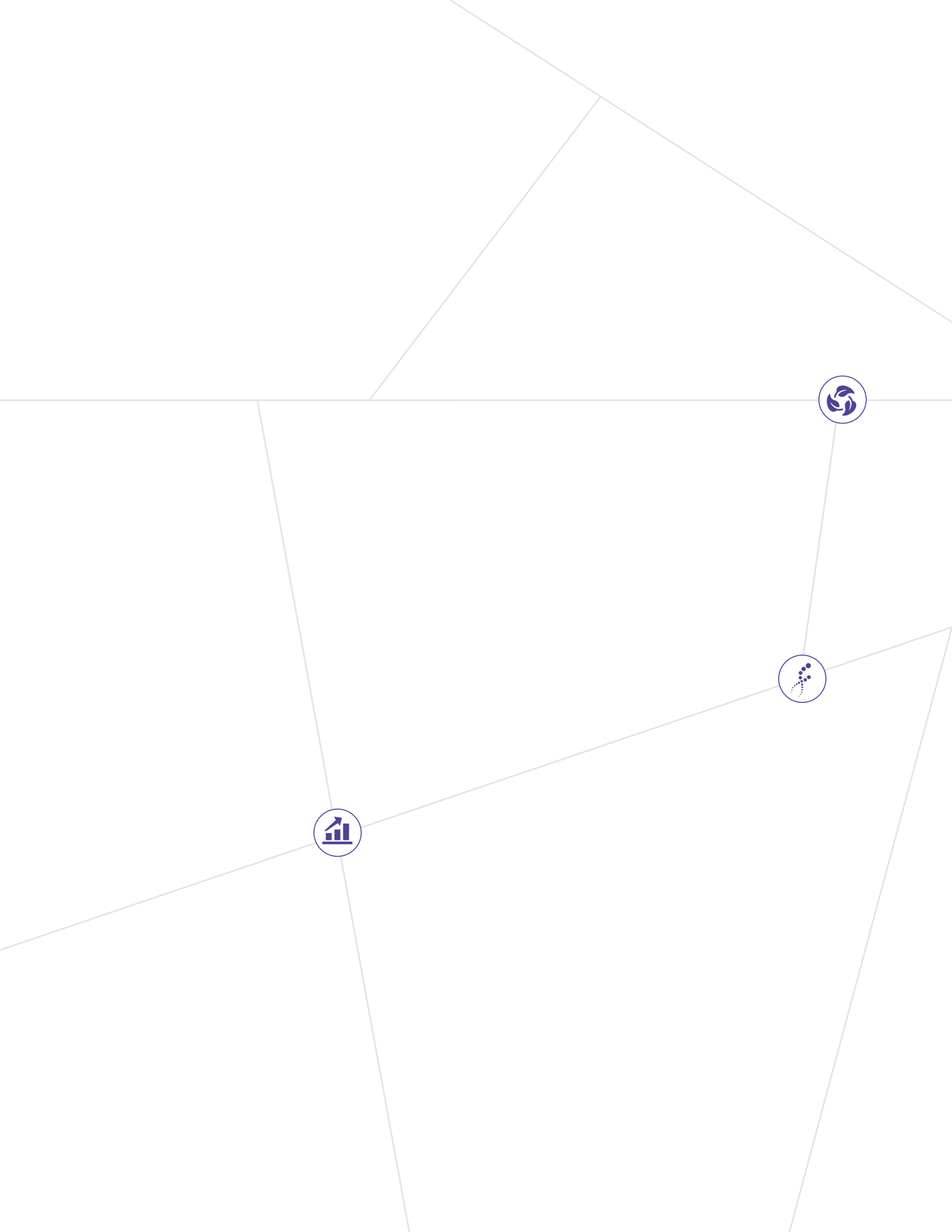
Sustainable development

The ethical and social consequences that may stem from certain measures will be acknowledged taking the principles of sustainable development into account. This will provide added value not only from an economic viewpoint, but also from a social and environmental perspective.

Public acceptability

The potential for change that research and innovation can unleash, the possible social consequences that the public may perceive as risks, and the importance of knowing what is acceptable to the public will all be acknowledged.

Technology and how it is used by society highlight the importance of life-long education at all levels.



1

NURTURING TALENT AND SKILLS, AND PREPARING THE NEXT GENERATION

The primary objective of the Québec Research and Innovation Strategy is to nurture talent and skills, and prepare the next generation.

A government priority

To dare to innovate, Québec must invest in the right skills, resources, and processes to create an environment that fosters creative thinking and values knowledge.

In a knowledge-based society, it is critical to develop a culture of science and innovation. A culture of science helps individuals better understand the world around them and develop a critical mind, which makes it easier to make informed decisions. In a culture of innovation, businesses and organizations have the skills and acquire the necessary means and space to embrace innovation as second nature.

A qualified and innovative labor force is absolutely essential to the future of Québec, its people, and its organizations.

Training the next generation, developing critical minds

The government views nurturing talent and skills and preparing the next generation as a priority for research and innovation.

Québec must train an innovative next generation of scientists ready to meet the needs of a changing society and must encourage entrepreneurs to be bold. Innovation concerns all of society.

Each individual must develop the critical-thinking habits to identify relevant information and develop solutions for the challenges at hand. Teamwork, investigation, and problem-solving methods must be practiced from a young age.

Three intervention areas

The Québec Research and Innovation Strategy sets out goals in three intervention areas.

- We must increase the ability of individuals and institutions to make decisions based on scientific knowledge.

This part of the strategy addresses the teaching of science in the education system so that the next generation is well prepared to face the future.

The government is announcing two inspirational projects to demonstrate how science and technology can be incorporated at the high school, college, and university levels.

These measures also apply to society as a whole, to help the general public develop a scientific culture and help institutions base their decisions on evidence.

- We must create enthusiasm for science and innovation.

Beyond the basic understanding that we should all have of science and technology, we need to encourage more students to work toward a scientific career.

Existing steps to improve science and technology education are part of the solution, but there is a need for specific measures such as promoting science and innovation and having academic tracks that emphasize science and careers in science.

- More must be done to promote talent and skills and put them to good use in society.

Those who opt for careers in research and innovation need support and advice, both in the academic setting and in businesses and organizations.

The government will support skills development, top talent, enterprise innovation internships, and the First Jobs Program in research.

BOX 6

TARGET FOR OBJECTIVE 1

The target for this objective: to improve Québec's ranking (5th) in Canada for the proportion of workers who have studied at the postsecondary level in relation to the total labor force.

Source: *Labour Force Survey: Public Use Microdata File*, Statistics Canada. Statistics from January 2017.

BOX 7 CULTURE OF INNOVATION

According to Nicola Hepburn, a culture of innovation fosters creative thinking and helps extract economic and social value from knowledge.

As a result, a culture of innovation generates new or improved products, services, or processes.

A healthy culture of innovation has a shared set of values and mutually reinforcing beliefs about the importance of innovation as well as an integrated pattern of behavior that supports research and innovation.

A culture of innovation thrives in an ecosystem adapted to its needs.

Source: Nicola Hepburn, "What is a culture of innovation?", *MaRS Blog*, May 17, 2013, https://www.marsdd.com/news-and-insights/what-is-a-culture-of-innovation/.

BOX 8 OBSERVATIONS ON THE SITUATION IN QUÉBEC

The issues

When students transition to high school, their interest in science and technology drops significantly. They are also less confident of their ability to succeed in these areas.

According to some studies, girls feel they have weaker skills than boys in math, science and technology, and social studies. This is borne out by the proportion of degrees awarded to women in pure and applied sciences, which has not budged, and by the fact that relatively few women work in natural and applied sciences.

In 2014, 20.3% of Québec's university graduates earned a degree in natural sciences or engineering. Only two Canadian provinces had a lower percentage, and the average for Canada was 22.3%. The OECD average was 24.6% in 2013.

According to a report by the Council of Canadian Academies, Québec is ranked lower than the national average for scientific knowledge. Only 26% of respondents met the scientific literacy threshold.

Strengths to leverage

Despite a drop in the number of people employed in R&D in 2013, Québec is ranked 1st in Canada and 6th among OECD countries, with 15.4 research workers per thousand active workers.

Québec is notable for its breadth of organizations with a culture of science or a culture of innovation and the prominent role of public broadcasters in culture and science popularization.

A Developing the ability of individuals and institutions to make decisions based on scientific knowledge

To nurture talent and skills and prepare the next generation, the government has identified a first priority: developing the ability of individuals and institutions to make decisions based on scientific knowledge.

Under the Québec Research and Innovation Strategy, the government is announcing four measures:

- Improvements to science and technology education in schools and colleges
- Two inspirational projects: Science Ambassadors and Learning Prototypes in Innovative Fields
- Development of a scientific culture in society
- Use of evidence in drawing up public policies

Improvements to science and technology education in schools and colleges

Science and technology are an important part of the curriculum. The education system has the serious responsibility of arming young people with a basic understanding of science and technology and nurturing their interest in these fields. Schools provide the ideal setting for exploring and discussing projects and initiatives and sharing experience, knowledge, and know-how.

To nurture young scientific minds, they need the resources and ability to connect to local and regional science and innovation organizations and to foster partnerships and networks in a host of fields.

We must develop a culture of science and a culture of innovation among the very young as well as among students preparing for a career in science.

Funding under the NovaScience Program

The Québec Research and Innovation Strategy includes a budget of $850,000 for the NovaScience Program, to support initiatives in science and technology education.

These new funds will be used to continue the work undertaken since 2013 with support from the Joint Committee on Education in Science, Technology, Engineering and Math, in which both MEES (Ministère de l'Éducation et de l'Enseignement Supérieur) and MESI (Ministère de l'Économie, de la Science et de l'Innovation) participate.

Other ministries and entities, including Secrétariat à la Jeunesse, may also join in these efforts.

Projects funded

The money will be spent on projects or initiatives aimed at

- initial training for teachers, partnerships with organizations that promote science and technology, and continuing education for educators to improve how science and technology are taught;
- the development of innovative professional practices for teaching science and technology in grade school, high school, and college and to adults;
- support for generalist teachers with responsibility for teaching science and technology;
- the use of academic research results in science and technology education;
- participation by businesses, research centers, and higher education institutions in development and innovation projects in science and technology education; and
- presenting and sharing the results of experiments carried out in schools or extracurricular programs.

BOX 9

THE NOVASCIENCE PROGRAM: A KEY COMPONENT OF THE GOVERNMENT'S ACTION

The NovaScience Program

Most of what MESI is doing to nurture skills, prepare the new generation, and develop a culture of science is part of the NovaScience Program.

This program seeks to foster a knowledge-based society through a variety of initiatives by organizations involved in promoting science, through support for innovative projects, and through partnerships that emphasize knowledge in science, technology, engineering, and math.

Many of the Strategy's initiatives are funded through one of the three components of the NovaScience Program.

Two inspirational projects: Science Ambassadors and Learning Prototypes in Innovative Fields

Two inspirational projects are being implemented with the goal of engaging young people in organized activities to encourage more students to continue with science and math.

Both innovative and structured, this approach is designed to boost the acquisition of knowledge in science and math through a variety of extracurricular activities.

These projects will be set up by MESI in partnership with other ministries, including MEES.

Science Ambassadors Program

Science Ambassadors are college and university students who devise fun science experiments and demonstrations for children in grade school and high school.

Sessions can be held either in laboratories at the Science Ambassadors' college or university or in schools. Mentors from the business world will be invited to talk to young people about their careers.

A budget of $500,000 over five years has been set aside under the Strategy for these projects via the NovaScience Program.

An interesting example of social innovation

The Science Ambassadors Program is an interesting example of social innovation that benefits all concerned.

Ambassadors promote science among children while serving as positive role models to inspire pupils to study science and pursue scientific careers.

By participating in the project, ambassadors develop extra skills they will need in any scientific career: teamwork, creativity, and an aptitude for communication.

Educators feel supported in their work as science teachers. The model is unique because it uses an innovative approach to develop tools that science and technology teachers can use over the long term.

BOX 10

THE TECHNOVATION CHALLENGE

Launched in Silicon Valley in the United States, the Technovation Challenge is an international competition for girls ages 10 to 18. The goal is for participants to develop skills in technology and business by creating a mobile application.

The model is similar to the one for Science Ambassadors. Teams from Montréal have taken the Technovation Challenge.

No matter where in the world the team is from, the challenge is the same: girls have to create an application to solve a problem in their community.

Enthusiasm for new technology

Guided by teachers and mentors with expertise in new technology, girls work in teams of five to create a mobile application over 12 weeks.

Students identify problems in their community, draw up a business plan, develop a prototype, and then submit their final project. No experience in programming is required to enter.

The top ten teams worldwide present their ideas to investors in Silicon Valley. Participation in the project creates enthusiasm among girls for new technology and fosters the development of high-value content and applications that will have a positive and beneficial impact on the community.

An opportunity for Québec to shine internationally

With the Technovation Challenge, girls develop entrepreneurial skills and create content that delivers tangible solutions to problems in their community.

The competition fosters the development of a new generation of innovative women entrepreneurs. Participation by teams from Montréal in the final stages highlights the commitment and drive of these girls as they work to help their community.

Sources: http://technovationchallenge.org/ and https://fairemtl.ca/en/defi-technovation-montreal-i-technovation-challenge-montreal

Learning Prototypes in Innovative Fields

Innovative learning environments

The Learning Prototypes in Innovative Fields project is an initiative to help young people learn from their peers or through collaboration.

This inspirational project seeks to create learning environments that are more innovative by exposing students to cutting-edge disciplines. It fosters the acquisition of skills relevant to emerging technology so students can easily learn how to develop and apply new ideas.

How to solve problems within businesses or organizations will be the biggest challenge and the most important skill taught. The project will use a cross-disciplinary approach. Participants will be given a kit to supplement the training and ensure projects are consistent. Calls for projects will be launched to determine what the kits should include depending on local needs.

Under the Strategy, a budget of $500,000 over five years will be devoted to these initiatives via the NovaScience Program.

BOX 11

CREATE YOUR CITY: INSPIRATION FOR THE SCHOOL OF THE FUTURE?

In 2014 Cégep Gérald-Godin launched Create Your City, a technical competition in which high school, college, and university students partnered with Québec businesses.

Students had to work on innovative projects put forward by information and communication technology companies with the goal of improving the city of today and creating the city of tomorrow. Projects needed to incorporate electronics, robotics, and software applications in three categories: environment, mobility, and transportation.

Helping to match training to the needs of the job market

The goal of the project was to match technical training to the evolving job market and to engage young people in math and applied science starting in high school.

A second goal was to develop technical entrepreneurship in schools through a unique and open approach.

Source: http://www.creetaville.com/category/communiques-de-presse/.

Development of a scientific culture in society

The development of a scientific culture must be encouraged throughout society.

Scientific and technological breakthroughs are occurring at lightning speed. To adapt to these changes and develop a critical mind, Quebecers need to acquire certain skills and knowledge in a variety of scientific and technical fields.

Better IT skills

Under the NovaScience Program, the Québec Research and Innovation Strategy will introduce a new initiative aimed at building IT skills and fostering a scientific culture in society.

A budget of $450,000 over five years will fund a call for partnership initiatives.

The goal is for Québec's development to be supported by greater IT knowledge and skills. We want Quebecers to develop the habit of seeking out data, hard facts, studies, and figures to validate what they hear and read.

BOX 12

EXAMPLE: THE AGENCE SCIENCE-PRESSE RUMOR DETECTOR

The Agence Science-Presse rumor detector is a fitting example of a project to develop people's ability to rely on evidence.

Using scientific facts, it verifies questionable statements, rumors, and ideas passed through the grapevine. It is Québec's first fact-checking website.

The rumor detector was created in part thanks to support from the government of Québec—in particular, Fonds de recherche du Québec—for research in universities and colleges and for research partnerships between academia and industry.

Source: http://www.sciencepresse.qc.ca/agence

Use of evidence in drawing up public policy

Just like the general public and other organizations, the government must rely more heavily on scientific knowledge in its decision making. To ensure informed decision making, an effective process for crafting public policy should be based on evidence.

The major goal of evidence-based policy development is to ensure that the experience, expertise, and judgment of decisionmakers are supported and resourced with the best available objective evidence and systematic research.[4]

Data broken down by gender can also enhance public policy outcomes and support government decision making.

Results assessments and forward-looking analyses

The Québec Research and Innovation Strategy stresses the importance of evidence-based decision making.

The government will encourage the use of evidence in public policy development in all departments. This approach will also facilitate Secrétariat du Conseil du trésor's efforts to enhance program support and tracking, with a view to producing concrete, measurable, and sustainable results.

A budget of $100,000 over five years will fund assessment of performance and public policy results and be used to carry out forward-looking analyses.

This approach should aid public policy decision making and enhance policy outcomes, particularly through the development of innovative measures or programs. It should also protect public services for the long term by setting the right priorities from the start and allowing efficiency gains.

4. CANADA (2013). "The Case for Evidence-Based Policy." Online: http://www.horizons.gc.ca/eng/content/case-evidence-based-policy.

BOX 13 PUTTING EVIDENCE TO USE

Evidence

Evidence is "something that yields relative confidence in the truth of a proposition that cannot be either logically proven or directly demonstrated through empirical observation."

Evidence might come, for example, from monitoring and assessment systems, academic research projects, best practices, or benchmarking.

Strategic information is a vital resource for organizations as it reduces uncertainty, aids decision making, fuels reflection, and thereby ensures better governance.

Data that must be relevant

To be relevant and valid in the eyes of decision makers, evidence must be considered in context and must be analyzed. It must also be

- objective,
- accessible,
- reliable,
- credible, and
- accurate.

Five ways the use of evidence can make a difference in public policy

According to UNESCO, the use of evidence can make a difference in public policy by

- achieving recognition of a policy issue,
- informing the design and choice of policy,
- forecasting the future,
- monitoring policy implementation, and
- evaluating policy impact.

Source 1: NCCHPP (2007). *"What is Evidence? A philosophical perspective," p. 1. Online: http://www.ncchpp.ca/docs/Weinstock_Evidence_Ang.pdf.*

Source 2 : Government of Canada (2013). "The Case for Evidence-Based Policy." Online: http://www.horizons.gc.ca/eng/content/case-evidence-based-policy.

Source 3: UNESCO (2008). *Bridging the Gap: The Role of Monitoring and Evaluation in Evidence-Based Policy Making*, pp. 7 and 8. Online: https://www.unicef.org/ceecis/evidence_based_policy_making.pdf.

BOX 14 PROMOTING RESEARCH IN THE FIELD OF PUBLIC POLICY

For several years the government has helped fund numerous high-level research organizations working to spark dialogue and discussion on topics of public interest.

The Québec Economic Plan provides for an additional $9.3 million over five years to help various organizations continue research in their areas of specialty.

The money needed to fund this research will be allocated to Ministère des Finances and Ministère du Conseil exécutif.

B Boosting enthusiasm for science and innovation

To nurture talent and skills and prepare tomorrow's workers, the government plans to boost interest and enthusiasm for science and innovation.

Five initiatives will guide work in this regard:

- Support for organizations that promote science and innovation
- Recognition for Québec researchers and innovators
- The promotion of academic tracks and careers with an emphasis on science
- The promotion of science careers among women
- Regional consultation on scientific culture

Support for organizations that promote science and innovation

Organizations that promote science and innovation play a vital role in engaging young people and the general public.

Many of these organizations, such as ACFAS (Association francophone pour le savoir), Agence Science-Presse, Réseau Technoscience, Vélo Québec Éditions, ADRIQ (Association pour le développement de la recherche et de l'innovation du Québec), and Science pour tous, are funded by the NovaScience Program.

To support their efforts and starting in 2018–2019, the Québec Research and Innovation Strategy will provide a $1.2 million boost in funding over five years.

Recognition for Québec researchers and innovators

To boost enthusiasm for science and innovation among youth in particular, it is important for young people to be in contact with people who can inspire them.

The excellence of Québec researchers must be recognized and encouraged, both among their peers and in society in general. This will increase the public's interest in science, inspire young Quebecers to choose scientific or technological careers, and drive competition among businesses through innovation.

Initiatives for greater recognition

Under the Québec Research and Innovation Strategy, researchers and innovators will enjoy greater recognition.

The strategy seeks to increase participation by winners of science awards (including the Prix du Québec awards, for which the culture category is organized in partnership with Ministère de la Culture et des Communications) in

- science outreach and promotion;
- science conventions, such as the one organized by ACFAS;
- mediation activities, such as the Science pour tous science cabaret events or the Science Bar organized by Québec-Science in partnership with a radio station;
- lectures at museums such as Musée de la civilisation, on TV, or live streamed; and
- lunchtime events.

Greater recognition will also be achieved through

- the creation of displays honoring prominent researchers and innovators from Québec that can be set up in the schools, colleges, and universities where they studied and videos aimed at youth for posting on social media;
- the organization of exhibitions on the research interests of Prix de Québec and other award winners (these could be traveling exhibitions in educational institutions or temporary or permanent exhibitions in public spaces);
- a new award for young innovators at the ADRIQ Innovation Awards Gala;
- more opportunities for aspiring researchers and innovators to network with award winners, in cooperation with partner organizations;
- the promotion of female role models who have achieved success in the fields of natural and applied sciences, where women are underrepresented, in partnership with the Natural Sciences and Engineering Research Council of Canada's Chair for Women in Science and Engineering; and
- a new award for an up-and-coming scientist, to mark the 40th anniversary of Prix du Québec in 2017. The prize would be given to someone under the age of 40 who has made their mark in science.

This would highlight the contribution of young innovators while at the same time raise awareness of Prix du Québec among young hopefuls by showcasing success stories.

The money will come from the Québec Research and Innovation Strategy budget under the third objective in this document.[5]

An international component

In addition to these initiatives for the recognition of researchers and innovators, work is being done at the international level.

In partnership with universities, colleges, and Fonds de recherche du Québec, the Québec Research and Innovation Strategy will assist Québec researchers in developing career plans that lead to opportunities for foreign awards and recognition. These researchers will then be well placed to join international research consortiums.

Additional activities could include the promotion of Prix du Québec award winners or participation in leading science conferences or international competitions.

This would make it easier for today's and tomorrow's researchers and innovators to benefit more from ideas and opportunities abroad and for Québec to more easily attract top international talent.

The promotion of academic tracks and careers with an emphasis on science

Overall, students in grade school and high school have a positive perception of science and technology. But interest drops significantly during the transition to high school.

The need for outreach

About 50% of students have only a limited knowledge of science- and technology-related professions.[6] More still needs to be done to boost interest in science and scientific careers.

5. See page 96.
6. HASNI, Abdelkrim and Patrice Potvin, Research Chair on the Interest of Young People for Science and Technology, *Résultats d'une enquête auprès d'élèves du primaire et du secondaire au Québec*, October 2015, p. 70

In many cases young people are reluctant to consider careers in science because they think the path of study will be long and difficult and they are not aware of all the career prospects that await them.[7]

Promotional campaigns or projects

To fuel students' interest in scientific careers, the Strategy includes a new initiative for academic tracks and career choices for high schoolers.

A budget of $250,000 under the NovaScience Program will be used to create promotional campaigns or projects for schools, highlighting scientific principles and career prospects in the targeted regions.

These campaigns or projects will be implemented by school boards in partnership with college technology transfer centers and the businesses they collaborate with. School board guidance departments will initiate the partnerships with college technology transfer centers.

A pilot project for one school board and one college technology transfer center will be set up, in partnership with a business. If the pilot is a success, more projects could follow.

BOX 15

A PASSION FOR AVIATION: LEARNING AND EVALUATION SITUATIONS

The learning and evaluation situations component of the Passion for Aviation Program, created in 2015 by Banque d'instruments de mesure with support from Aéro Montréal, gives students a hands-on introduction to aircraft construction techniques.

Teams of students build a glider and adjust the specifications to see the effect on performance. Students study the scientific and technical concepts associated with flying and take a look back at the history of aviation. They also take a virtual tour of the Bombardier plant in Saint-Laurent.

Source: http://carrefour-education.qc.ca/activites/passion_aviation_sae_de_bim_et_daero_montreal

Promotion of science careers among women

We must encourage more women to pursue science and engineering careers. Women have a pivotal role to play in these fields at a time when globalization and freer markets have made science and technology keys to empowerment and action in society.

We must also enlist female talent if women are to become stakeholders in the technological and societal choices and approaches at play.

Room for improvement

Women strive for equality with their male colleagues. With more women studying and employed in certain fields of natural and applied sciences, progress has been made, but there is still room for improvement.

Ordre des ingénieurs du Québec reports it has few women members and their number is increasing slowly. According to the latest figures, women account for only 13.6% of all engineers.

Calls for clearly defined projects

To encourage more women to pursue careers in science, the Québec Research and Innovation Strategy includes a budget of $750,000 over five years to fund calls for projects specifically targeting this issue. This initiative will be implemented through calls for projects in the various categories of the NovaScience Program.

7. *Ibid*, p. 75.

If we increase the number of women in science and engineering and showcase role models to those already working in these fields or considering careers in them, we will improve gender balance in the science and engineering workplace.

Increasing the number of women with careers in the pure and applied sciences will foster organizational creativity while giving women a voice in today's most pressing social, economic, technological, and environmental challenges.

BOX 16 FOR GENDER EQUALITY

When work first began on the 2016–2021 Government Strategy for Gender Equality coordinated by Secrétariat à la condition féminine, numerous important issues came to light, including how stereotypes affect career choices.

Statistics on the number of women in science- and technology-related careers show there is still much to be done to close the gender gap. For example, women hold one-fifth of jobs in natural and applied sciences.

The promotion of science careers among women is an integral part of the Québec Research and Innovation Strategy. Its goal is to give women more career choices.

Source: MESI (2016). *Bilan de la progression des Québécoises en sciences et en technologies de 2003 à 2013*. https://www.economie.gouv.qc.ca/fileadmin/contenu/publications/etudes_statistiques/innovation/progression_femmes_sciences_2003-2013.pdf

BOX 17 UNESCO'S SAGA PROJECT

An international project with Québec as a partner

In 2015 UNESCO's Natural Sciences Sector and Institute for Statistics created the SAGA project with support from the Swedish International Development Cooperation Agency. The government of Québec is one of the project partners.

The goals of the project

The overall objective of the SAGA project is to help reduce the gender gap in science, technology, engineering, and math in all countries and at all levels of education and research.

To achieve this objective, sex-disaggregated data is collected and analyzed and then used to develop and implement policies with the potential to improve gender equality in the targeted fields.

More specifically, the SAGA project aims to

- undertake inventories of gender equality policies and show how some policies affect the gender balance in science, technology, and innovation;
- develop new and better indicators to support the various processes involved in policy making;
- build capacity for data collection on gender equality; and
- prepare methodological documents to support the collection of statistics.

Source: http://www.unesco.org/new/en/natural-sciences/priority-areas/gender-and-science/improving-measurement-of-gender-equality-in-stem/stem-and-gender-advancement-saga/

Regional consultation on scientific culture

To promote activities related to scientific and technological culture in schools, the Québec Research and Innovation Strategy includes a budget of $1 million under the NovaScience Program.

Expanding the range of activities related to scientific and technological knowledge

This initiative, implemented in partnership with MCC and MEES, seeks to expand the range of activities related to scientific and technological knowledge in schools by

- providing schools with lists of local resources, organizations, and museums active in science and technology and that offer activities for school groups; and
- providing financial support to school boards and schools planning to visit these organizations or museums (transportation and ticket costs) or organize scientific or technological activities in the classroom with these resources and organizations.

The role of the Interministerial Museum Task Force, which reports to MCC, is to ensure consultation and cooperation between the main Québec ministries and government agencies with museum-related responsibilities.

The task force is working on a government accreditation procedure for museums, including science museums. Ministries and government agencies will contribute their specific expertise to launch the procedure. Special attention will be paid to science museums.

C The promotion of talent and skills for the greater benefit of society

To nurture talent and skills and prepare tomorrow's workers, the government has identified a third priority: the promotion of talent and skills for the greater benefit of society.

Under the Québec Research and Innovation Strategy, the government is initiating four measures in this regard:

- Increase in the number of enterprise innovation internships
- Support for top talent through Fonds de recherche du Québec
- Identification and development of the skills tomorrow's workers will need
- Continuation of the First Jobs Program in research

An increase in the number of enterprise innovation internships

Business internships are a valuable tool both for the companies that host interns and for the students who reap the benefits.

For businesses looking to increase their innovation capacity, these internships help meet the high demand for qualified workers. Companies or non-profit organizations that recruit interns benefit not only from the students' innovative ideas but also from the know-how of their supervising professors.

Enterprise innovation internships

The Enterprise Innovation Internships initiative gives Québec students access to three major scholarship programs supported by Mitacs: Accelerate, Elevate, and Globalink. These three programs are funded through a partnership between the federal government (via Mitacs), private businesses, and provincial governments.

$50 million over five years

To ensure Québec students are represented in these programs, the Québec Research and Innovation Strategy will provide $50 million over five years, through the Enterprise Innovation Internships initiative.

If the federal government and other partners (businesses or non-profit organizations) are also included, this amount could increase to almost $190 million over five years. This will do much to meet increasing demand from businesses and non-profit organizations for research and innovation support.

In particular, stable and increased funding will

- renew and expand internships offered under the Accelerate program for businesses and partners in Québec (the number of internships should increase from 1,000 in 2015–2016 to 2,750 in 2021–2022);
- make it easier for students and graduates to access the Elevate program in order to build their entrepreneurial and work skills; and
- allow more students to gain experience in foreign companies and foster international networking, through the Globalink research award program (Accelerate on an international scale).

An initiative linked to other strategies

The Enterprise Innovation Internships initiative plays a role in the Digital Economy Action Plan, which provides for more than 175 internships each year.

It is also part of the aerospace strategy, under which more than 95 internships are offered each year.

BOX 18

MITACS AND INTERNSHIP PROGRAMS IT SUPPORTS

Mitacs

Mitacs is a non-profit organization that has designed and delivered research and training programs in Canada for 15 years. It works with some 60 universities as well as private companies and the federal and provincial governments.

Mitacs was founded in 1999 to support applied and industrial research in mathematical sciences and associated disciplines. The organization later expanded its scope and is now open to all disciplines.

The three Mitacs programs

Each research internship is funded by a private company or non-profit organization, the federal government, and the government of Québec. Through its participation the government of Québec aims to meet increasing demand for innovation from Québec companies and from universities by offering stable and increased financial support.

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Accelerate

The goal of the Accelerate program is to encourage businesses to work with graduate students and researchers to overcome innovation challenges.

Bursaries of $15,000 are available for projects lasting at least four months.

Companies or non-profit organizations that recruit interns benefit not only from the students' innovative ideas but also from the expertise of their supervising professors. These bursaries offer businesses and non-profit organizations of any size a cost-effective and low-risk partnership.

Elevate

The Elevate training program is designed for postdoctoral researchers, giving them an opportunity to lead large-scale research projects in businesses or non-profit organizations.

Bursaries of $50,000 are available for projects lasting at least 24 months.

In addition, throughout the program researchers are exposed to immersion training through research partnerships. They are able to build on their communication and management skills thanks to the unique array of activities and training workshops offered as part of the program.

Accelerate on an international scale – Globalink

The Globalink program (Accelerate on an international scale) allows students enrolled in a Mitacs partner university to participate with an international partner in a research project hosted by a business or university outside the United States.

Awards of $15,000 are available for projects lasting four to six months.

By supporting business research partnerships between Canada and partner countries, Globalink helps participants develop research skills in new environments.

Source 1: Mitacs, "About Mitacs." Online: https://www.mitacs.ca/en/about-mitacs, consulted March 21, 2017.

Source 2: Government of Canada, *Economic Action Plan 2015*, April 2015, p. 78.

Support for top talent through Fonds de recherche du Québec

Talent drives the research of tomorrow.

Support for top talent—youth, students, and aspiring researchers—is crucial for Québec to prosper and ensure a supply of human capital that, besides being vital to our understanding and ability to overcome the significant challenges ahead, will heighten Québec's appeal to the most innovative companies.

Over the last twenty years, Québec has seen a major improvement in the proportion of the population with a university degree. However, the province still lags behind the most innovative countries in Europe when it comes to doctoral degrees.

The role of Fonds de recherche du Québec

One of the duties the government has entrusted to Fonds de recherche du Québec is to support the development of talent (students and aspiring researchers) by offering adequate and appropriate aid.

Such support is usually in the form of merit scholarships, some of which are for work placement.

More than $73 million in additional funds over five years

To support top talent, the Québec Research and Innovation Strategy provides an additional $73.35 million over five years for Fonds de recherche du Québec.

These extra funds will be used to

- increase the value of merit scholarships;
- increase the number of merit scholarships funded (master's, doctoral, and postdoctoral), especially for work placement (industry, non-profit organizations, government) for international students;
- promote training for executives and employees to foster the development of skills and a culture of innovation in business;
- award salary/career scholarships to young researchers in all three Fonds de recherche du Québec disciplines rather than just in health as is currently the case; and
- support internships offering an introduction to research (at the cégep and undergraduate levels) and promotion activities targeting women, visible minorities, and youth (e.g., scientific awards for researchers and aspiring researchers, Research Day, and technology competitions such as Expo-sciences, which spur an entrepreneurial spirit in young people).

Funding increased to more than $340 million over five years

Funding for Fonds de recherche du Québec scholarships and support for top talent will thus be increased to more than $340 million over five years.

This extra investment will contribute to the development of top talent and provide young workers with the skills and competence they need to be part of innovative and forward-looking projects and drive prosperity in Québec.

More specifically, it will

- attract the best students from all regions of Québec and other countries to our higher education programs;
- facilitate recruitment of young, qualified researchers and help in their career advancement; and
- fuel an interest for science among young people, especially women.

BOX 19

FONDS DE RECHERCHE DU QUÉBEC

Three funds under one umbrella

When Bill 130 came into force on July 1, 2011, it restructured Québec's three research funding agencies.

The primary aim was to ensure strong management for the support and promotion of Québec research and thereby improve Québec's position in the global science arena, foster and enhance synergies and partnerships between different research sectors, and improve the visibility of government research in Québec and elsewhere, all under a single umbrella.

Although now grouped together under the banner "Fonds de recherche du Québec," the three funds have retained their individual missions:

- Fonds de recherche – Nature et Technologies supports natural sciences, mathematical sciences, and engineering
- Fonds de recherche – Santé supports health, including basic, clinical, and epidemiological research, research in public health, and research in health services
- Fonds de recherche – Société et Culture supports social sciences and humanities as well as education, management, arts, and literature

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Increased funding under the Québec Research and Innovation Strategy

Many of the initiatives in the Québec Research and Innovation Strategy involve Fonds de recherche du Québec in one way or another. The grand total for all extra funding for Fonds de recherche du Québec will amount to $180 million over five years, bringing the funds invested by MESI over the period to about $1.05 billion.

Source: Fonds de recherche du Québec, "The Research Funds." Online: http://www.scientifique-en-chef.gouv.qc.ca/en/les-fonds-de-recherche/, consulted March 21, 2017.

Identifying and developing the skills tomorrow's workers will need

A suitably qualified workforce is a prerequisite for innovation.

We must match available training to the needs of companies, particularly in innovative industries where training must be tailored to very specific requirements.

More generally, the Québec education system must foster creativity, talent, and general skills in order to train a qualified and innovative labor force. In a world of innovation where change happens quickly, continuing education—particularly when offered online—is vital to keeping workers' skills current.

Following up on Rendez-vous national sur la main-d'œuvre

Because workers—and especially their skills—are so critical to innovation, the government's efforts to match training to job market requirements will have a direct impact on the success of the Québec Research and Innovation Strategy.

Budgets for identifying and developing the skills tomorrow's workers will need to face the challenges of innovation will be part of this effort.

To adequately support investment in research and innovation, priority will be given to the following measures:

- Faster government decisions on training, to meet the needs of the job market more quickly
- Development of a culture of continuing education
- Easier access to training and support for workers, particular outside major urban areas, through innovative processes

BOX 20

MATCHING TRAINING TO JOBS: RENDEZ-VOUS NATIONAL SUR LA MAIN-D'ŒUVRE AND THE NATIONAL WORKFORCE STRATEGY

Matching training to jobs

In his inaugural address in May 2014, the premier stressed that matching training and workers' skills to the needs of the job market was a priority for the government.

To this end, the government has revised the role of Commission des partenaires du marché du travail so that more can be done to match training to jobs.

Québec's three most recent budgets provide for significant investment (more than $750 million) over the coming years to boost the performance of the job market by bringing training more into line with jobs.

Rendez-vous national sur la main-d'œuvre

Rendez-vous national sur la main-d'œuvre, a gathering on workforce training held in February 2017, led to agreement on what needs to be done to develop the skills of the current and future workforce, taking into account shifts in technology and demographics and how they will affect the Québec economy.

Whether through productivity gains, radical changes in production processes, or the creation of completely new products and services, the skills of Québec's workforce must keep pace with these changes.

The advent of new technology should impact the entire value chain, starting with education for those preparing to join the workforce and continuing education, for workers to keep their skills up-to-date and meet the new realities of the job market.

Actions to promote the digital economy and initiatives to train young people in programming and coding will be included in the forthcoming National Workforce Strategy.

First Research Job renewed

Few recent graduates find jobs in applied research or R&D.

First Research Job

First Research Job, a 2015–2016 budget measure, aims to provide college and university graduates with research work experience in a QuébecInnove member organization.

Work experience is acquired as part of an applied research or R&D project in partnership with a company, cooperative, or non-profit organization.

The measure grants employers a subsidy of up to 50% of the employee's salary, provided the job meets the criteria. The subsidy can last for as long as two years.

First Research Job met with a very enthusiastic welcome and was found to be one of the most well-liked government programs in consultations in the lead-up to the current strategy.

In place for the next five years

As part of the Québec Research and Innovation Strategy, the government is announcing that First Research Job's funding, which would have ended in 2018, will be extended.

A total of $3.5 million over five years has been set aside for First Research Job under the NovaScience program. The fund will subsidize about 35 jobs annually. Extra funding will be available to employers for employee training.

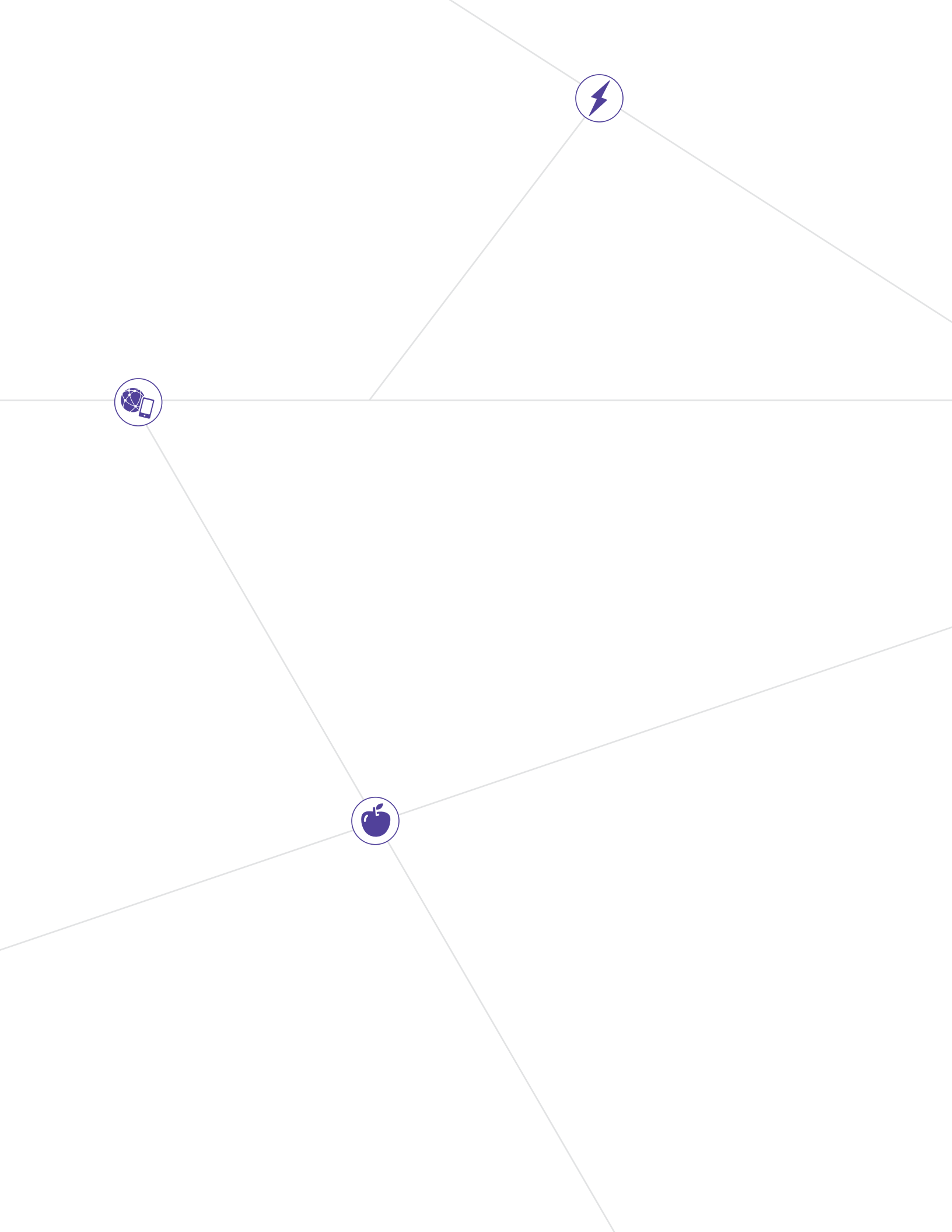
This measure fosters a culture of innovation and is an incentive for partners and research organizations to transmit their know-how.

Companies gain easier access to highly qualified research and innovation workers, while graduates benefit from a better school-to-work transition.

TABLE 21 **Fiscal framework – First objective: nurturing talent and skills and preparing the next generation (in millions of dollars)**

	Impact on students, researchers, and innovators	Impact on SMEs	Impact on large enterprises	Impact on institutions and RI organizations	Impact on the public	Impact on local governments and regions	Impact on health and education	Economic stimulus	QRIS 5-YEAR TOTAL[1]	OTHER 5-YEAR TOTAL[2]	5-YEAR GRAND TOTAL[3]
A) Improve public and institutional aptitude for evidence-based decision making											
Improvements to science and technology education in schools and colleges	X			X	X	X	X		0.85		0.85
Two inspirational projects: Science Ambassadors and Learning Prototypes in Innovative Fields	X			X	X	X	X		1.00		1.00
Development of a scientific culture in society	X	X		X	X	X		X	0.45		0.45
Use of evidence in drawing up public policy				X	X	X			0.10	9.30	9.40
B) Creating enthusiasm for science and innovation											
Support for organizations that promote science and innovation	X			X	X		X	X	1.20		1.20
Recognition for Québec researchers and innovators	X			X	X						See objective 3
Promotion of academic tracks and careers with an emphasis on science	X	X	X	X	X				0.25		0.25
Promotion of science careers among women	X	X	X	X	X		X	X	0.75		0.75
Regional consultation on scientific culture						X			1.00		1.00
C) Promoting talent and skills for the greater benefit of society											
More enterprise innovation internships	X	X	X	X				X	50.00		50.00
Support for top talent through Fonds de recherche du Québec	X	X	X	X				X	73.35		73.35
Identification and development of the skills tomorrow's workers will need		X	X	X	X		X	X			0,00
Continuation of the First Research Job program	X	X	X	X				X	3.50		3.50
TOTAL									**132.45**	**9.30**	**141.75**

1. Includes 2016–2017 subsidies under the 2017–2018 Québec Economic Plan to fund new initiatives.
2. "Other" means "Appropriations from other sources including the Life Sciences Strategy and the Maritime Strategy."
3. May not exactly add up due to rounding



2

INCREASE QUÉBEC'S CAPACITY FOR ALL FORMS OF RESEARCH AND INNOVATION

The second objective of the Québec Research and Innovation Strategy is to increase the province's capacity for all forms of research and innovation.

Québec's researchers must have the necessary means at their disposal

To compete in the field of research and innovation, Québec's researchers must have the necessary means at their disposal.

All researchers and innovators from institutional and industrial sectors, as well as institutions, companies, and their affiliate organizations, must receive adequate support.

This support must increase research capacity and encourage innovation in all its forms.

Three intervention areas

The Québec Research and Innovation Strategy sets out goals in three intervention areas.

- We must first support researchers and innovators to foster new ideas.

  The announced measures will support all forms of research and innovation in the institutional and corporate sectors, as well as knowledge transfer between actors in the research and innovation ecosystem.

  The government is making strategic research alliances more competitive, increasing its support for enterprise innovation, and introducing a new Research and Innovation Organizations Support Program.

  The government is also announcing targeted assistance for intermediation and knowledge exchange organizations in Québec's research and innovation ecosystem.

- Investments must also be made in collaborative research and innovative projects.

  Collaborative research is an excellent way of meeting society's great challenges, which are, by definition, multidimensional and, quite often, transdisciplinary. It is essential that we act at the project level by encouraging the emergence of innovative projects in a variety of areas.

  In response to society's great challenges, the government is boosting its support for international research and innovation initiatives and providing new support for multidisciplinary research.

  The government is creating a fund to spur innovation in health and social services and is stepping up its support of genomics and personalized care.

  The government is launching two inspirational projects—a first to provide support for Réseau Québec Maritime's Odyssée Saint-Laurent and a second aimed at modernizing justice.

- To ensure quality research, it is essential to build and fund competitive infrastructure.

  Research infrastructure quality determines research quality. The government is significantly increasing its investment in research infrastructure.

  The government is committed to covering the full direct and indirect costs of the projects it funds.

BOX 22 TARGETS FOR OBJECTIVE 2

Targets for this objective are as follows:

Improve Québec's rank (10th) among the top 10 OECD countries for number of personnel engaged in research and higher education per 1,000 labor force.

Improve Québec's rank (7th) among the top 10 OECD countries for number of personnel engaged in commercial R&D per 1,000 labor force.

Source 1: CANSIM table 358-0160, Statistics Canada, and Stat OECD, Main Science and Technology Indicators (MIST) database.

Source 2: Idem

BOX 23 OBSERVATIONS ON THE SITUATION IN QUÉBEC

The issues

Small and medium-sized businesses are little active in R&D, with most domestic R&D spending coming from large or foreign-operated companies. Companies with more than 5,000 employees account for over a third of industrial R&D. Foreign-operated companies, while representing only 5.9% of all businesses involved in R&D, account for another third of industrial R&D spending.

Few Québec-based companies, whether they integrate technology or create it themselves, have the ability to play a pivotal role in R&D.

Industrial R&D spending is in steep decline in Québec. In 2006 it represented a respectable 1.66% of the province's GDP. As a share of GDP, industrial R&D has since experienced successive drops. In 2013, its share of GDP was tallied at 1.28%.

Québec companies are trailing in R&D investment and new technology integration, especially information and communications technologies. This explains in large part the lower productivity growth in Québec than in Ontario or the United States.

Companies often fail to properly appreciate support programs and organizations.

Certain services provided by tech support organizations located outside major urban areas are underutilized.

Capitalizing on our strengths

Both R&D investment and highly qualified workers are in abundant supply in Québec:

- Quxébec ranks first among Canadian provinces (13th in OECD) in domestic R&D spending as a share of GDP (2013).
- Québec ranks second among Canadian provinces (3rd in OECD) in domestic academic R&D spending as a share of GDP (2014).
- Québec tops Canadian provinces (14th in OECD) in domestic business R&D spending as a share of GDP (2013).
- Québec is first among Canadian provinces (8th in OECD) for the number of researchers as a share of the labor force.

Publicly funded research in Québec is in a very good position compared to the rest of Canada. Spending on publicly funded research (institutional and government) exceeded 1% of Québec's GDP in 2013.

Québec researchers publish about 1% of all scientific papers worldwide, even though Québec's population represents only about 0.1% of the world total. And according to the main bibliometric indicators, papers published by Québec researchers are held in high esteem in international scientific circles.

Source 1: Some companies with more than 5,000 employees are foreign operated. These two numbers from Institut de la statistique du Québec cannot be added together.

Source 2: Québec researchers publish a significant number of articles in very prestigious journals worldwide. This can be seen in their 2010–2014 average relative impact factor of 1.21, easily outclassing the world average of 1.00. Further proof that Québec papers are well received in international scientific circles is that they are cited 36% more often than the world average (relative average number of citations of 1.36 between 2010 and 2014).

A Support researchers and innovators to foster new ideas

To increase Québec's capacity for all forms of research and innovation and foster new ideas, the government emphasizes support for researchers and innovators.

Under the Québec Research and Innovation Strategy, the government is announcing four measures:

- Steps to boost the competitiveness of strategic research alliances
- Increased support for enterprise innovation through the new Innovation Program
- Introduction of the new Research and Innovation Organizations Support Program
- Targeted actions to support intermediation and knowledge exchange organizations

Steps to boost the competitiveness of strategic research alliances

Strategic research alliances are conducive to the transfer of knowledge, tools, techniques, procedures, and processes to user environments, especially companies and the government. Each year, these alliances lead to numerous inventions, both patented or under a first patent license, as well as to the creation of spinoff companies.

The impact of research alliances goes beyond commercialization of research results. They also spur innovation in fields such as territorial development, quality of life, and senior social participation.

Support for these alliances is a way to provide support for social and technological support.

$61.7 million in additional resources over five years

To improve the competitiveness of research alliances and increase the research capacity of current and future research alliances, the government is announcing the addition of $61.7 million over five years.

Resources totaling $366 million

This significant increase means that the total funds set aside for these alliances by Fonds de recherche du Québec will be nearly $366 million over five years.

This measure will provide the alliances with the means to attract talent, keep the best researchers working in Québec, and ensure the quality of the research carried out in the province.

These alliances should also contribute further to the training of new talent, students, and young researchers by providing opportunities for hands-on research experience.

BOX 24

STRATEGIC RESEARCH ALLIANCES SUPPORTED BY FONDS DE RECHERCHE DU QUÉBEC

Strategic research alliances

Strategic research alliances are alliances of researchers, research teams, and student researchers from various disciplinary backgrounds, academic units, and schools.

All alliances must prove that they possess the critical mass needed to meet their objectives and that they support excellence in research:

- By creating opportunities for ideas to be exchanged and research results shared
- By encouraging the development of common projects
- By taking a leading role in research initiation and training
- By reserving a special welcome for postdoctoral students
- By encouraging actively recruiting new researchers
- By presenting, transferring, and recognizing research results
- By fostering links and exchanges with researchers in the rest of Canada and around the world
- By being a place of scientific learning that benefits the entire research and student community.

Each strategic alliance must distinguish itself from others in the same field and show that it has special strengths in Québec, yet is fully engaged in major national and international research currents.

Improved synergy

Each actor in the research system has a role to play. It is essential to improve the synergy between researchers from different sectors to accelerate knowledge- and skill-sharing for the benefit of society as a whole.

Through alliance programs, Fonds de recherche du Québec acts as a catalyst, intensifying collaboration between sectors, especially between university and college researchers, increasingly including researchers from college technology transfer centers.

A number of alliances pair researchers from outside major urban centers with those working in large cities.

These alliances were what led to the creation of nine industrial research sector alliances.1

Open to international partnerships

Knowledge creation and advancement require the contribution of the entire international scientific community.

World-class research based on international collaboration is one of the keys to fostering a competitive research and innovation system.

Considering the small size of its research community, Québec must develop a robust network of international partners at the cutting edge of knowledge.

In 2015 more than thirty Fonds de recherche du Québec partnership agreements opened the door for Québec researchers to international collaboration networks in the fields of neuroscience, aging, cancer, digital technology, and information and communications technologies to name just a few.

A complementary measure to federal action

Research alliances are complementary to the federal government's Networks of Centres of Excellence.

The support of the Québec government for these alliances consolidates and builds on Québec's research capacity and will give our researchers a competitive edge in developing or joining Canada-wide and worldwide networks.

For instance, many researchers from the Centre for Northern Studies, a strategic alliance, participate in research projects run by ArticNet, a Canadian network of centres for excellence.

(Source: http://www.frqsc.gouv.qc.ca/fr/bourses-et-subventions/concours-anterieurs/bourse/regroupements-strategiques-concours-automne-2013-gi5dpz6d1400190613093

Increased support for enterprise innovation through the Innovation Program

Enterprise innovation is the key to greater productivity.

Innovation is considered crucial to building industry's competitive capacity and improving economic performance. However, many companies do not have the human or financial resources to invest in innovation and are not prepared to take on the size or the nature of the risks associated with it.

Multitude already exist to help fund enterprise innovation, but this is a cause of confusion. Companies don't know which programs to turn to and find it harder to get the financial aid they require.

Consolidating several measures: the Innovation Program

In order to make more efficient use of public money invested in innovation, the government is announcing the consolidation of several enterprise innovation measures under the responsibility of MESI as part of a new "Innovation Program."

The Innovation Program will be in place as of the 2018–2019 fiscal year.

The program will cover the entire innovation chain, from R&D to commercialization, but its first component will focus on enterprise innovation.[8]

Additional funding of $62 million

This program component will receive funding from the $62 million over five years set aside by the strategy.

The additional funds will increase wealth in Québec by developing the innovation capacity of SMEs across the province.

The enterprise innovation component will boost business productivity and competitiveness, especially for SMEs, through technological, social, or organizational innovation.

This measure will be implemented through calls for projects, which will increase the return on public funds invested in support of enterprise innovation.

BOX 25

A NEW CONSOLIDATED PROGRAM FOR ENTERPRISE INNOVATION: THE INNOVATION PROGRAM

Several existing measures consolidated into a single program

The Innovation Program consolidates several existing MESI direct financial aid programs:

- Innovation Passport Program
- First Patent Program
- Research Support Program –International Research and Innovation – Business Clientele
- Social Economy Support Program – Innovation
- Creativité Québec Program
- Development and Transfer Assistance Program – Part 3: Support for Innovative High-Tech Companies
- Strategic Sector and Niche of Excellence Development Support Program – Part 2 (innovation projects only)

The Innovation Program will be introduced at the start of 2018–2019 fiscal year and will cover the entire innovation chain, from R&D to commercialization.

8. The program's second component is presented on page XX, under objective 3 of the Strategy.

BOX 26

FISCAL RELIEF FOR INDUSTRIAL RESEARCH AND INNOVATION IN QUÉBEC

In addition to direct budgetary aid to support research and innovation, the Québec government is giving substantial fiscal relief to companies

R&D tax credits

R&D tax credits are the biggest government incentive for innovation. A company in the life sciences sector carrying out R&D activities in Québec can qualify for four refundable tax credits:

- Tax credits for researcher salaries
- Tax credits for contracts with universities, eligible public research centers, or research consortiums
- Tax credits for private precompetitive research partnerships
- Tax credits for fees and contributions paid to research consortiums

The tax credit rate is 30% for SMEs and 14% for larger companies. Fiscal relief is available for researcher salaries, equipment, or outsourcing contracts with universities, eligible public research centers, or research consortiums.

Companies can also benefit from a federal tax credit, on top of the Québec tax relief. The federal tax credit rate is 35% for SMEs and 15% for larger companies and can be used to pay for researcher salaries and research equipment.

Tax holidays for foreign researchers and experts

Foreign researchers and experts who work for companies that carry out R&D in Québec are eligible for a Québec income tax holiday on their salaries for five consecutive years.

The tax holiday diminishes over time, starting at 100% of the salary for the first two years, then dropping to 75% in the third year, 50% in the fourth, and 25% in the fifth.

Deduction for patent revenues

On 1 January 2017, Québec launched a patent revenue deduction plan aimed at manufacturing companies. Fiscal relief for patents mainly consists of a lower tax rate on revenue from the commercialization of patents.

The effective tax rate on eligible patent revenue is 4%.

The goal of this new tax deduction for innovative manufacturing companies is to encourage manufacturing companies to monetize in Québec the results of any R&D they carry out in the province that leads to a new patent

Introduction of the new Research and Innovation Organizations Support Program

The research and innovation ecosystem has over 100 organizations dedicated to research and innovation. These organizations play diverse, complementary, and indispensable roles in the health of the research and innovation chain.

Funding to rise from $230 million to $300 million

To make more efficient use of public funds invested in research and innovation organizations, the Québec Research and Innovation Strategy calls for the creation of a support program for research and innovation organizations.

This program will bring together all the various existing sources of support for research and innovation organizations, providing one-stop access to research and innovation support and streamlining financial criteria. This new formula will make it possible to continue implementing the recommendations of Commission de révision permanente des programmes through the task force on economic development financial aid.[9]

A total of $230 million is currently earmarked over the next five years for support to research organizations.

In its March 2017 Economic Plan, the government announced additional sums under the Québec Research and Innovation Strategy that will top up this amount to $300 million for the period covered by the Strategy.

In addition, under objective 3, another component of the program is to receive $50.29 million in support of intermediation organizations and research development corporations.

Supported activities

This new program will be aimed at providing operational and project funding for various types of organizations carrying one or more of the following activities:

- Support for companies and organizations in carrying out R&D activities
- Coaching for high-tech firms
- Assistance for researchers on how to transfer the results of public research
- Matching companies and organizations for precompetitive research partnerships
- Basic and applied research with the aim of commercializing its results

With these gains in efficiency and the structural impact of QuébecInnove, the government is aiming for better coordination, cohesion, and synergy between research and innovation organizations and better R&D support for businesses.

9. One of the five interministerial task forces created by the government as part of its program review to gain an overall view of government action. The goal was to improve coordination and consistency and avoid overlap and duplication.

Targeted actions to support intermediation and knowledge exchange organizations

Under the Québec Research and Innovation Strategy, the government is announcing targeted actions in support of intermediation and knowledge exchange organizations.

Five organizations identified

As announced in the 2017–2018 Economic Plan, more than $60 million has been set aside for support of research and innovation through the following five organizations:

- National Optics Institute
- Computer Research Institute of Montréal
- Consortium of Applied Research in Mineral Processing
- Marine Biotechnology Research Centre
- Société des arts technologiques

These organizations are active in key sectors for Québec.

Covering a wide range technology readiness levels, their activities are focused on applied research with a strong transfer potential.

In addition to conducting research, these organizations are involved in development, technological and organizational support, technical services, and technological and knowledge transfer.

These centers also have the capacity, if need be, to conduct fundamental research leading to new discoveries required for the development of practical solutions for industry and companies in general.

Increased support for the National Optics Institute

A leader in optical photonics, The National Optics Institute focuses on industrial development and receives $6.4 million of support annually from the Québec government.

This new strategy provides an additional $25 million for the National Optics Institute to develop its know-how in the fields of the Internet of things, advanced robotics, and 3D printing. This will keep the Institute at the forefront of technology and optimize its contribution to business productivity and competitiveness, leading to major economic spinoffs.

Increased aid to the Computer Research Institute of Montréal

This organization, in collaboration with its clients and partners, develops innovative technologies and cutting edge know-how that it transfers to Québec companies and organizations to boost their productivity and their local and international competitiveness.

The organization will receive a $25 million investment.

This increases its annual funding by 20% to help implement its 2017–2022 strategic plan.

Support for the Consortium of Applied Research in Mineral Processing

The Consortium seeks to render industrial mining operations more competitive by developing and transferring sustainable technological innovations. With mining going through a major slowdown, it is important that we support these types of activities.

The Consortium is also a showcase for Québec's mineral processing expertise.

As announced in the 2017–2018 Economic Plan, the Consortium of Applied Research in Mineral Processing will receive $6 million over five years to coordinate its research activities.

Support for the Marine Biotechnology Research Centre

The Marine Biotechnology Research Centre serves as an intermediary and coordinator between universities and private sector businesses by conducting research and transferring it to the private sector in various biotechnology sectors and markets.

It is an additional source of assistance for companies in the field in need of technological or scientific support.

The Centre is directly linked to the Maritime Strategy, which also partly funds its activities. Its mission is to bolster industrial growth in marine biotechnology through technological research, development, and transfer in order to modernize Québec's fisheries and aquaculture industry and ensure their long-term success.

Additional support

The government is increasing support to the Marine Biotechnology Research Centre by $5 million.

Funding for projects and new initiatives will be in line with Québec's Maritime Strategy. One of the Maritime Strategy's goals is modernize the fisheries and the aquaculture industry and ensure their long-term survival through advances in marine biotechnology.

This additional funding will help Québec's only marine biotechnology center fulfil its research and innovation mission.

Growth and visibility for Société des arts technologiques

Société des arts technologiques is a non-profit organization involved in research and creation in the technological arts. It defines itself as a transdisciplinary center dedicated to creation, research, training, production, dissemination, and conservation of digital culture.

The government is stepping up its support for Société des arts technologiques by $500,000 to be delivered at the end of the 2016–2017 fiscal year and in 2017–2018.

The extra funding will be used for Société des arts technologiques' strategic action plan, to ensure the organization's continued growth. It will go towards communications, promoting its know-how, and growing the organization internationally.

This assistance will enable Société des arts technologiques—an organization like none other in Québec—to continue to grow and develop and to maintain its leadership position in the field.

BOX 27

CRIQ: LEVERAGING QUÉBEC'S INDUSTRIAL COMPETITIVENESS

Helping industry compete for nearly 50 years

CRIQ (Centre de recherche industrielle du Québec) will celebrate its 50th anniversary in 2019.

Founded in 1969, its mission is to improve the competitiveness of Québec's industrial sector and help organizations grow by supporting innovation, productivity, and exports. It has 195 employees, including 125 technicians, research agents, and professionals.

Through partnerships or in collaboration with other organizations, CRIQ comes to the aid of some one hundred companies each year.

CRIQ's main areas of activity are productivity, competitiveness, exports, the environment, and eco-efficiency.

CRIQ provides the information, know-how, and services companies need to excel in the development of distinctive products and to adopt new technologies and production methods that boost productivity and international competitiveness.

According to its latest performance statistics (2015), CRIQ carries out an average of 2,953 projects and contracts with companies every year.

Stronger thanks to the Québec Research and Innovation Strategy

The Québec Research and Innovation Strategy will strengthen CRIQ's position as a driver of industrial competitiveness in the province.

It has become a leader in digital excellence in Québec. It possesses unique expertise to guide companies that wish to begin or accelerate their shift to Industry 4.0.

CRIQ also runs Réseau Québec-3D, a network that promotes the use of additive printing in manufacturing, particularly in the medical sector where 3D printing holds out the promise of new and exciting applications.

CRIQ also takes part in the development of new production norms as an active member of the Standards Council of Canada's parallel committee on additive manufacturing.

Government support for a joint project with CHU de Québec

The government is backing a joint laboratory project with CRIQ and CHU de Québec to develop an integrated medical 3D printing center.

The project will spur the development of medical technologies that use additive manufacturing.

The knowledge, technologies, and know-how developed by teams in the various phases of this massive undertaking will serve to construct the required developmental infrastructure for the bioprinting of human organs. This will maintain Québec's position as a leader in this field.

For the university health network, this project boosts technological and financial autonomy as well as opportunities for major scientific advances.

For hospital patients, it means increased comfort and quicker surgeries thanks to innovative solutions and the availability of prostheses, living tissue, and perhaps eventually personalized organs.

Special support for technology platforms

Technology platforms play a crucial role in supporting research.

Research (fundamental, applied, free, or targeted) and innovation use specialized technology to deliver high-tech services.

These technology platforms must be fully optimized to reap their benefits. They must also meet standards of practice for international collaboration.

Some of these platforms already have funding. Québec is providing strategic support for two: Génome Québec and Calcul Québec.

Additional funding

Under the Québec Research and Innovation Strategy, $5 million in additional funding over five years will serve to finance new technology platforms.

The funding will support development of important technology research platforms in strategic and emerging sectors to assist with operations and maintenance.

The funding provided to companies will help them

- pay highly qualified equipment operators and client service managers,
- cover the cost of regular equipment maintenance,
- cover costs of certification for recognized standards and practices, and
- cover the cost of developing a broader selection of services.

This measure will optimize management of major technology platforms by providing funding for actual operating and maintenance costs and thereby ensure their long-term viability.

BOX 28 THE IMPORTANCE OF TECHNOLOGICAL PLATFORMS: THE EXAMPLE OF CALCUL QUÉBEC

Calcul Québec

Québec researchers rely on the advanced research computing resources of Calcul Québec whether seeking to refine climate models, predict the specifications of materials, or develop better medical imaging technology.

The universities joined forces in Calcul Québec to set up data centers equipped with state-of-the-art supercomputers. Calcul Québec has teams of cutting-edge specialists to make sure the facilities achieve their full potential.

Growth in big data and artificial intelligence will drive demand for Calcul Québec's services in the coming years, particularly industrial demand for collaborative research partnerships.

A real-world example

Dr. Alan Evans, 2016 Prix Wilder-Penfield recipient, co-directed the Big Brain project for ten years. In 2013 the BigBrain ultrahigh-resolution 3D brain atlas went online. Mapping for BigBrain was by a team of researchers from McGill University's Neuro and Forschungszentrum Jülich in Germany.

It's an open-access online tool that allows users to magnify images of the brain down to its deepest structures and cells, the way some applications close in on individual houses along a street.

"The BigBrain dataset is 125,000 times bigger than a typical MRI," said Dr. Evans. It will help specialists understand the internal organization of the brain and facilitate research on diseases like Parkinson's and Alzheimer's.

Funding from the Canada First Research Excellence Program

The Healthy Brains for Healthy Lives initiative was awarded $84 million in Competition 2 of the federal government's Canada First Fund.

Healthy Brains for Healthy Lives involves creating a global center for excellence, establishing a hub for neuroinformatics and big data analysis, and accelerating translational discoveries that will improve brain health in Canada and around the world.

BOX 29

SUPPORT FOR RESEARCH VESSELS: KEY TECHNOLOGY PLATFORMS

The *Lampsilis*, Université du Québec à Trois-Rivières research vessel

R/V *Lampsilis* is a key technology platform for marine research in freshwater ecosystems.

The shallow draft of its double-hull structure makes its suitable for sampling shallow riparian habitats as well as high-velocity deepwater sections in the St. Lawrence Seaway and Estuary.

R/V *Lampsilis* is equipped with a wet laboratory and a dry laboratory, sensors for measuring the properties of the water, and samplers for collecting water, sediment, plankton, invertebrates, and fish specimens.

Research program

Lampsilis research projects could involve, for example,

- conducting and understanding a health assessment of St. Lawrence ecosystems and monitoring their development;
- identifying and understanding ecological services rendered by the St. Lawrence system and assessing their productivity; or
- identifying and understanding the vulnerability of St. Lawrence system components.

Funding in support of Maritime Strategy priorities

Funding in the amount of $1.75 million was granted in 2016–2017 to the *Lampsilis* to support its activities and operations.

This funding serves to defray costs associated with the highly skilled workforce required to operate the equipment and manage client services, cover regular maintenance expenses, pay costs deriving from certification for recognized standards and practices, and cover the costs associated with developing a wider range of services.

It means that Réseau Québec Maritime can make the *Lampsilis* available to big projects while limiting the researchers' expenses to the direct cost of their research. It will also useful as leveraging for grants that require matching contributions from partners.

R/V *Coriolis II*, Université du Québec à Trois-Rivières research vessel

R/V *Coriolis II* is a key technology platform for marine research in freshwater ecosystems.

Research program

R/V *Coriolis II* is primarily involved in the following research challenges:

- Understanding the role of the oceans in the global climate and in climate change;
- Predicting how marine ecosystems will respond to human disturbances
- Developing sustainable strategies for harvesting fish stocks
- Developing new technologies for observing and modeling the oceans

R/V *Coriolis II* has been used by 12 universities in five provinces.

It has also been assigned to international collaborative missions with French, American, Norwegian, and Argentinian researchers. It is also chartered by the Canadian private sector.

In addition, research using R/V *Coriolis II* aligns with many Maritime Strategy priorities and objectives.

BOX 29 SUITE

Funding under the Québec Research and Innovation Strategy

The government of Québec announced in its 2016–2017 *Economic Plan* in April 2016 the award of $6.2 million in funding over five years for Université du Québec à Rimouski's *Coriolis II* research vessel.

The grant is specifically for ship maintenance and service, to ensure that the ship is available and up to standard for national and international research teams and organizations in the coming years.

The QRIS adds a sixth year of funding in the amount of $1.4 million for 2021–2022. Total funding for the *Coriolis II* over the Strategy term is $6.5 million.

Source: https://oraprdnt.uqtr.uquebec.ca/pls/public/gscw031?owa_no_site=2137&owa_no_fiche=11

BOX 30

ANOTHER EXAMPLE OF A TECHNOLOGY PLATFORM, FROM THE FOREST INDUSTRY

New platform for the development of composite panel and engineered wood

In its 2017–2018 Economic Plan, the government announced it was establishing an innovation platform to support and accelerate the development of a new generation of panel and engineered wood composites.

The platform will position the Québec forest industry in the forefront for innovative companies involved in developing products, applications, processes, and markets.

Québec's composite panel and wood industry exports 47% of its production, directly generating close to 8,000 jobs with annual sales of nearly $1 billion.

The sector is therefore critical to the forest products industry in addition to being a key outlet for sawmill and reclaimed lumber industry byproducts.

Four million dollars has been earmarked for the initiative.

Included are the hiring of top researchers and networking of the equipment of research partners FPInnovations, Université Laval, and Cégep de Rimouski's SEREX forest product processing research and technology transfer center.

BOX 31

THE OECD'S KEY OR EMERGING TECHNOLOGIES

Technological change is a megatrend in its own right, constantly reshaping economies and societies, often in radical ways.

The OECD (2016) identified 10 emerging technologies from the results of foresight exercises.

These emerging and future technologies lie along the borders of the 40 key frontier technologies and are as follows (see also the figure below):

1. the Internet of things; 2. big data analytics; 3. artificial intelligence; 4. neurotechnologies; 5. nano/microsatellites; 6. nanomaterials; 7. additive manufacturing; 8. advanced energy storage technologies; 9. synthetic biology; and 10. blockchain.

Ten key and emerging technologies for the future highlighted out of 40

The ten key and emerging technologies for the future, like the 40 they are selected from, are expected to have wide impacts across several fields of application, many of which cannot be anticipated.

These impacts will be shaped by a range of non-technological factors—some of which show up in global megatrends—including aging societies, climate change, economic and social developments, and changes in social preferences.

Public sector research plays a pivotal role in developing key and emerging technologies and their associated skills.

Source: OECD (2016). OECD Science, Technology and Innovation Outlook 2016. Online: http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-innovation-outlook-2016_sti_in_outlook-2016-en

B Investing in collaborative research and innovative projects

The government has identified a second intervention area that will build capacity for research and innovation in all their forms: collaborative research and innovative projects.

The government must be a partner in scientific development by establishing the necessary conditions to stimulate it.

To that end, it is important for the government to support bold capacity-building projects that catalyze collaborations and partnerships and mobilize a range of stakeholders. It must also join knowledge development with that of innovation in pursuit of a common purpose, particularly in Québec's key sectors.

Under the Québec Research and Innovation Strategy, the government is announcing five measures:

- An increase in support for international research and innovation initiatives through a restructuring of the current program
- An increase in support for intersectoral research in response to society's greatest challenges
- The establishment of a health and social services innovation fund under the auspices of the Life Sciences Strategy
- Enhanced support for genomics and personalized care, through Génome Québec
- Two inspirational projects: Réseau Québec Maritime's Odyssée Saint-Laurent and justice system modernization

An increase in support for international research and innovation initiatives through a restructuring of the current program

One of the principal success factors for research and innovation is the availability of tools for developing partnerships with international researchers.

There are numerous opportunities for Québec research and innovation researchers and businesses to collaborate internationally on large-scale research. Such partnerships leverage knowledge developed elsewhere and thus can move forward more quickly.

At the same time, knowledge developed in Québec and put to work for international companies can provide leverage for Québec's smaller tech businesses to plug into foreign economic networks.

This two-way relationship is particularly valuable for Québec, which may not always attain critical mass with its small population of research teams relative to the countries Québec collaborates with.

The International Research and Innovation Initiatives Support component of the Research Support Program

The Research Support Program's International Research and Innovation Initiatives Support component has been funding such initiatives since it was set up in 2007.

Québec is the sole Canadian province to have such a funding tool, positioning the province and raising its profile with strategic partners.

An update and upgrade

The Research and Innovation Strategy has used the program to provide an additional $2 million in funding over five years—for an available total of $25.3 million—in order to act more effectively in support of international research and innovation initiatives.

The updated program will include

- regular calls for applications according to a stable calendar known in advance;
- calls for international joint projects involving QuébecInnove members and partners; and
- funding to establish partnerships and foundational initiatives in technology development in research firms and institutions or funding for international deployment plans.

The program will increase the impact of Québec expertise and innovations on the international scene and integrate Québec's researchers into the big global strategic research and innovation networks. It may leverage access to foreign funding by supporting Québec researchers within major consortiums, such as Horizon 2020.

Ultimately updating and upgrading the International Research and Innovation Initiatives Support component will contribute to Québec discoveries and innovation development by opening the way for associations with top-tier international partners.

The simpler program structure should help researchers make their way into the big consortiums that demand plenty of paperwork of their own.

BOX 32

PART OF A PROCESS OF INTERNATIONALIZATION

Supporting international research and innovation initiatives is part of a movement to internationalize Québec's research and innovation.

Supporting Québec's networks internationally

International ventures will be supported through consolidation and development of networks in Québec and internationally, and by targeted outreach in countries considered innovative.

Organizations' and businesses' need for guidance on external markets varies greatly, depending on their experience operating outside Québec and internationally.

By working with its partners, the government can provide interested parties guidance and services adapted to their experience outside Québec at each stage of the project they are pursuing.

An action under consideration

Research and innovation advisors will be attached to Québec's international offices for this.

BOX 33

HORIZON 2020

Horizon 2020

Horizon 2020 has been up and running since January 1, 2014. It consolidates European Union research and innovation funding and is based on three broad priorities:

- Excellence in science
- Industrial leadership
- Societal challenges

An increase in support for intersectoral research in response to society's greatest challenges

Research and innovation have a particularly critical role to play in responding to the major societal challenges facing both Québec and all the world's nations and countries.

Increasing Québec's research and development capacity is therefore vital to finding solutions to the great challenges of sustainable development, the fight against climate change, demographic shifts, and the aging of the population, in order to reduce their social and economic impacts.

They are complex, multidimensional challenges. The only way to meet them is to combine knowledge and harness the contributions of multiple disciplines and fields of research in a coordinated and collaborative attack on social, economic, and environmental problems and issues.

A $44.95 million funding increase.

To spur research aimed at addressing the great societal challenges of our day, the Québec Research and Innovation Strategy has set aside $44.95 million in funding over five years for intersectoral research on those issues, to be administered by Fonds de recherche du Québec.

The additional resources will go to

- fund innovative research projects involving university and college researchers from a variety of sectors, disciplines, and settings and possibly including public or private partnerships;
- support research by and the development of top Québec talent—students and young researchers—funded through Canada First;
- support initiatives and research projects that call for boldness, creativity, and risk-taking and that stimulate entrepreneurial thinking in young people;
- help Québec researchers join national and international networks; and
- set up mechanisms to facilitate interaction (knowledge-sharing and transfer forums and activities) to publicize new practices, possibilities, and approaches for tackling the great challenges of society.

This will position Québec in promising areas of research and as an international leader, and better equip it to face the great societal challenges of sustainable development, climate change, and an aging workforce.

The intersectoral research programs being implemented will complement similar government initiatives. The 2013–2020 Climate Change Action Plan, for example, earmarked $15 million from the Green Fund for research into GHG emissions reduction, and $8.08 million of that budget will be used for Fonds de recherche du Québec Nature et Technologies and Fonds de recherche du Québec Société et Culture to launch an intersectoral research project based on partnerships in the field.

The establishment of a fund to support health and social services innovation under the Life Sciences Strategy

Over the last few years, considerable sums have been invested in the life sciences sector for health and social services innovation. The projects in question have, like others throughout the world, led to spectacular advances in our understanding of human health.

The large investment of public funds and extensive promotion of the potential benefits have nourished high expectations among patients, clinicians, managers, institutions, and the general public. Little however has to date been invested in gathering hard data for use in informing future decisions about how to introduce these innovations into the Québec health system.

An innovation fund

That is why the government is establishing the health and social services innovation fund.

The $18 million investment will be part of the Life Sciences Strategy and will directly support the Québec Research and Innovation Strategy objectives.

There will be two components to the program.

- The first component—innovation projects by SMEs in the field of human health in Québec—will support SMEs seeking to test their innovations in real-world care settings.
- The second component–institutional innovation projects in the field of human health in Québec—will support institutions seeking to validate non-commercial innovations in real-world care settings.

The program is likely to yield the data required for commercial or operational application of innovations.

Details can be found in the Life Sciences Strategy.

Increased funding for genomics and personalized care through Génome Québec support

Advances in genomics have paved the way for new approaches in a variety of fields. Québec and Génome Québec have posted big successes in the past few years in areas such as forest genomics. Québec's continued success depends on being able to establish strategic partnerships for collaborative research.

BOX 34 GENOMICS AND THE CHEESE INDUSTRY: A PERFECT PAIRING

Cheese is made by coagulating milk, draining away leftover liquids, and then, in most cases, ripening the results. Cheesemaking also relies on certain microorganisms that acidify the milk and others that impart flavor. If an unbalance occurs in that ecosystem, which can contain up to 20 species in the more complex cheeses, it compromises the end product.

Genomic tools however can be used to create a profile of complex microbiota and reveal what the right proportions of microorganisms are.

This work by researcher Steve Labrie, in partnership with Agropur, is helping boost the already high reputation of Québec products internationally.

Source: http://www.genomequebec.com/26-agroalimentaire-capsule-la-genomique-nouvelle-alliee-des-fromagers.html

The challenges

Current challenges in genomics include coordinating with investments at the Canadian level (Genome Canada) and accelerating the take-up of advanced personalized care treatments and technologies so they can benefit patients.

There is also the need to ensure that this strategy's investments in personalized care research and innovation complement those of the Digital and Life Sciences Strategies.

A budget of $40 million has been earmarked for such things as maximizing Québec's performance for Genome Canada programs.

BOX 35 PERSONALIZED CARE AND AVAILABLE HEALTHCARE AND PRECISION MEDICINE FUNDING

Personalized care and precision medicine

- Personalized medicine means selecting treatment options based on each individual's genotypic features.
- Subgroups are identified as sharing a physiological susceptibility to particular diseases or a response to particular molecules used for treatment.
- Patients thus receive treatments customized for the group they belong to, as determined by common biomarkers.
- Personalized care can empower patients in the treatment and prevention of illnesses.

Competition by Genome Canada

- Genome Canada recently launched a healthcare and precision medicine competition through its Large-Scale Applied Research Project Competition program.
- Funds accorded to Génome Québec will improve the odds of receiving financial support through programs sponsored by Genome Canada.

Source: http://crchum.chumontreal.qc.ca/bulletin-recherche-crchum/labc-de-la-medecine-personnalisee

Two inspirational projects: Réseau Québec Maritime's Odyssée Saint-Laurent project and the modernization of the justice system

Odyssée Saint-Laurent

Réseau Québec Maritime is a network that joins together leading actors in research and innovation in maritime-related fields. Its mission is directly within the purview of the Quebec Maritime Strategy.

Under the Maritime Strategy, a five-year $15 million grant has been allotted to Réseau Québec Maritime for Odyssée Saint-Laurent in line with Innovation Strategy objectives.

Odyssée Saint-Laurent is a large-scale research program divided into three projects:

- The Discovery Project, targeting the acquisition of strategic knowledge on the St. Lawrence system
- The Applications Project, developing tools, technology, and practices
- The Open Innovation Project, dedicated to governance, social innovation, and knowledge transfer

Project partners will include partners from outside Québec, providing a leverage effect with the federal government.

Justice modernization project

We need to make changes to how we interact with individuals and support the courts if we want to deliver legal services more efficiently at this time of increasingly diverse needs and ever-rising demand.

Ways to modernize

Many approaches are on the way between now and 2022 to update Québec legal services, make them more effective, and reduce the cost of providing them. such as

- making greater use of technology to streamline operations, improve the range of services available, and provide more support for staff;
- reviewing operational processes and methods to seek out more innovative and effective ways of doing things, adapted to the needs of users and partners and easier for staff to carry out;
- optimizing legal services delivery throughout Québec, including Nord-du-Québec;
- improving client services according to the needs and expectations expressed by the public and the value added; and
- implementing new measures to unclog the court system.

To carry out new collaborative research to tackle this challenge, $250,000 of the funds earmarked for society great challenges will be made available for cross-sectoral projects supported by Fonds de recherche du Québec.

Providing answers to this great societal challenge may eventually lead to support for Table Justice-Québec partners, who are actively seeking to be part of the cultural change required to render justice in a timely manner.

BOX 36 MODERNIZING JUSTICE: TWO EXAMPLES

Court of cyberjustice infrastructure

The Cyberjustice Laboratory is outfitted with advanced equipment for cyberjustice research and training.

- It includes CyberTribunal for examining how technology might affect the legal system. Its server room simulates a networked judicial system to permit study of the issues associated with courts hosting digital data in that context.
- With most organizations currently hosting data in the cloud, there is a need to identify best practices for upholding judicial integrity and the principles governing the justice system.

Researchers work synergistically with the IVADO Institute for Data Valorization to develop software using artificial intelligence and big data to improve the use of judicial data in decision making.

Predictive justice, for example, evaluates the chance of winning a lawsuit, with possible compensation amounts and legal risks, based on algorithms derived from jurisprudence.

The $6.1 million project is jointly funded by the federal and Québec governments ($2.0 million and $4.1 million respectively).

Digital records

Ministère de la Justice du Québec, in collaboration with its partners in the legal field, plans to digitize judicial files in order to improve the efficiency of the justice system and make records more accessible.

Projects are already underway to allow electronic disclosure of evidence in criminal cases and filing of electronic versions of records for everything else. These projects will also allow evidence to be submitted on pending cases by electronic means.

Justice modernization projects are based on the best practices in the field and draw on already existing initiatives from Québec and beyond while providing the government with the advice it needs to deal with legal issues about authentication, hosting, cloud computing, confidentiality, security, and so forth.

BOX 37 LABORATOIRE DE SCIENCES JUDICIAIRES ET DE MÉDECINE LÉGALE

Laboratoire de sciences judiciaires et de médecine légale was North America's first forensic laboratory at its Montréal founding in 1914. Its mission is to provide scientific support and insight for the administration of justice.

It operates under the responsibility of Ministère de la Sécurité publique. It encompasses various fields of scientific expertise and houses a forensic medicine department to foster synergies among the personnel and ongoing improvement to services.

Scientific and medical analysis is conducted there to further the administration of justice and support police and legal investigations.

Source: https://www.qualite.qc.ca/uploads/files/laureats/fichelsjml.pdf

C Ensuring access to and funding of competitive infrastructure

A third intervention area, providing access to and funding for competitive infrastructure, has been established as a way of increasing Québec's research capacity while supporting innovation in all its forms.

The government thus announces the following two measures as part of the Québec Research and Innovation Strategy:

- Increased research infrastructure investment through the Québec Infrastructures Plan
- A commitment to assume the entire cost of the research projects thus funded

Increase in research infrastructure investment through the Québec Infrastructures Plan

Superior research facilities are now more important than ever to the quality of research, the retention and recruitment of researchers, the training of young researchers, and the competitiveness of Québec's research institutions.

Technology is evolving more and more rapidly, the life span of specialized equipment is shorter and shorter, and countries are picking up the pace of investments in research infrastructure. The government of Québec must invest at a level sufficient to keep Québec institutions competitive, both nationally and internationally.

$490 million over the next five years

To maintain and develop advanced research infrastructure to support international-level research, the Québec Research and Innovation Strategy will draw on the Québec Infrastructures Plan, which has boosted the sharing of research funding to $863.9 million for 2017–2027, including over $490 million in the next five years.

This represents an increase of close to 4% in research infrastructure investment.

The investment will go to the delivery of capacity-building Québec infrastructure projects and to leverage anticipated federal government investments in research infrastructure:

- Projects co-funded under the program of the Canada Foundation for Innovation
- Co-funding for ad hoc federal initiatives

BOX 38

THE PLAN NORD: SCIENTIFIC INFRASTRUCTURE

Institut nordique du Québec

Establishing the new Institut nordique du Québec (INQ) was among the priority actions for 2015–2020 set forth in *The Plan Nord toward 2035*.

INQ was founded in fall 2014 by Université Laval, McGill University, and Institut national de recherche scientifique.

It deploys a range of expertise in the natural, social, and health sciences and engineering to consider sustainable development in the North at its interdisciplinary, inter-institutional research and innovation center.

- It also offers government, community, and private sector decision makers the scientific knowledge and technical knowhow they need for sustainable development in northern Québec.

INQ provides scientific support to northern Québec socioeconomic development initiatives.

- It seeks to diversify research relating to the North of Québec and attract top talent in fields of interest such as mining, energy, forestry, tourism, architecture, health, culture, agriculture, and technology.

Building a scientific complex

INQ's scientific complex will consolidate Québec northern research capacity and, more importantly, raise that capacity to make it a world-class polar research institute.

The new building on the Université Laval campus will bring together several Québec centers of excellence on the North covering topics ranging from natural science and health to engineering, social sciences, and the humanities.

Commitment to assume the entire cost of funded research projects

A comprehensive reckoning of research costs includes both direct and indirect expenses. Covering them in their entirety creates a setting conducive to competitive, quality research. Yet research funding does not always make allowance for all the indirect costs.

Under this research and innovation strategy however, the government has committed its ministries and public bodies to covering all the costs of the research conducted through their research programs.

Furthermore, it is essential for purposes of this reform that a fair share of the indirect costs be borne by the institution that conducts project research activities, notably in the case of health institutions.

By setting an example, the government of Québec seeks to make stakeholders aware of the importance of paying or billing indirect costs relating to research projects. It must also be emphasized that successful funding of all research costs will require the collaboration of the federal government and other financial backers.

BOX 39 INDIRECT RESEARCH COSTS

The indirect research costs represent the operating costs inherent in research projects.

They include the cost of operating and maintaining infrastructure, managing and administering projects, and meeting research program requirements.

They may include such costs as purchasing or leasing workspace and materials, paying for telecommunications, or hiring administrative or maintenance staff.

BOX 40 THE QUÉBEC ECONOMY: NUMEROUS SECTORS OF EXCELLENCE

A diversified economy

Québec's is a diversified economy. It boasts numerous sectors of excellence, supported by a wide range of stakeholders pursuing research and innovation. Its workforce is highly skilled, and it has an abundance of natural resources.

Québec's know-how has made it a world-class exporter in many major industrial sectors including aeronautics, aluminum, biofood, and forestry.

Endless adaptation

Technological and environmental trends in a variety of areas of interest demand constant adjustments, arising for instance from new applications generated by emerging technologies.

Innovative manufacturing is an example with applications in multiple fields, including photonics and mining. Life sciences, climate change, sustainable mobility, renewable energy, culture and communications, new clean technologies and such emerging technologies as digital intelligence and genomics have a big impact on broad sections of our economy.

The creative industries are developing more and more of the technology and processes shared with other economic sectors. An aptitude for the development of creative products is seen as an aptitude for creation in general.

Ever-increasing globalization means that these organizations and businesses must constantly adapt to stay competitive, rethinking their business models and seeking strategic partnerships for research and innovation.

The measures implemented under the Québec Research and Innovation Strategy and other government strategies and action plans are designed to release the potential of those sectors while taking technological change into account. The maritime industry is an example of an innovator in its work to reduce its carbon footprint, and it is very active in research, including marine biotechnology, maritime incidents, and marine ecosystems. Energy transition is also a constant concern. It targets the industries and entities that consume or produce the most energy and addresses the worldwide issues of global warming, loss of biodiversity, increasing scarcity of fossil energy, and inequalities in sources of supply. All populations are affected.

40
SUITE

An example of evolving to adapt: Business innovation for cultural industries

Taking advantage of business innovation opportunities in the cultural sector is an example of evolving to adapt to the conditions of production and dissemination.

In 2016–2017, Société de développement des entreprises culturelles du Québec held two events under the name SODEC-Lab. The February 2016 event was for producers and distributors of fiction and documentary feature films, who demonstrated an interest in developing new 360-degree marketing strategies.

The workshops were led by Bond Strategy and Influence and tackled the following topics: audience data, digital sales and communities, direct sales to the public, the importance of content, and working with aggregators.

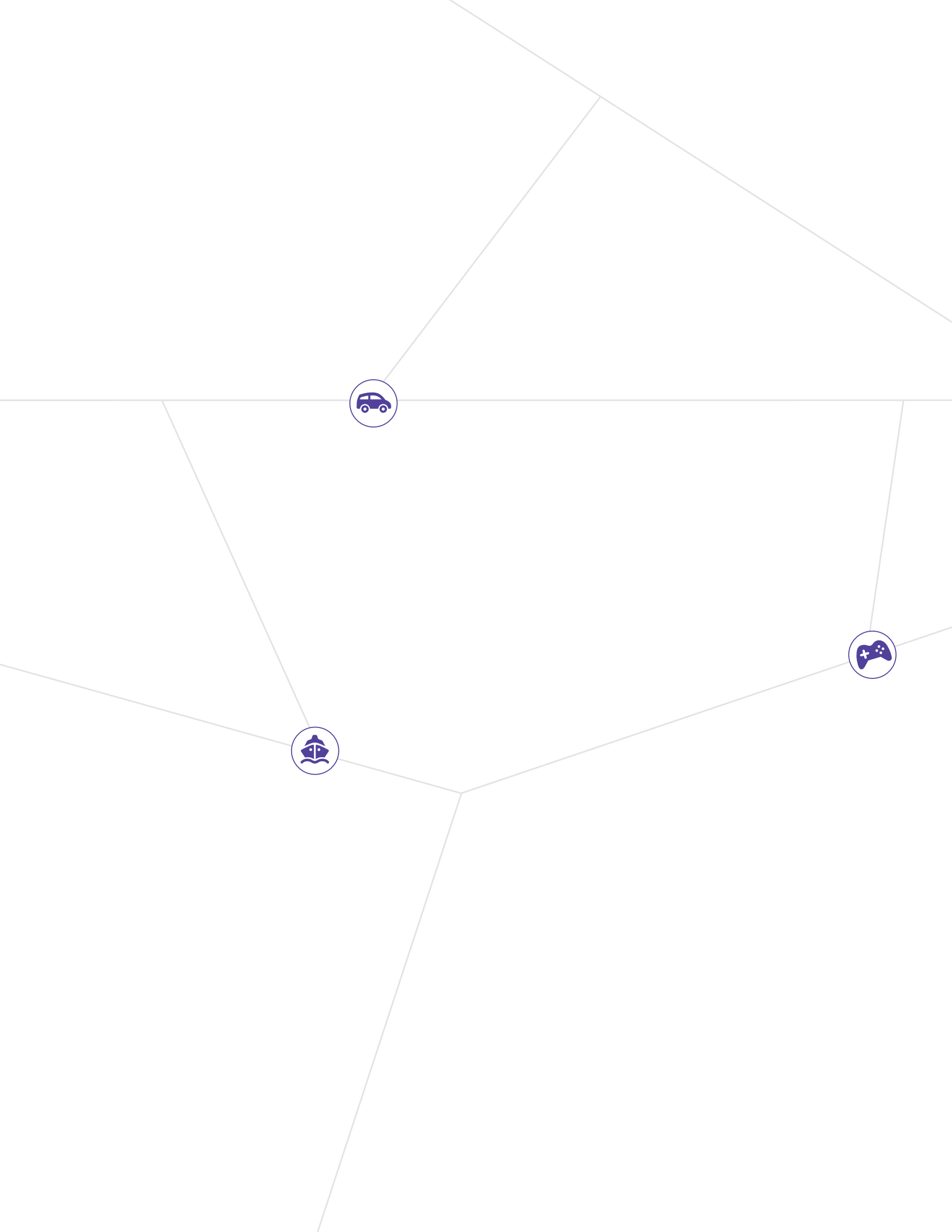
At the end of the three-day event, three companies were selected for several months of coaching from Bond Strategy and Influence to develop and implement their 360-degree strategy with the agency of their choice, which also took part in the workshop.

The three companies also received a $20,000 grant to help finance their 360-degree strategy and received support from Bond Strategy and Influence for a maximum of one year for the development and implementation of their strategy.

TABLE 41 **Financial Framework - Second Objective: Increasing research and innovation capacity in all forms (in millions of dollars)**

	Impact on students, researchers, and innovators	Impact on SMEs	Impact on large enterprises	Impact on R & I institutions and organizations	Impact on the public	Impact on local governments and regions	Impact on health and education	Structural impact on the economy	QRIS 5 YEAR TOTAL[1]	OTHERS 5 YEAR TOTAL[2]	5 YEAR GRAND TOTAL[3]
A) Support researchers and innovators to ensure the cross-fertilization of ideas											
Increased competitiveness of strategic research clusters	X			X					61.70		61.70
Increased support for enterprise innovation projects through the new Innovation Program		X	X			X			62.04		62.04
Establishment of the Research and Innovation Organizations Support Program		X	X	X							
Targeted actions to benefit knowledge transfer and exchange organizations	X			X		X			50.00	11.50	61.50
Special support for technology platforms		X	X	X					5.00	4.00	9.00
Support for research vessels Lampsilis and Coriolis II	X			X		X			1.40	1.75	3.15
B) Invest in collaborative research and innovative projects											
Increased support for international research and innovation initiatives through a restructuring of the current program	X	X	X	X					2.00		2.00
Increased support for intersectoral research in response to society's greatest challenges	X		X	X				X	44.95	15.00	59.95
Establishment of a fund to support health and social services innovation under the Life Sciences Strategy	X	X	X	X			X	X		18.00	18.00
Increased support for genomics and personalized care through support for Génome Québec			X	X	X			X	40.00		40.00
Two inspirational projects: Réseau Québec Maritime's Odyssée Saint-Laurent and the justice system modernization	X		X	X	X	X		X		15.00	15.00
C) Ensure access to and funding of competitive infrastructure											
Increase in research infrastructure investment through the Québec Infrastructures Plan	X			X							490.40 (PQI)[4]
Commitment to assume the entire cost of funded research projects				X							
TOTAL (excluding infrastructure spending)									**267.09**	**65.25**	**332.34**

1. Including 2016-2017 grants from the 2017–2018 *Québec Economic Plan* that allow for funding of new initiatives.
2. "Others" corresponds to "appropriations from other sources, including the Life Sciences Strategy and Maritime Strategy."
3. May not add up due to rounding.
4. Infrastructure amounts from the Québec Infrastructures Plan.



3

ACCELERATE AND AUGMENT THE TRANSFER AND COMMERCIALIZATION OF INNOVATION

The Québec government has a third objective for the Québec Research and Innovation Strategy: accelerating and augmenting the transfer and commercialization of innovation.

A crucial step that boosts the economic benefits of research and innovation

Commercialization is a crucial step in boosting the economic benefits of research and innovation

Ongoing challenges

Québec faces a number of ongoing challenges in commercializing the often remarkable results of its researchers and innovators.

Getting a technology to market is often one of the more difficult steps.

Innovation is a continuous process in which individuals, businesses, and organizations update, master, and use new products, concepts, processes, and methods. Innovation—from idea to commercialization—is a continuum where technology evolves and matures over time.

Translating investment in research and development more quickly into investment in innovation should and can be a priority, whether the R&D is propelled by the market or by advancements in knowledge.

We must find ways to transfer research results and unlock R&D's potential to benefit society, the market, and users.

Four strategic priorities

The Québec Research and Innovation Strategy is guided by four strategic priorities aimed at boosting the transfer and commercialization of innovation.

- The government announces increased support for the commercialization of innovation ecosystem

The government will encourage collaboration between key stakeholders, offer support to groups that serve as intermediaries between R&D organizations, and provide targeted stimulus through selected projects.

This includes strengthening ties with the financial industry to make it easier for businesses of any size to access capital.

The government has two inspirational projects in the works, including establishment of an artificial intelligence supercluster.

- The government is announcing measures to promote the creation and growth of innovative businesses through early adoption and the integration of innovation.

  The government will support startups and innovative entrepreneurship, as well as innovation hubs and industry 4.0 centers of expertise.

- The government will support commercialization projects through its new Innovation Program. It will fund an inspirational project on sustainable mobility and support the commercialization of clean technology and clean innovation.

- The government will consolidate existing programs to maximize the transfer of social and technological innovation and augment its impact. It will provide additional support to social and technological intermediation organizations and invest in bringing cutting-edge, innovative, home-grown products and services to market outside Québec.

BOX 42

TARGETS OF OBJECTIVE 3

This objective targets are as follows:

- Move Québec (currently ranked 12th) into the top ten OECD rankings for investment in IT and communication businesses, measured as a percentage of GDP[1]
- Increase Québec's ranking (currently 4th place) within Canada for the percentage of innovative businesses in the province (engaged in one of four types of innovation: product, process, organizational, and marketing)[2]

Source 1: Statistics Canada, OECD: Conference Board of Canada (2015).

Source 2: CANSIM table 58-0221, Survey of innovation and business strategy - 2012, Statistics Canada.

BOX 43

ROOM FOR IMPROVEMENT IN COMMERCIALIZATION

In 2015, the Conference Board of Canada assigned Québec a grade of "B" in the overall innovation report card, the same as Ontario. Québec ranks second among Canadian provinces and eighth among the 26 geographic areas included in the comparative analysis.1

Québec ranks high for venture capital investment and public research and development, earning an "A" for these indicators.

Indicators related to scientific articles and entrepreneurial ambition also earn Québec a respectable "B" grade. Québec earns only a "C" however for connectivity, business enterprise R&D, ICT Investment, and the number of researchers engaged in research and development.

The province's weakest indicators (number of patents, enterprise entry rates, and labor productivity) earn a grade of "D."

According to the Conference Board of Canada, the weakness of these three indicators in both Québec and Ontario may explain why these provinces are having trouble commercializing innovation and reaping its economic benefits.

See Appendix 2 for more information.

BOX 44

SOME COMMENTS ON THE SITUATION IN QUÉBEC

Issues observed

The services provided by Québec government ministries and agencies should reflect a comprehensive innovation strategy designed to dovetail with that of the federal government.

Companies, universities, and researchers in every region of Québec should be encouraged to develop stronger synergies.

It is still difficult for the private sector to access public research infrastructure. More effort must be made to facilitate access and encourage the sharing of knowledge and resources, including between institutions.

Access to funding appears to be a challenge at some of the riskier phases of innovation and commercialization as well as at the startup phase outside major urban centers.

Québec is only seeing average commercialization results compared to similar regions and countries. Some of its biggest challenges include gaining access to capital, staying competitive on the global market, attracting talent, and developing relevant skills.

On the international stage, Québec scores well on entrepreneurial ambition. However, the business startup rate in Québec is still below that of other Canadian provinces.

Capitalizing on our strengths

The QuébecInnove Network

Created in December, 2014, the QuébecInnove Network fosters collaboration, coordination, and synergy between innovation system stakeholders by offering incentives for business collaboration.

University technology transfer organizations, college centers for the transfer of technology, and social and technological intermediaries

A culture of commercialization and innovation is present among academic researchers thanks to university technology transfer organizations, college centers for the transfer of technology, and social and technological intermediaries, as well as incentives that encourage collaboration between businesses and universities.

Université du Québec operates college technology transfer centers on several of its campuses throughout the province, making it easier for local businesses to access organizations that support R&D and innovation.

Investment in venture capital

The venture capital market is very active in Québec.

Last year, Québec posted its strongest numbers yet for venture capital investment—$1.1 billion—a level not seen since 2000.

Québec's share of total venture capital investment in Canada is nearly 30%. Montréal ranks second among Canadian cities for venture capital investment, with $930 million, behind Toronto at $1.221 billion. Vancouver is third, with $462 million.

Private investment in postsecondary research

In 2014 in Québec, 8.5% of internal postsecondary research and development expenditures were underwritten by the private sector, compared to 7.8% for Canada as a whole. Québec ranks fourth in Canada for private investment in academic research. These numbers provide insight into the strength of business/university partnerships in the province.

A Stimulating the ecosystem of innovation commercialization

To accelerate and augment the transfer and commercialization of innovation, the government will take action to stimulate the ecosystem that supports this commercialization.

Under the Québec Research and Innovation Strategy, the government will take four initiatives:

- Encourage collaboration between key actors through QuébecInnove
- Support intermediaries and commercialization agencies
- Launch two inspirational projects: an AI supercluster and a cutting-edge sawmill

An integrated research and innovation ecosystem with greater collaboration among key stakeholders, through QuébecInnove

The QuébecInnove network is recognized by the Québec government.

QuébecInnove brings together research and innovation stakeholders to meet the needs of organizations and businesses.

QuébecInnove brings together more than 100 key stakeholders in research and innovation under one roof, including research groups, technological innovation intermediation organizations (sectoral industrial research coalitions), social innovation intermediation organizations, university research groups and their technology transfer organizations, certain colleges, and all college technology transfer centers.

The network also works with other partners to boost support for businesses and build synergies vital to the success of innovative projects.

Two projects entrusted to QuébecInnove

The government is entrusting two projects to QuébecInnove.

QuébecInnove will work with its members to create shared tools, including procedures and protocols governing intellectual property. The development of intellectual property agreements will make it much easier for SMEs and startups to form partnerships.[10]

QuébecInnove will organize innovation laboratories[11] bringing together industry partners and venture capitalists (which many include venture capital firms, angel investors, the Business Development Bank of Canada, and brokerage firms), support networks (Réseau M, Réseau conseil en technologie et en innovation, government ministries and agencies), research and innovation stakeholders, and commercialization organizations (university entrepreneurship centers, accelerators and incubators, university technology transfer organizations).

These meetings will provide participants with an outlet to discuss new patents, products, and businesses, as well as possible funding and support options.

The government's long-term goal is to augment the transfer and commercialization of intellectual property developed by Québec researchers.

10. The basic agreement developed by the Natural Sciences and Engineering Research Council of Canada under the Idea to Innovation Grants (I2I) program could serve as a template. Under this agreement, if a research project receives the majority of its funding government sources, it must include a technology transfer component that will benefit Canadian companies.

11. Physical proximity of industry players will lead to more effective and frequent interaction, e.g., when innovation stakeholders share office space on a weekly rotating basis.

Consolidation of network activity

The government will adapt its funding for QuébecInnove and its platforms based on impact indicators related to these activities. The goal is to reduce barriers and stimulate collaboration and synergy within the Québec ecosystem, boosting the added value of platforms for clients.

Organizations in the QuébecInnove network will also be expected to provide client support and interact with the entire research and innovation ecosystem. To this end, a diagnostic exercise will first analyze and seek to consolidate the innovation ecosystem at the time that government programs are reviewed. Consultations with stakeholders and relevant ministries will take place as part of this process.

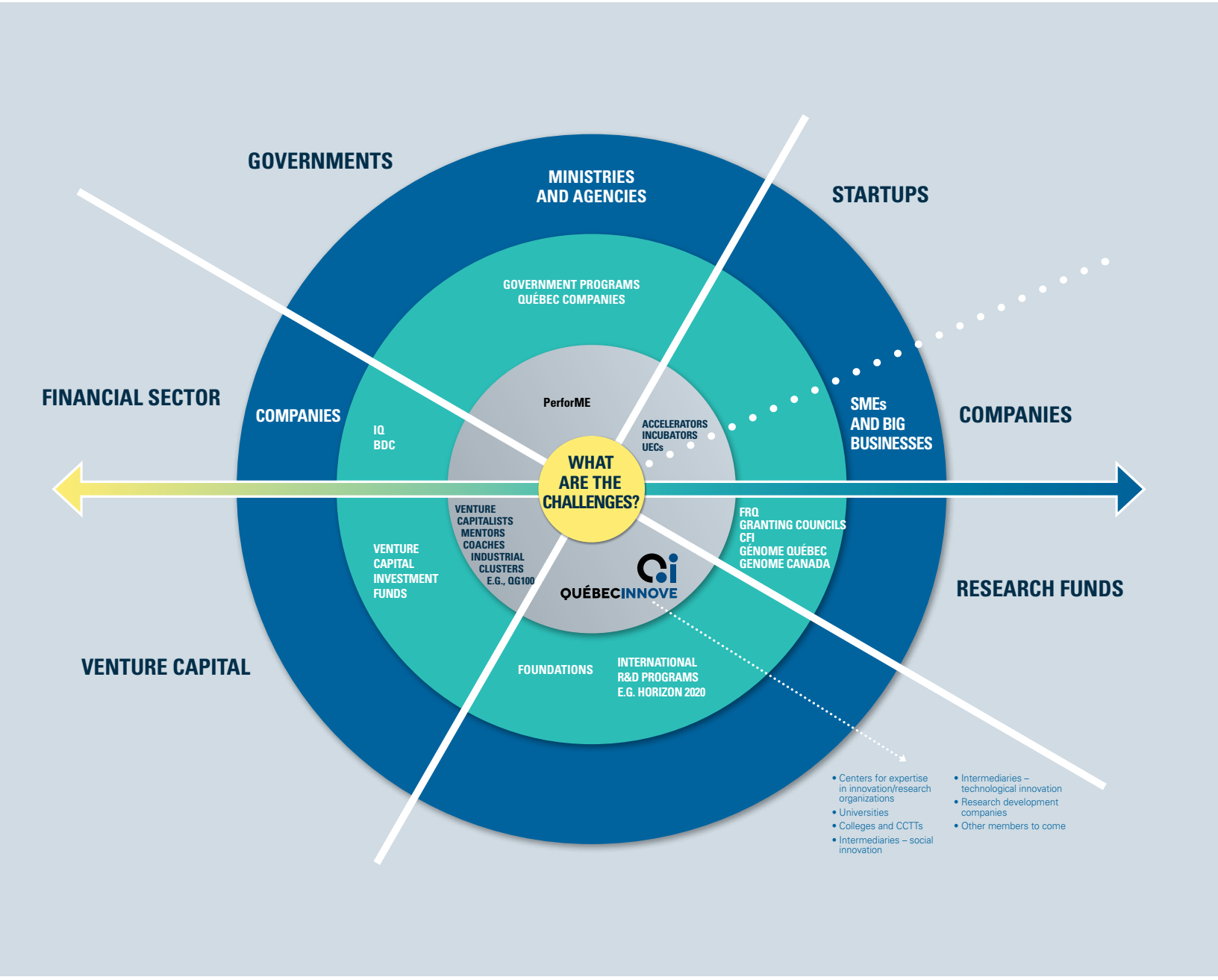
QuébecInnove will serve as an intermediary between external stakeholders throughout the province and abroad, to overcome social and technological challenges associated with knowledge transfer and the commercialization of innovation.

These mandates and requirements will allow QuébecInnove to meet is primary objectives, namely:

- Augment the transfer and commercialization of intellectual property through the joint action of QuébecInnove members;
- increase fluidity, synergy, and links between organizations operating in the Québec research and innovation system;
- strengthen the Québec research and innovation system for businesses and organizations, in collaboration with QuébecInnove partners and government bodies;
- take a collaborative approach to all forms of innovation, whether technological, social, or organizational; and
- ensure that every region of Québec benefits from the work of applied research and innovation organizations.

To that end, $2 million in additional funding over five years will be put toward consolidating QuébecInnove.

FIGURE 45 **Research and innovation ecosystem**



Legend:

Opportunities, clients **Financing** **QuébecInnove and partners that provide aid and support**

Integration of emerging technologies

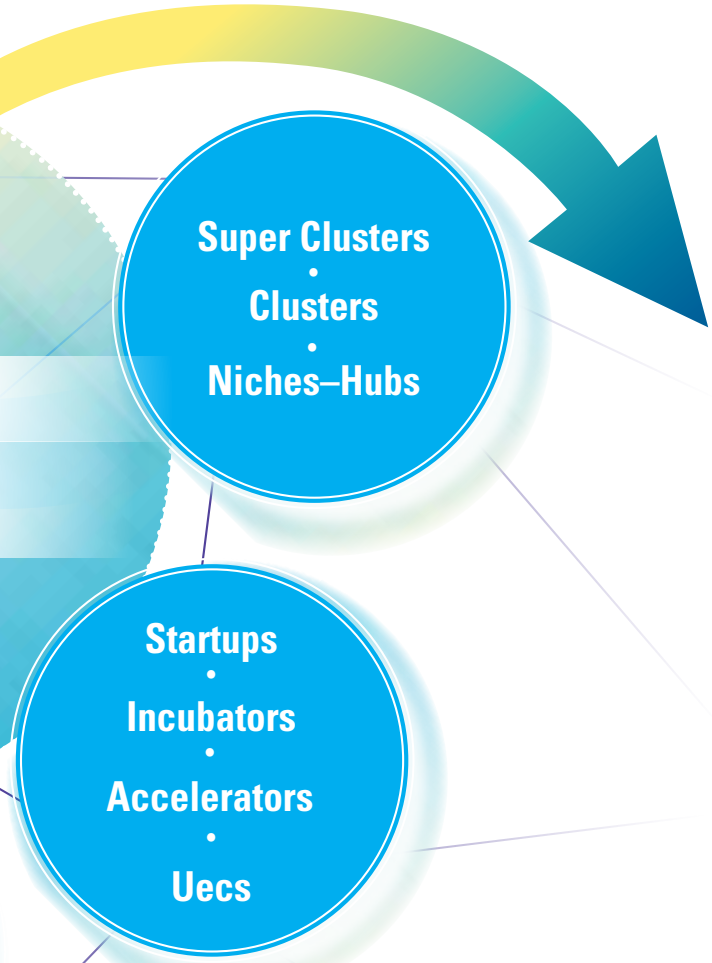
This diagram uses concentric circles to illustrate the synergy between players in research and innovation. It shows the interactions between participants with the common goal of meeting a specific challenge. In the centre, challenges may stem from businesses, major buyers, organizations, or society. In the second circle, supporters, including members of QuébecInnove, can find solutions to these challenges. Players in funding are shown in the third circle. The last circle represents clients and the market. All these participants and partners work together to support and implement the stages in the innovation process.

FIGURE 46 **The research and innovation commercialization ecosystem**

This diagram shows the ideas, challenges, and solutions that are part of the research and innovation commercialization process. Producers of ideas driven by science and technology are shown on the left. On the right, companies and organizations are facing challenges driven by the needs of society and the market. The solution providers—QuébecInnove and its partners—are shown in the centre.All these players work together in the ecosystem to support the commercialization of research and innovation results in light of new realities and opportunities.

THEIR USES AND ASSESS THEIR SOCIOECONOMIC REPERCUSSIONS

THINGS • NEW GENERATION GENOMICS • RENEWABLE ENERGY • ENERGY STORAGE



CHALLENGES DRIVEN BY THE MARKET

Startups, SMEs, big businesses, and organizations

- Better risk sharing
- Attraction of talent
- More commercialization
- More collaboration
- Enhanced productivity

OPPORTUNITIES ..... EASIER ACCESS TO FUNDING

solutions in government contracts • Ready to tackle societal challenges

Support for intermediation and commercialization organizations

To keep pace with competition, innovative businesses and organizations must find partners with which to collaborate.

They must also be able to identify potential partners quickly—particularly those in institutional research—and establish relationships to encourage the development of synergies. A high degree of synergy can accelerate and augment results at every stage, from research to commercialization.

Currently this kind of fluid collaboration in hindered by a number of obstacles, including intellectual property management, how research projects are supervised and carried out, and how technology is integrated by the acquirers.

Intermediation organizations

Intermediation organizations act as intermediaries between innovation stakeholders, whether businesses, researchers, or other partner organizations. They facilitate partnerships in order to commercialize innovation.

Intermediation organizations provide platforms for developing and financing collaborative and co-creation research projects: they may share the costs and risks associated with research projects, they bridge the gap between public, industrial, and social innovation research, they facilitate knowledge transfer, and they help build strategic alliances.

In Québec the primary intermediation organizations in innovation are university technology transfer centers and social and technological innovation intermediation organizations.

These organizations have, in particular, helped to develop the work conducted by researchers in partnership with businesses, augment the transfer of intellectual property, and increase the number of new startups.

An expanding role with a new vision of innovation

Over the past years, a new vision of innovation has emerged, one that embraces open innovation and emphasizes interaction and shared learning among stakeholders.

Intermediation organizations must expand their role and mission, diversify their offerings (particularly networking services), and build relationships between key industry players. This requires an emphasis on digital technology and on international markets, to fully reap the benefits of open innovation.

Additional funding

To support intermediation organizations in their new role and provide them with adequate funding, the Québec Research and Innovation Strategy will implement the Research and Innovation Organization Support Program.[12]

The government is announcing an additional investment of $4.8 million over five years, which will increase available funding to $55.1 million. This money will go toward organization operating costs.

It will

- ensure the efficient use of public funds by intermediation organizations working in research, innovation, and technology transfer;
- improve the cohesion, synergy, and coordination of intermediation organizations' activities; and
- improve research and development support services for companies and other decision makers and stakeholders.

12. See Objective 2, page 50.

BOX 47

FIRST PATENT PROGRAM

The protection of intellectual property is essential to a company's growth as it pursues new business opportunities at home and abroad.

The First Patent Program seeks to encourage innovation and boost the competitiveness of Québec companies by increasing the number of businesses that protect their intellectual property.

The program provides a maximum of $25,000 to Québec SMEs undertaking to protect their intellectual property for the first time (patents or industrial design applications), with a view to commercialization.

Since it was first launched in 2015, the program has assisted more than 100 companies and has distributed over $2.25 million in financial aid.

The First Patent Program is a part of the new Enterprise Innovation Support Program, Component 1.

Two inspirational projects: an artificial intelligence supercluster and a cutting-edge sawmill

Creation of an artificial intelligence supercluster

Artificial intelligence (AI) technology is advancing rapidly, presenting great opportunities for Québec.

Already AI technology has opened new markets and new avenues for progress in critical fields such as health, education, energy, and the environment.

While past industrial revolutions resulted in mechanical advances, the industrial revolution currently underway will expand our cognitive abilities.

Québec (and in particular Montréal) is very well positioned in this regard with its many highly qualified researchers and its specialized research centers.

A $100 million investment

As part of the Québec Research and Innovation Strategy, the government will invest $100 million to help create an AI supercluster.

This supercluster will turn Montréal into a major economic and scientific center for research, training, and technology transfer. The city will become a hub for the creation of value-added products and solutions, creating jobs and attracting companies specializing in collecting and analyzing big data to facilitate decision making.

A collaborative approach

The supercluster will be developed using a collaborative approach.

First, Université de Montréal will partner with key stakeholders in the field, including other postsecondary institutions working in artificial intelligence, to form a steering committee that will guide the supercluster's development.

Among other tasks, the committee will be mandated to maximize the leverage effect of government funding by prospecting companies likely to invest in the supercluster or in AI projects.

BOX 48

THE ARTIFICIAL INTELLIGENCE SUPERCLUSTER

Five targeted streams of intervention

The supercluster will focus on five streams of intervention:

- Attracting and retaining talent in a field where the demand for deep learning expertise is very high
- Creating a critical mass of high-caliber AI researchers in Québec to attract young researchers to the field and draw the attention of industry players
- Creating a business climate conducive to the development and commercialization of scientific advances into products and solutions
- Encouraging startups, facilitating access to venture capital in the field of AI in Québec, and educating graduate students about what AI startups entail
- Boosting acceptance of AI and educating the public on its social impact, ensuring that these issues (including privacy) are addressed by experts and discussed with the public.

Tapping into the expertise of the Institute for Data Valorization (IVADO)

The supercluster will leverage the expertise of the Institute for Data Valorization (IVADO), which will play a pivotal role.

This will allow the supercluster to

- gain access to the resources it needs to develop artificial intelligence and innovations in the field;
- build partnerships between postsecondary institutions and the private sector to secure funding for its operations and research; and
- study the issues associated with data science, particularly confidentiality and ethics.

An academic and industrial initiative

The Institute for Data Valorization (IVADO) was created out of an academic and industrial initiative as part of Campus Montréal, which brings together HEC Montréal, Polytechnique Montréal and l'Université de Montréal.

IVADO brings together industry professionals and academic researchers to develop cutting-edge expertise in data science, operational research, and artificial intelligence. The Institute has more than 900 world-renowned data scientists on its roster, including 150 researchers.

IVADO is known for its leading academic impact in the fields of deep learning and operational research and attracts students from around the globe.

Scientific breakthroughs

Scientific breakthroughs by IVADO researchers such as Yoshua Bengio are swiftly finding application in our daily lives, in fields like voice and handwriting recognition (check cashing) and bus fleet management (with Giro, a Québec company, a leader in the field).

Businesses in a variety of sectors are turning to AI to improve their manufacturing processes and services (finance, insurance, logistics) and to develop new diagnostic technology (Imagia).

IT giants such as Google and Microsoft have opened laboratories in Montréal to work with IVADO, prompting the emergence of new startups (Element AI).

The Canada First Research Excellence Fund recognized IVADO's achievements with a $93.6 million research grant.

Collaborations are being planned with centers in Montréal, Toronto, and Edmonton.

BOX 49

INTELIA: ARTIFICIAL INTELLIGENCE IN A HENHOUSE

Artificial intelligence can be found in a growing number of sectors, including more traditional fields such as agriculture.

In 2005 Intelia, a designer and manufacturer of electronic systems, worked with poultry farmers to develop new tools to help monitor and optimize their production. Several of these farmers become Intelia shareholders, taking part in a company expansion.

The firm now focuses primarily on the agricultural industry, designing a range of intelligent controllers to facilitate production management. Its products control humidity levels in pens, measure the average weight of poultry, and track the animals' growth curve.

Over the past few years, venture capitalists have invested heavily in the company to help it expand to markets in the U.S. and abroad.

Source (in French): http://affaires.lapresse.ca/portfolio/developpement-economique-regional/portrait-2017-lanaudiere/201704/13/01-5088164-intelia-lintelligence-artificielle-jusque-dans-le-poulailler.php

A cutting edge sawmill: SM2 project

During the 2016 Wood Innovation Forum, the five workshop groups (sawmills; boards; wood construction; pulp, paper and bioproducts; bioenergy) pointed to innovation as a significant growth factor for the forest products industry.

The sawmills group highlighted the importance of innovation in the development and adaptation of processes, products, equipment, and processing tools, to boost performance and make wood processing plants more competitive and versatile.

A $13 million assistance package

That is exactly the goal of FPInnovations' SM2 initiative (Smart Manufacturing 2.0), which seeks to improve plant efficiency and boost the competitiveness of the Québec sawmill industry through development and industrial trials, demonstrations of emerging technologies, and the creation of a flexible and intelligent processing platform.

Announced on March 16, 2017, this initiative is backed by a $13 million government assistance package and will be the subject of a call for projects in intelligent manufacturing to improve productivity in Québec plants and boost their competitiveness.

BOX 50

AN INSPIRATIONAL PROJECT: SM2 INITIATIVE – SMART MANUFACTURING

The SM2 project reflects the recommendations put forward by the Sawmill workshop group at the 2016 Wood Innovation Forum. This initiative will encourage the shift to a new paradigm where logs are transformed into new products and co-products for new markets, using emerging technology and a flexible and intelligent processing platform.

FPInnovations spearheaded this initiative, which will stimulate growth and boost profits for the Québec and Canadian log processing sector by

- encouraging the sector to adopt new business models and reduce its dependence on revenue from co-products;
- creating, developing, and supporting revolutionary technologies that will improve the value of processed logs and encourage the recovery of all logs for new products and applications;
- adapting to the needs of today's market and the demand for intelligent and versatile manufacturing solutions; and
- accelerating innovation and helping to build partnerships between industry, government, and academic stakeholders.

Through research and development, industrial trials, and demonstrations and commercial applications in existing sawmills, the initiative seeks to

- increase recovery rates of hard wood (for structural and non-structural applications in new markets) by 30%;
- reduce the production volume of subproducts by 20%; and
- boost revenues in non-traditional markets (solid products and co-products).

Reaching these targets would boost profits in the Québec wood processing sector by more than $250 million per year, helping to maintain and create direct and indirect jobs in several industry-dependent regions and communities.

These economic spinoffs will be bolstered by additional growth opportunities with the development of new solid products and co-products.

B Foster the creation and growth of innovative businesses through the early adoption and integration of innovation

Still with an eye to accelerating and augmenting the transfer and commercialization of innovation, the government has identified a second strategic priority: the early adoption and integration of innovation.

Under the Québec Research and Innovation Strategy, the government is announcing the following four measures:

- Increased funding for the Startup Québec Program to support startups that demonstrate significant growth potential and innovative entrepreneurship
- Support for innovative and scientific entrepreneurship in young people through Startup Youth
- Support for the development of innovation hubs throughout Québec
- Support for industry 4.0 centers of expertise

Increased funding for Startup Québec to support startups and innovative entrepreneurship

Boosting support for innovative entrepreneurship is vital to improving the rate of commercialization of home-grown ideas and research results.

Over the past five years, Québec's economic landscape has shifted significantly: startups now play an important role in the entrepreneurial system as job creators and wealth builders. With more and more emerging each year, startups are now a major driver of Québec's economic growth.

To increase the number of startups and help them accelerate their growth, the Québec Research and Innovation Strategy will boost funding to the Startup Québec Program. This program will now cover all economic sectors in Québec, including social and cooperative entrepreneurship.

A total of $6.81 million has been earmarked for this initiative.

The creation of business incubators

This measure is to help create business incubators with the financial support of leading Québec companies. These hubs should focus on problem solving to encourage the creation of crossover technology.

This measure will thus help lead to the establishment of corporate business incubators over the next five years. Each incubator will be selected through a thematic call for projects.

In addition, companies will receive step-by-step assistance to guide them through the setup process.

BOX **51** **STARTUP QUÉBEC**

A program born of the Digital Economy Action Plan

Startup Québec was created in 2016 through financing provided under the Digital Economy Action Plan.

In 2016 the call for projects for the first two components attracted a high volume of applicants across all sectors.

Three components expanded to all sectors

Startup Québec will fund three components, each of which responds to a different need:

Component 1: international partnerships. This component allows Québec startups to take part in international exchanges with foreign businesses, providing them with incubation and accelerator experience at innovative businesses outside Canada. Foreign startups will also be offered development opportunities to attract them to Québec.

Component 2: incubators, accelerators and university entrepreneurship centers. These projects enhance current approaches to startup incubation and acceleration by prioritizing collaborative work, network building, experience sharing, quality services, and open innovation.

Component 3: innovative projects. These pioneering projects adopt new approaches to business incubation and acceleration, to spur innovation in startup management practices. This component may include interdisciplinary or multisectoral projects that encourage exchanges and collaboration, or new approaches to mentorship.

Support for innovative and scientific entrepreneurship in young people

Developing entrepreneurship among today's youth is an issue Québec must face, given the big role that SMEs play in the economy and the need for young people to pick up the reins as many in the workforce near retirement.

In the field of innovation, the lack of practical training in entrepreneurship is a major concern for incubators, accelerators, and startups. More needs to be done to help young people develop their entrepreneurial spirit, grow their business knowledge, and master economic concepts.

A new measure with two components

To educate young people on science innovation and entrepreneurship, the Québec Research and Innovation Strategy includes a new two-fold measure backed by $2.5 million in funding over five years.

First component

The first component, Startup Youth (secondary, college, and university levels) is to attract young people to careers in entrepreneurship and innovation.

High school students will be provided with funding to create their own businesses. They will also spend time at a Québec incubator or university entrepreneurship center (grades 7 to 9) or accelerator (grades 10 and 11), where they will be assigned mentors.

Students in their last year of college or university will have an opportunity to create their first scientific enterprises and to intern with scientific entrepreneurs.

This approach is based on the successful First Research Job Program. A business professional will mentor the students throughout their internship, nurturing and maintaining their interest in entrepreneurship and innovation. Mentorship may continue for those students who decide to launch or take over a business.[13]

Second component

The second component—the Innovation and Scientific Enterprises Competition—is inspired by another Québec competition, *Science, on tourne!*

This competition will challenge secondary students to design a simple, innovative and useful tool based on a predetermined scientific theme.

The competition will run over an entire school year. Students will be supervised by their teacher, as well as by an industrial designer or other professional specializing in product development. A jury will select six or seven winners, who will have the opportunity to bring their scientific business projects to fruition under the supervision of the professional designer.

This measure will augment knowledge transfer between experienced workers/entrepreneurs and upcoming talent, boost recruitment in scientific entrepreneurship, and groom the next generation of entrepreneurs.

13. Ministère de l'Économie, de la Science et de l'Innovation provides funding to Réseau M, backed by Fondation de l'entrepreneurship, allowing it to operate its network of mentors throughout Québec.

Support for the development of innovation hubs (co-creation spaces) throughout Québec

Innovation hubs encourage innovation by providing an outlet for learning and a place to share ideas.

These hubs offer entrepreneurs shared workspaces and a variety of research and innovation equipment. They also serve as venues for a wide range of events and give members an opportunity to make contacts and expand their network.

Hubs are generally made up of organizations and businesses operating in close proximity. They can be incubators, accelerators, cowork spaces, startups, research laboratories, universities, colleges, or arts and culture centers.

The growth of hubs

All around the world, hubs are growing in number, especially those specializing in certain in-demand sectors or technologies.

These hubs often form around established companies, SMEs, and major local and international businesses looking to develop innovative ecosystems to boost creativity. They make Québec more attractive to foreign investors and help the province stay competitive.

Québec is seeing the emergence of hubs focused on specific fields, such as Montréal's Innovation District, the CHU Saint-Justine Innovation Platform for health care, the Living Lab for Food Science at Université Laval's Institution of Nutrition and Functional Foods, and the MiQro Innovation Collaborative Centre (C2MI) for microsystems at Université de Sherbrooke.

$3.5 million over five years

To support the development of innovation hubs throughout the province, the Québec Research and Innovation Strategy includes a new measure backed by $3.5 million in funding over five years.

A call for projects will be launched to support innovation hubs that bring together within a defined geographic area one or more educational institutions, a critical mass of industrial concerns, startups, and financial service providers, and one or more innovative enterprise incubators and accelerators.

All projects must have the support of local partners. International partnerships may also be established.

Financial support will be available to help with new innovation hubs in areas of high potential (spinoffs, impact) and where stakeholders are most active.

Funding will be accorded to projects that seek to augment and develop existing innovation hubs.

Terms and conditions

Most of the money will go toward the hub's coordination mechanisms, which are crucial to its success and visibility. Some will also be used to fund communications, events, and other efforts to attract partners and businesses to the hub.

Funding may also be provided for initiatives to get members of the general public involved in the hub or establish partnerships with other, similar innovation hubs elsewhere in Canada and around the world.

BOX 52

COLLEGE TECHNOLOGY TRANSFER CENTERS (CCTTS): RESOURCES BORN OF INNOVATIVE SOCIAL PRACTICES

Important research is being conducted at the college level. College technology transfer centers are vital to Québec's economic development and play a role in our students' education. By funding CCTTs and college and university training programs outside major urban centers, we are in a better position to respond to our companies' labor needs and encourage entrepreneurship throughout Québec. These investments will stimulate innovation and harness our colleges' expertise and applied research in support of Québec businesses.

Living laboratories for bio-food innovation

The Northern Bio-food Alliance is building R&D synergies among four CCTTs specializing in agriculture, bio-products, and the agrifood sector: Agrinova, Biopterre, Cintech Agroalimentaire, and the Centre d'innovation sociale en agriculture (CISA).

The Alliance supports local communities by stimulating economic and social development in the northern bio-food sector through a transdisciplinary and participatory approach that combines applied research, action, and training.

Northern communities are taking an active role in projects spearheaded by the Alliance, helping to stimulate regional development. The Alliance is committed to respecting the cultural diversity of northern communities as it works to strengthen the northern bio-food chain.

Support for industry 4.0 centers of expertise

Québec manufacturers need to stay on the cutting edge in order to remain competitive in the global market. Major buyers are joining the industry 4.0 movement in growing numbers, and many are requiring their suppliers to follow suit.

MESI has launched a number of initiatives to encourage companies to make the necessary changes to stay competitive. These include the recent Innovative Manufacturer Initiative, launched in collaboration with Investissement Québec.

Establishing industry 4.0 centers of expertise in Québec will help innovative manufacturers access a changing ecosystem, one that includes experimental laboratories, learning environments, and value-added service centers.

Establishing industry 4.0 centers of expertise

The Québec Research and Innovation Strategy will seek to establish industry 4.0 centers of expertise to help companies make the shift to industry 4.0, to develop the expertise of research centers, universities, and colleges, and to educate the workers of tomorrow.

During the 2016-2017 fiscal year, the government spent $870,000 on these pilot projects.

Industry 4.0 centers of excellence will allow manufacturers to see new technology in action, test-drive it in their facilities, and gain access to specialists. Equipment manufacturers will be invited to use "technology showcases" to demonstrate their capabilities.

Companies and public research institutions will have the opportunity to partner on collaborative research projects, paving the way for new innovations in manufacturing.

The centers' research and innovation projects will boost the competitiveness of Québec's manufacturing industry.

This measure will be coordinated by Association pour le développement de la recherche et de l'innovation du Québec.

Strengthening Centre de recherche industrielle du Québec

This measure will be implemented by CRIQ (Centre de recherche industrielle du Québec) and by universities, research centers, and the business sector.

Under the Québec Research and Innovation Strategy, the government will strengthen CRIQ's ability to ensure Québec's industrial competitiveness.

CRIQ is playing a key role in helping Québec reach its digital technology goals; it will use its know-how to guide companies as they begin or accelerate their shift to industry 4.0.

Companies will improve their productivity through access to state-of-the-art laboratory and equipment. In addition to government funding, the centers' costs will be underwritten by in-kind and cash contributions. Member-companies will pay an annual fee.

Members will also have the opportunity to award contracts for projects, and technology suppliers will be able to lend or donate equipment to members for testing purposes.

Industry stakeholders (including CRIQ, colleges and CCTTs, universities, companies, and municipalities) will be invited to help establish these centers.

BOX 53

INNOVATIVE MANUFACTURER INITIATIVE

In conjunction with Investissement Québec, MESI has introduced a number of measures under the Innovative Manufacturer Initiative to increase support for Québec companies as they modernize and innovate in their manufacturing processes.

The Innovative Manufacturer Initiative is spurring the Québec manufacturing industry toward innovation.

More than fifty partners have collaborated on this project, representing a cross-section of Québec industry players and their value and service chains, as well as public and private sponsors.

Ten-point action plan

This joint effort is being carried out via a ten-point action plan that seeks to address all the needs of Québec manufacturers, from raising awareness of the importance of innovative manufacturing to providing the necessary financing tools.

Adequate support and effective collaboration are key to the success of innovative manufacturers. Under this initiative, SMEs that wish to boost their competitiveness and optimize their expansion plans will

- gain access to an assessment tool and receive support from an innovative manufacturer, to build their internal Industry 4.0 expertise and smartly accelerate their shift to innovative manufacturing; and
- profit from the success of other companies as they make the shift to innovative manufacturing.

In conjunction with CRIQ and other manufacturing partners, MESI will encourage businesses to develop collaborative projects aimed at automating their processes and innovating.

These projects will encourage collaboration among manufacturing industry players and drive innovation in this economic sector.

BOX 54

PERFORME STRATEGY

The **perform** strategy is another example of an initiative that helps companies grow through innovation.

Major objectives

The major objectives of the **perform** strategy are

- foster growth for companies;
- sustain employment and create wealth in every region of Québec; and
- accelerate export and innovation projects

Strategic priorities

The **perform** strategy seeks to accelerate projects that spur company growth by maximizing their innovation and export potential.

Selected companies will receive customized support from an advisor at MESI, which is leading a project acceleration team made up of ministry specialists and representatives from Export Québec, the Science and Innovation Sector, Investissement Québec, and Emploi Québec.

To facilitate access to capital and secure investment partners, the Ministry has signed an agreement with Investissement Québec, Caisse de dépôt et placement du Québec, Capital régional et coopératif Desjardins, FondAction CSN, and Fonds de solidarité FTQ. A $50 million fund has been earmarked for companies undertaking projects requiring financing of over $1 million.

Results

Since the call for applications was launched in 2015, the **perform** committee has green-lit 164 innovation and export projects from 16 Québec regions.

Participating companies are committing more than $500 million to these projects, strengthening jobs and creating new employment.

A survey was conducted on companies that received financing in the first three rounds of the **perform** initiative (93 projects). The results are as follows:

- 65% reported that they boosted their competitiveness on the global market and recorded a growth in sales.
- 70% saw an increase in their market share.

C Supporting projects that commercialize innovation

Accelerating the transfer of technology and the commercialization of innovation is the focus of the third strategic priority: supporting commercialization projects.

Under the Québec Research and Innovation Strategy, the government is announcing the following four initiatives:

- Support for commercialization projects through the new Innovation Program
- An inspirational project: support for the development of sustainable mobility solutions with the participation of key partners
- Support for technology transfer through the promotion of innovative solutions in government contracts
- Support to facilitate and spur green innovation

Support for commercialization projects through the new Innovation Program

The Innovation Program[14] to be implemented under the Québec Research and Innovation Strategy includes a component aimed at supporting the commercialization of innovation.

An additional $6 million will be allocated to this component, bringing the total amount available to $31 million over five years. The program's second component will be overseen by Investissement Québec.

This funding will take the form of repayable contributions for the support and commercialization of innovation (expenditures related to commercialization plans: showcases, promotion, marketing, advertising, etc.).

This component will replace the current Créativité Québec Program.

The government will use this measure to fund technology showcases for domestic and export markets and for government procurement projects.[15]

BOX 55 THE REVERSE TECHNOLOGY SHOWCASE OF THE QUÉBEC GOVERNMENT'S SHARED SERVICES CENTER

With the Reverse Technology Showcase, government ministries and agencies can now inform technology companies about projects and requirements that will be the subject of upcoming requests for proposals.

Reverse Technology Showcase

IT companies will be invited to attend information sessions prior to the issuing of RFPs by government ministries or agencies.

As its name suggests, the Reverse Technology Showcase reverses the usual roles, with government ministries and agencies outlining their upcoming projects to IT companies in advance of RFPs.

Government ministries and agencies will clarify their IT requirements, and companies will receive information that lets them adapt their solutions to the needs of each government project.

This new approach is in line with the government's IT Strategy.

14. See the announcement on page 48 concerning the new program launch.

15. Implementation of recommendations 7, 8, and 9 of the Final Report of the *Comité de travail sur l'entrepreneuriat des jeunes entreprises* (working committee on startup entrepreneurship).

An inspirational project: support for the development of sustainable mobility solutions with the participation of key partners

Québec is well positioned to capitalize on the increasing popularity of electric vehicles and the growth of intelligent transportation technology. The government is committed to supporting the development of a new, highly competitive Québec industry in the field of sustainable mobility.

An intelligent transportation innovation corridor

The growth of this industry coincides with the development of an innovation corridor in the Greater Montreal Area focused on intelligent transportation.

From the north shore to the south, more and more organizations and strategic initiatives are developing and demonstrating new technologies.

A test track has been set up in Blainville to assess innovative technology in a controlled setting.

In Laval, a center for smart mobility incubation and acceleration (CIAMIL) has built a testing laboratory for smart mobility technology.

In Montréal, the Innovation District provides a live testing environment associated with the Electrification and Intelligent Transport Institute created by the municipality.

On the south shore, the IVÉO technology park offers a semi-controlled environment for simulating interactions between vehicles and infrastructure.

These initiatives are contributing to the emergence of a top-tier innovation ecosystem, one that will allow companies to bring ideas to market inside a 50-km radius.

Enormous potential benefits

Intelligent transportation is an emerging sector with enormous potential benefits.

However, it also involves complex issues and a diverse set of players.

Progress will depend on the ability to work together effectively.

To develop projects with true potential, we must work to increase the sector's capacity for innovation by encouraging collaboration among industry players.

Financing with two components

Under the Québec Research and Innovation Strategy, the government is announcing two components of support for the development of mobility solutions.

Component 1

Component 1 – $1.5 million to support collaboration and open innovation in sustainable mobility

This money will go toward setting up collaborative research projects with companies, research institutions, cities, and transportation agencies.

It will help build an open innovation network in sustainable mobility conducive to international collaboration. Cities will be able to specify their sustainable mobility needs and attract technology showcases to their areas.

Component 2

Component 2 – Support for the electrification of transportation and intelligent transportation

Applied research will be funded through targeted calls for projects launched by the Québec Research Fund – Nature and Technology and the Québec Research Fund – Society and Culture. Financed by the Green Fund, these projects will build partnerships among researchers, colleges, universities, and acquirers.

Calls for projects in industrial research will be launched by intermediation organizations in technological innovation (sectoral industrial research coalitions): InovÉÉ, PROMPT (Partenariat de recherche orientée en microélectronique, photonique et télécommunications), PRIMA Québec (an advanced materials research and innovation hub), and Consortium de recherche et d'innovation en transformation métallique. A total of $11 million will be made available from the Green Fund.

The Technoclimat Program, which falls under the jurisdiction of Transition énergétique Québec, could be used to fund demonstration projects.

Depending on their project's level of development, companies could select the most appropriate hubs from among those mentioned above to showcase their technology. These innovation hubs could eventually adapt to meet the needs of their region.

$4.4 million

This measure is in line with the $4.4 million package announced under the 2017–2018 Québec Economic Plan for the electric and intelligent vehicle industrial cluster.

This cluster will bring together industry players to work on collaborative projects, including research and innovation.

Among other initiatives, cluster members will work together to streamline the service offer in greater Montréal with regard to prototyping, incubation, demonstration, and testing.

BOX 56

MOVIN' ON SUMMIT: A NEW MOVEMENT FOR SUSTAINABLE MOBILITY

The strength of Québec's innovation ecosystem is one of the reasons Montréal has been selected as the site of the Movin' On Global Summit for Sustainable Mobility, which takes place June 13 to 15, 2017.

Hosted by Michelin in partnership with C2 Montréal, the event will shine a global spotlight on Québec's sustainable mobility leaders. The Summit will offer networking opportunities that could lead to long-term collaborations and spur new projects in Québec.

Support for technology transfer by promoting innovative solutions in government contracts

Québec high-tech companies boast a vast range of expertise.

This is no less true when it comes to green technology. Our know-how extends to fields such as water treatment and water management, waste management and recycling, ambient air treatment, greenhouse gas reduction, soil treatment, and energy efficiency.

A common challenge: convincing the first buyer

Before they can successfully commercialize their innovations, Québec companies must overcome a common challenge—convincing their first buyer to purchase new technology.

This can be a difficult hurdle to clear. When they first bring their technology to market, companies usually need to make adjustments and optimizations, which can lead to delays and additional costs. That said, acquiring a first buyer (a "reference" customer) establishes a new technology's credibility and opens the door to commercialization on a larger scale.

Government procurement

Government procurement, whether by government ministries, public and broader public agencies, or municipalities, can play a major role in helping home-grown technologies achieve commercialization.

By selecting innovative technology and products, government buyers help break the impasse and reduce the risk associated with an unproven track record, making it easier for other potential buyers to embrace new technology.

Government buyers must, however, comply with established trade agreements in the performance of their jobs.

Two initiatives

With this in mind, the Québec Research and Innovation Strategy is proposing two initiatives:

Creation of a marketplace for government buyers and technology suppliers

First, a marketplace for government buyers and technology suppliers will be created, to shine the spotlight on Québec technology currently under development.

This will take the form of laboratories or exchange platforms similar to the INNO+ model, or the NovaCentris model, which is based on open innovation and allows companies to submit their requirements to a wide community of solution providers. A dozen or so activities are in the works.

Participation in technology showcases or reverse showcases

Centre de services partagés du Québec will also organize technology showcases and reverse showcases.

Support tool

A support tool will be created to guide and educate government buyers.

It will consist of the following:

- Current programs that promote technology trials in government contracts, such as the Build in Canada Innovation Program and the Québec City technology showcase program, which are open to Québec companies
- Financing programs that are already available: Sustainable Development Technology Canada, Technoclimat, Créativité Québec, the Green Municipal Fund, Ecofuel accelerator

This tool will be made available at events on eco-friendly government procurement (which is mandated by the government's sustainable development strategy) or the development of clean technology.

BOX 57

THE INNO+ MODEL

Écotech Québec is the author of the INNO+ formula, which identifies creative solutions to environmental challenges faced by businesses and organizations, and which could be adapted to the needs of government buyers.

During INNO+ networking workshops, SME technology companies are invited to present their solutions directly to organizations with environmental challenges.

For example, in 2013, INNO+ hosted a workshop for Bell, which was seeking energy-saving solutions.

Ten Québec companies showcased their technological solutions, and Carnot Refrigeration was awarded a contract to design a reliable and eco-friendly refrigeration system for Bell's server rooms.

Support to facilitate and spur green innovation.

To facilitate and spur green innovation, the government is announcing a measure that is partly inspired by a new French program—the France Expérimentation Initiative.

Using calls for projects, the program assists innovative project instigators whose development has been halted or impeded by regulatory provisions governing sustainable development.

This type of call for projects can be used to identify mitigation measures that target specific needs.

The measure seeks to

- use the permit application process to identify the most constraining or common challenges and bottlenecks that risk jeopardizing the development and commercialization of innovative solutions that otherwise meet many other sustainable development criteria;
- use the results of the above exercise to prioritize the identified challenges; and
- develop potential mitigation measures to test in pilot projects.

D Boost the transfer and impact of social and technological innovation

The fourth strategic priority takes a two-pronged approach to accelerating and augmenting the transfer and commercialization of innovation (both social and technological), to maximize its impact:

- Provide support for commercialization and transfer projects by strengthening existing programs through additional aid for sectoral industrial research coalitions and social innovation
- Implement a strategy to promote Québec research and innovation by investing in greater visibility for Québec products and services outside the province

Support for commercialization and technology transfer projects

Over the years the Québec government has launched many direct aid initiatives in support of innovative researchers and companies.

These have yielded positive results, and the government intends to continue its support for individual projects.

The government will maintain its current support for research and innovation projects whereby acquirers have the possibility of obtaining aid at any step in a project. The government will then consolidate its programs once their normative frameworks have expired.

This will ensure that the services available are comprehensive, consistent, and flexible and that they continue to meet the needs of companies, researchers, and organizations.

An increase in funding will allow us to

- stimulate greater collaboration among Québec research stakeholders in social and technological innovation;
- direct research in accordance with the needs of acquirers; and
- leverage the participation of industry players and federal funding bodies.

The current strategy will provide specific support for three types of projects:

- Social innovation projects ($5 million)
- Technological innovation projects ($5 million)
- Projects carried out by intermediation organizations specializing in technological innovation, such as sectoral industrial research coalitions ($49 million, including $25 million announced in the 2017–2018 Economic Plan and $24 million in new spending in 2018–2019

A strategy to promote Québec research and innovation

As part of the 2016–2020 Québec Export Strategy, the government is announcing two initiatives to promote the province's strategic sectors:

- Develop new tools to build awareness of Québec's sectors of excellence, including a YouTube channel promoting the province's expertise, current projects, and applications stemming from research and innovation
- Promote Québec products and services at major trade shows

Designing a communications strategy

Over the next five years, the government will earmark up to $800,000 for the design and implementation of a communications strategy.

In both form and content, the communication strategy will be adapted for new modes of communication and will use the power of digital technology to reach audiences that are usually overlooked by traditional promotional campaigns. A YouTube channel entitled "Voilà Québec" will promote Québec research and innovation.

The interministerial research and innovation committee will be in charge of selecting which research and innovation topics to prioritize under this measure, in collaboration with Secrétariat à la communication gouvernementale, Secrétariat à la jeunesse, and participating government ministries and agencies.

In-house government know-how will be tapped to hone the strategy's effectiveness. The promotional campaign will, by necessity, reach out to international audiences.

BOX 58

THE IMPORTANCE OF A COMMUNICATIONS STRATEGY

Reasons for investing in a communications strategy

There are many reasons why Québec must invest in a communications strategy:

- Québec must compete with other regions of Canada to recruit top talent and have access to the most promising technology. This will allow us to attract and build partnerships with companies enjoying the strongest economic growth.
- We must find ways to educate members of the Québec public about locally developed innovations. This will enhance their daily lives and introduce them to emerging technologies, helping to create new jobs and industries while giving existing industries fresh impetus.
- Québec needs entrepreneur researchers who are also good communicators, as today's policymakers and scientists must clearly communicate the results of publicly funded research and innovation projects.
- This communication component is all the more crucial at a time when policies are driven by scientific data, to keep the public well informed on a wide range of issues.

A good foundation in Québec

Québec already has a good foundation in place: a government in tune with the issues surrounding research and innovation, a chief scientist, Commission de l'éthique en science et en technologie, several popular scientific magazines including *Québec Science* and *Les Débrouillards*, Association de communicateurs scientifiques (association of scientific communicators, or ACS), and ACFAS, a scientific association with more than 5,000 members that will celebrate its centennial in 2023.

The province is also home to other active associations committed to innovation, such as Association pour le développement de la recherche et de l'innovation au Québec.

What needs to be developed is a way to talk about research and innovation that everyone understands and that truly engages stakeholders, producers, and user-producers.

Scientific communication

The ACFAS stresses that:

"Taken in the broad sense of the term, scientific communication begins when an individual communicates scientific information to someone else, whether by writing an article, a grant application or a micropost on Twitter, participating in a radio interview, or teaching.

The public will understand and retain a clear, concise, appropriate message.

This is the cornerstone of committed, diversified, inclusive science.

Sound scientific communication is essential to broaden the impact of research, all the more so because the current interdisciplinarity of the sciences requires effective communication to promote collaboration and innovation both inside and outside research teams in institutions and businesses."

When an institution or company is looking to do business abroad, the ability to make a good first impression with potential international partners can make all the difference.

We must therefore do whatever we can to boost the visibility of Québec's businesses and strategic sectors on the international stage and paint a positive picture of what we have to offer. Québec must take action to attract the interest of foreign customers and stand out from our global competition.

BOX 59

ABOUT "MY THESIS IN 180 SECONDS"

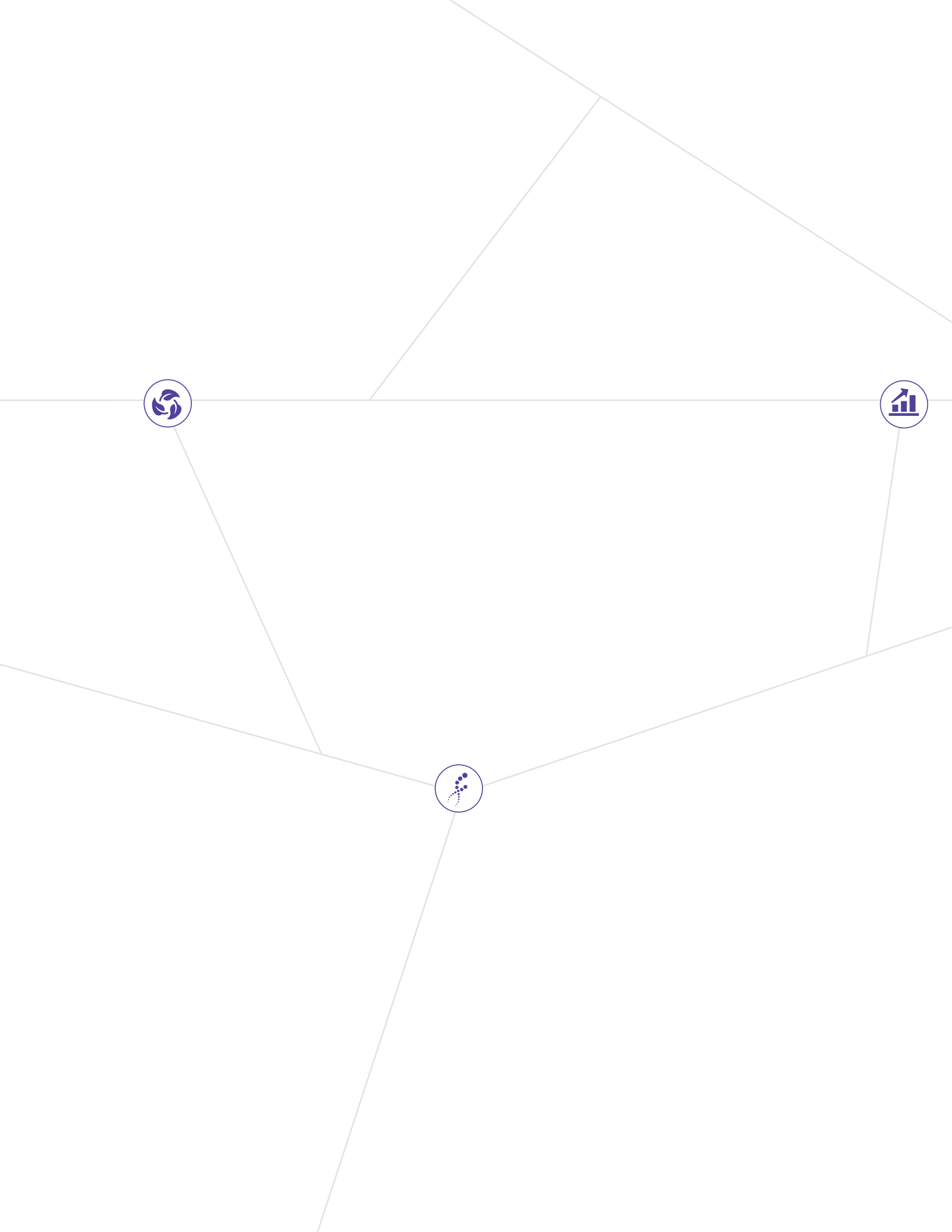
My Thesis in 180 Seconds is a competition that challenges doctoral students to present their research topics in plain language to a diverse and non-specialist audience. Each student must take no more than three minutes to make the thesis topic easily understandable in clear, concise and convincing language.

Organized by Acfas, the Québec competition is the first of its kind to be held in French. My Thesis in 180 seconds gives young researchers the opportunity to develop their communication skills and expose their work to the general public.

TABLE 60 **Financial framework – Third objective: Accelerate and augment the transfer and commercialization of innovation (in millions of dollars)**

	Impact on students, researchers, and innovators	Impact on SMEs	Impact on large enterprises	Impact on R&I institutions and organizations	Impact on the public	Impact on local governments and regions	Impact on education and health	Structural impact on the economy	TOTAL QRIS 5 YEARS[1]	TOTAL OTHER 5 YEARS[2]	GRAND TOTAL 5 EAYRS[3]
A) Support the ecosystem of innovation commercialization											
An integrated research and innovation ecosystem with greater collaboration among key actors, through QuébecInnove		X	X	X				X	2.00		2.00
Support for intermediation and commercialization organizations	X	X	X	X		X			4.76		4.76
Two inspirational projects: an AI supercluster and cutting-edge sawmill	X	X	X	X				X	100.00	13.00	113.00
B) Promote the creation and growth of innovative businesses through early adoption and the integration of innovation											
Increased funding for Startup Québec to support startups and innovative entrepreneurship	X	X							5.61	1.20	6.81
Support for innovative and scientific entrepreneurship in young people (Startup Youth)	X				X				2.50		2.50
Support for the development of innovation hubs throughout Québec	X	X	X	X	X				3.50		3.50
Support for industry 4.0 centers of expertise				X	X					0.87	0.87
C) Support projects that commercialize innovation											
Support for commercialization projects through the new Innovation Program	X	X		X	X	X			6.00		6.00
An inspirational project – support for the development of sustainable mobility solutions with the participation of key partners	X			X	X				1.50	15.40	16.90
Support for technology transfer by promoting innovative solutions in government contracts	X	X	X	X							
Support to facilitate and spur green innovation	X	X		X					0.05	0.10	0.15
D) Maximize the transfer of social and technological innovation and augment its impact											
Support for commercialization and technology transfer projects	X	X	X	X	X				59.00		59.00
A strategy to promote Québec research and innovation				X	X					0.80	0.80
TOTAL									**184.91**	**31.37**	**216.28**

1. Including grants awarded in 2016–2017 under the 2017–2018 Economic Plan that allow for the funding of new initiatives.
2. "Other" corresponds to "Funding from other sources, including the Life Sciences Strategy and the Maritime Strategy."
3. Note that totals may not equal the sum of the parts due to rounding.



4

IMPLEMENTATION OF THE QUÉBEC RESEARCH AND INNOVATION STRATEGY

The Québec Research and Innovation Strategy covers the 2017–2022 period.

- To explain the implementation process, the following items are detailed below:
  - Targets for 2022
  - Deployment of the Strategy
  - 2017–2022 financial framework

A Targets for 2022

BOX 61

TARGETS

- Overall Strategy target
  - By 2022, move Québec into the top ten OECD leaders in research and innovation
  - By 2030, transform Québec into one of the world's most innovative and creative societies, recognized as an incubator of talent, ideas, and innovation and capable of facing major social challenges.
- Develop talent and skills and prepare the next generation
  - Boost Québec's ranking (5th place) in Canada for the proportion of workers with university degrees (private- and public-sector employees) in relation to the total number of employees in the workforce.
- Increase the province's capacity for research and innovation in all its forms
  - Boost Québec's ranking (10th place) among the top ten OECD rankings for number of people in academic research and development per 1,000 active workers.
  - Boost Québec's ranking (7th place) among the top ten OECD rankings for number of people in corporate research and development per 1,000 active workers.
- Accelerate and augment the transfer and commercialization of innovation
  - Move Québec (12th place) into the top ten OECD rankings for investment in IT and communication businesses, measured as a percentage of GDP.
  - Improve Québec's ranking (4th place) within Canada for the percentage of innovative businesses in the province (engaged in one of the four types of innovation: product, process, organizational, and marketing)

B Deployment of the Strategy

- The Québec Research and Innovation Strategy includes a large number of initiatives and new measures, built around three objectives.
  - The Strategy's deployment and ultimate success will depend in large part on effective coordination of these diverse initiatives and the full collaboration of partners.
  - The government is taking specific actions to
    - strengthen collaboration and synergy among various partners;
    - better coordinate government efforts; and
    - make the government a catalyst for change.

Strengthen collaboration and synergy

Research and development involves the participation of many partners. In Québec, a large number of stakeholders, individuals, companies, and organizations are actively committed to research and innovation.

The consultation process that produced the Québec Research and Innovation Strategy tapped into this richness and diversity through regional issues tables, public consultations, codevelopment workshops, an advisory committee, and an interministerial committee.

Drawing on best practices, the government intends to place even more emphasis on collaboration. Our ability to build effective partnerships will give Québec a competitive edge.

To compete on a global level, we must develop flexible and nimble research and innovation systems. Our innovation system must allow for greater integration to optimize R&D results, maximize our technology transfer capacity, and reap the maximum benefits.

To this end, the government will provide support to startups, innovative entrepreneurship, innovation hubs, and industry 4.0 centers of expertise, with initiatives to build bridges between research and innovation stakeholders on the one hand and industry players and professional development resources on the other.

QuébecInnove will help research and innovation organizations strengthen their capacities, build synergies, and identify common touch points. It will also augment the services it provides to companies working on research and development projects.

Better coordinate government efforts

The consultation process revealed that government resources are sometimes underutilized, which could hamper our ability to achieve the Strategy's objectives.

At times there is a lack of coordination between policies and programs, limiting the flow of information and impeding access to government services by internal and external partners and potential clients.

By better coordinating our programs and providing improved, integrated services, we will see a more efficient use of government resources and a more effective distribution of research and innovation funding, leading to improved results.

One such example is the creation of Transition énergétique Québec, whose mission is to support, stimulate, and promote energy transition, innovation, and efficiency and coordinate the implementation of all programs and measures necessary to achieve the energy targets defined by the government.

Guiding principles

In 2016–2017 the interministerial committee on economic development examined the various forms of direct support provided to investment and innovation. From this, it drew up guiding principles for government ministries and agencies to follow in developing and reviewing financial aid programs.

These guiding principles can now be applied to direct support programs for innovation and investment aimed at for-profit companies and collective entrepreneurship enterprises looking to boost their productivity.

Maintaining the interministerial committee on research and innovation

The government will maintain the interministerial committee on research and innovation to offer direction on how to support research and innovation.

This committee will be overseen by a unit within MESI (Science and Innovation Sector) tasked with promoting and supporting innovative projects. The committee will work to improve the government's service offer, in partnership with stakeholders from the research and innovation ecosystem.

The committee will organize innovation "gatherings" and "sessions" to help the government adapt and evolve and to ensure efficient and effective program delivery.

This will provide a collaborative platform that fosters government innovation, both external and internal, and encourages innovation among government personnel.

The objectives are as follows:

- Help transform the government to ensure its global competitiveness, through public innovation supported by digital technology
- Stimulate and support innovative government initiatives to meet society's major challenges, through the development of public policy and by improving the government's service offer through open innovation

Other support

This work could be supported by the Chief Scientist, the Québec Research Fund, and Commission de l'éthique en science et en technologie.

The Commission draws attention to ethical concerns related to science and technology and provides expert advice to the government on these issues.

Make the government a catalyst for change.

The Québec Research and Innovation Strategy will make the government a true catalyst for change, thanks to two initiatives:

- The public innovation laboratory
- Access to data and the use of open data

The public innovation laboratory

In its effort to improve societal outcomes, the government must gradually move away from a linear and sequential approach to policymaking and embrace a model that prioritizes open innovation—one that harnesses the various components of Québec society through partnerships and collaborations with the general public, civil society, and the private sector.

This entails a reconfiguring of the responsibilities shared between the government and various social actors. We will need to adopt new practices to leverage the creativity of government agents, in order to achieve effective public policy and deliver quality services and products, among other goals.

The emergence of this new paradigm, which will transform government through innovation, will require us to

- facilitate the co-design and co-creation of innovative solutions by the government, the general public, civil society, and the private sector;
- adopt new collaborative models for the delivery of government services;
- make room for innovative disruptive technology (big data, social networks, cloud computing, etc.); and
- encourage public servants to be bold in embracing experimentation and entrepreneurship. These principles must become embedded within a new culture throughout the entire public sector ecosystem, to achieve better results in terms of quality, efficiency, equity, transparency, and accountability.

For example, with regard to research and innovation, these principles will help strengthen our prioritization process and modernize our approach to funding.

The interministerial committee on research and innovation will be tasked with investigating the creation of a public innovation laboratory—PublicLab—within the provincial government, in consultation with expert advisors.

This public laboratory will bring together a team dedicated to creative thinking and experimentation who will test and evaluate innovative solutions to society's greatest challenges.

They will develop new ideas for public policy and examine ways to improve government services through innovation (design thinking, co-creation, user-driven development, etc.).

The laboratory will also explore the potential of digital technology.

Access to data and the use of open data

In May 2012 Québec committed to becoming an open government.

Open data is the cornerstone of a new partnership the government intends to build with the public. An open data approach has many benefits: it boosts transparency, encourages citizen engagement, fosters the development of new services, and helps grow the economy.

Government data is a great collective asset, and making it more readily available will produce many positive outcomes for Québec. Greater connection with the public is a key part of open government.

Initiatives already underway

In April 2016 the government launched the new Données Québec website, which now contains close to 800 data sets.

Many Québec cities and towns—including Montréal—have adopted open data policies, setting their scope and outlining the roles and responsibilities of administrative units. The Cities of Gatineau, Laval, Montréal, Québec, and Sherbrooke have worked with the Québec government to implement the Données Québec platform, which provides for improved access to open data of public interest. Other municipalities, such as Rimouski and Shawinigan, are now distributing certain data through this interface.

Québec government ministries and agencies can learn from these cities' approaches to open data in particular and to open government in general. This move to open government will require a major cultural shift on the part of the public service.

BOX 62 DONNÉES QUÉBEC (QUÉBEC'S OPEN DATA COLLABORATIVE PLATFORM) AND PORTAIL DE L'INNOVATION MUNICIPALE (HOSTED BY UNION DES MUNICIPALITÉS DU QUÉBEC)

Données Québec is a data-sharing platform created jointly by Québec municipalities and the provincial government.

Données Québec is a repository for open data of public interest produced by a number of different organizations. A host of data collectors are helping the Québec government reach out to the public, with more than 800 data sets now available for consultation.[1]

Portail de l'innovation municipale

The Ovation Award of Merit is given to municipalities (regardless of size, population, or geographic location) that have set themselves apart by innovating, creating, or developing an activity, program, or project to improve their residents' quality of life.

Many of these award-winning initiatives can be found on Québec's Portail de l'innovation municipale, hosted by Union des municipalités du Québec.[2]

Source 1 (in French): https://www.donneesquebec.ca

Source 2 (in French): https://umq.qc.ca/prix-et-innovations/merite-ovation-municipale/portail-innovation-municipale.

Support innovative economic development initiatives by leveraging open data

The 2017–2019 Action Plan on Open Government will contain specific measures for the proactive release of data to the Québec government and the public.

Under the Québec Research and Innovation Strategy, the government will support innovative economic development initiatives by leveraging open data.

MESI has committed to the following deliverables:

- The publication of a study on the use of open data and the types of potential users, and the development of strategies to reach these users
- A pilot project aimed at increasing the use of open data among a select group of companies

A business support program could be developed based on the pilot project's results.

Encourage research by facilitating access to data

Thanks to new technology, it is now possible to analyze and leverage big data for the benefit of the knowledge economy.

Providing researchers with access to personal information data held by government ministries and agencies (such as health information) is key to stimulating research and innovation in Québec. Data produced by researchers must also be shared and disseminated to optimize knowledge transfer and spur research.

The government must therefore provide conditions that make it easier to access certain of its databases for research purposes. This data (health data in particular) has enormous scientific and economic potential, and it must be leveraged to ensure excellence in research.

A working committee

Under the Québec Research and Innovation Strategy, the government will establish a working committee to develop a general procedure for accessing certain databases for research purposes (particularly health care research).

This working committee was announced as part of the 2017 Québec Economic Plan. This initiative is one of a series of measures that will benefit the public by creating a more open government.

As part of its mandate, the committee will also

- assess how Institut de la statistique du Québec could improve its service offer through access to open data;
- identify the resources required to implement the data access procedure;
- identify the legislative and regulatory changes required; and
- ensure the protection of personal information.

The committee will report to Ministère des Finances and be made up of representatives from MSSS, MESI, Institut de la statistique du Québec, Régie de l'assurance maladie du Québec, Commission d'accès à l'information, and Secrétariat à l'accès à l'information et à la réforme des institutions démocratiques.

Consultations may also be held to gather proposals from various stakeholders on such topics as the implementation of security measures for protecting personal information.

The committee is slated to complete its work and deliver its recommendations to the government by the fall of 2017.

TABLE 63 **Financial framework – Strategy implementation (in millions of dollars)**

	Impact on students, researchers, and innovators	Impact on SMEs	Impact on large enterprises	Impact on R&I institutions and organizations	Impact on the public	Impact on local governments and regions	Impact on education and health	Structural impact on the economy	TOTAL QRIS 5 YEARS[1]	TOTAL OTHER 5 YEARS[2]	GRAND TOTAL 5 YEARS[3]
Strengthen collaboration and synergy	X	x	x	x		x		X			
Better coordinate government efforts	X	X	x	x		X		X	0.55		0.55
Make the government a catalyst for change.		x			x	x		X			
TOTAL									**0.55**	**0**	**0.55**

1. Including grants awarded in 2016–2017 under the 2017–2018 Economic Plan that allow for the funding of new initiatives.
2. "Other" corresponds to "Funding from other sources, including the Life Sciences Strategy and the Maritime Strategy."
3. Note that totals may not equal the sum of the parts due to rounding.

C 2017–2022 financial framework

TABLE 64 **2017–2022 Financial Framework of the Québec Research and Innovation Strategy – Summary (in millions of dollars)**

	2016–2017[1]	2017–2018	2018–2019	2019–2020	2020–2021	2021–2022	Total[2]
Objective 1: Develop talent and skills, and prepare the next generation	0.00	14.10	26.83	29.58	30.98	30.98	132.45
Objective 2: Increase the province's capacity for research and innovation in all its forms	90.00	21.64	33.52	36.47	42.72	42.72	267.09
Objective 3: Accelerate and augment the transfer and commercialization of innovation	75.00	4.26	9.60	28.85	31.10	36.10	184.91
Strategy implementation			0.05	0.10	0.20	0.20	0.55
Total QRIS	**165.00**	**40.00**	**70.00**	**95.00**	**105.00**	**110.00**	**585.00**
Investments outlined in the QRIS and those from other sources, including the Maritime Strategy, support earmarked for mining research, and the Climate Change Action Plan	31.72	17.77	16.30	17.58	12.20	10.35	105.92
Total 5 years							
Funding – QRIS							585.00
Funding from other strategies related to research and innovation (announced under the 2017–2018 Economic Plan)							248.60
Other funding announced in the 2017–2018 Economic Plan							5.60
Base budget and announcements made prior to the 2017–2018 Economic Plan related to QRIS measures[3]							1,420.82
Investment in research infrastructure							490.40
Funding for the Climate Change Action Plan (2013–2020) present in the QRIS							26.00
TOTAL – Revenue cost and investment							**2,776.42**
Estimated cost of tax expenditures							2,600[4]
Overall total							**5,376.42**

1. Grants awarded in 2016–2017 under the 2017–2018 Economic Plan that provide funding for new initiatives.
2. Note that totals may not equal the sum of the parts due to rounding
3. Base budgets do not take into account funding of research infrastructure
4. Estimate by Ministère des Finances, including R&D tax credits, the Innovative Companies Deduction, and foreign researchers and experts tax holidays.

CONCLUSION

With the release and launch of this new Québec Research and Innovation Strategy, the government of Québec is aiming high.

By 2030 the government expects Québec to be one of the world's most innovative and creative societies, recognized as an incubator for talent, ideas, and innovation and possessing a can-do approach to major societal challenges. By 2022, the goal is for Québec to be ranked among the top ten OECD countries for research and innovation.

The means to do the job

The government is making a big financial commitment to this challenge. Over the next five years, $830 million in new money will be available for research and innovation under the Québec Research and Innovation Strategy and other related strategies and government initiatives.

Counting MESI's base budgets, new investment in infrastructure, and the various tax measures currently in force, the government will have invested almost $5.4 billion in research and innovation by 2022.

The Québec Research and Innovation Strategy has been drawn up with three clear objectives in mind, corresponding to the three major challenges facing Québec:

- We must nurture talent and skills, and prepare the next generation.
- We must increase Québec's capacity for all forms of research and innovation.
- At the same time, we must increase the pace and scope of innovation transfer and commercialization.

These objectives encompass the entire innovation chain and concern all phases, from the initial idea to commercialization and development of the product, process, or method.

More than thirty measures and seven inspirational projects will be put in place to achieve these objectives and make society even more innovative, for the greater benefit of all of Québec and all of its regions.

Governance and collaboration

The Québec Research and Innovation Strategy will be founded on new structures and governance, for easier access to partnerships and funding. And we will work with our partners to track and record our success, determine whether our targets have been met, and make adjustments accordingly.

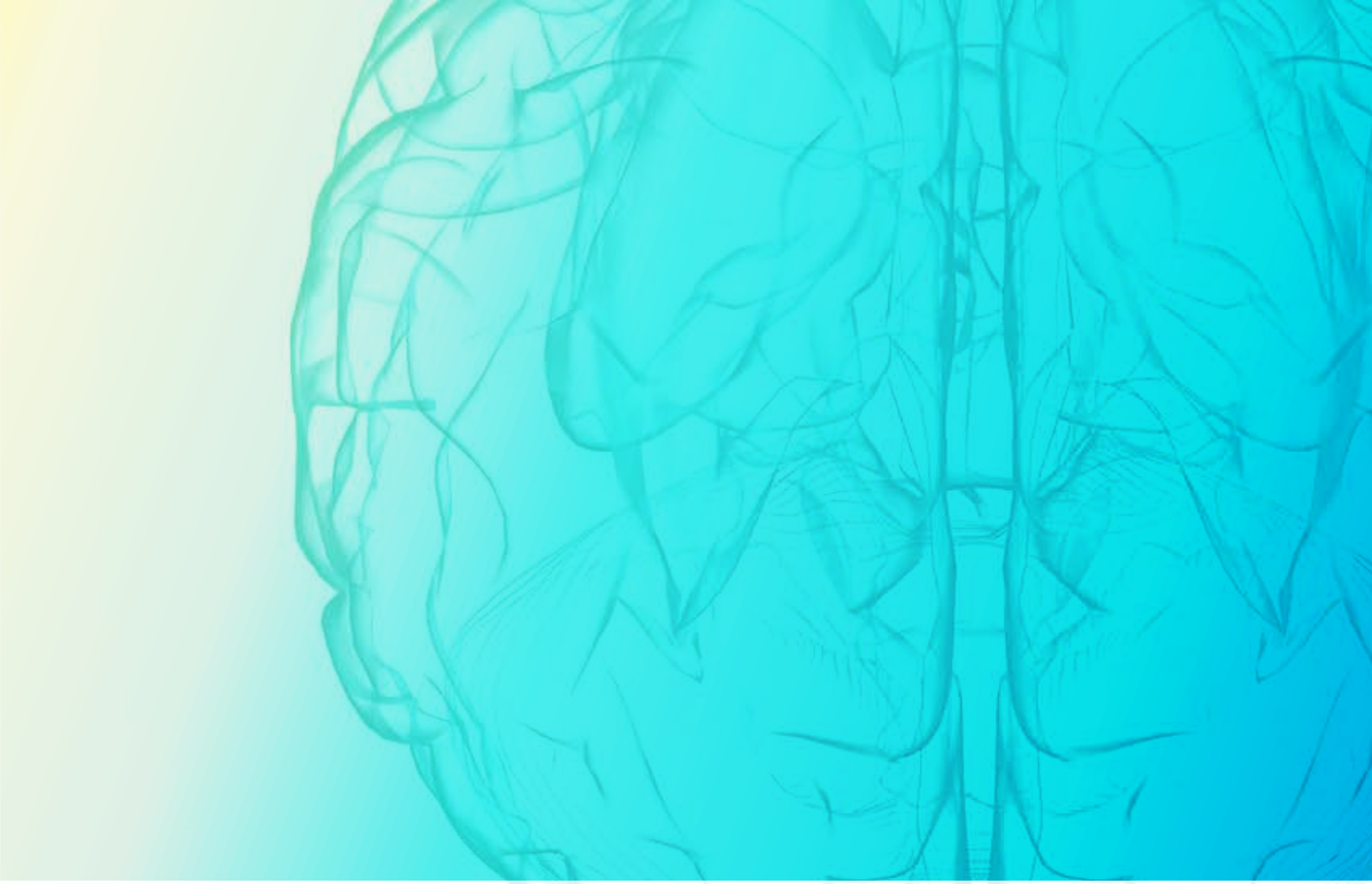
The government believes that actions must be driven by close collaboration between public and private stakeholders. Research development, speedier commercialization, and adoption and use of innovations hinge on this type of collaboration.

The Québec Research and Innovation Strategy, the result of extensive consultations, illustrates how our knowledge-based society in Québec is founded on the excellence and diversity of all those who contribute to it—researchers, businesses, institutions, organizations, and the public itself. It also reaffirms the importance of the government as an agent for change in the promotion and use of innovation.

The principles of sustainable development will be taken into account to allow not only for economic development but also for social development and environmental protection.

DARE to Innovate

With the Québec Research and Innovation Strategy, the government is calling on the audacity and creativity of Quebecers and urging that we develop a culture of innovation throughout society, so that everyone has the right knowledge, skills, and qualifications to DARE to Innovate.



APPENDICES

Appendix 1 – Indicators

Québec Research and Innovation Performance[16]

Indicator	Objective for the indicator	Ranking	Deviation (in relation to average of the OECD top ten and the leader in Canada)	Deviation (in relation to the 10th OECD country and the 3rd Canadian province)	OECD leaders	
R&D expenditure intensity (GERD/GDP) (2013 data) 2.30%	Bring Québec into the top 10	13th	-0.83	+0.44	1. Korea 4.15	6. Denmark 2.97
					3. Japan 3.31	8. Austria 2.97
					4. Sweden 3.31	9. Germany 2.82
					5. Finland 3.29	10. United States 2.74
Business enterprise R&D expenditure intensity (GERD/GDP) (2013 data) 1.28%	Bring Québec into the top 10	14th	-0.90	-0.60	1 Israel 3.49	6. Austria 2.10
					2. Korea 3.26	7. Switzerland 2.06
					3. Japan 2.52	8. Slovenia 1.99
					4. Sweden 2.28	9. United States 1.93
					5. Finland 2.26	10. Denmark 1.88
Higher education R&D expenditure intensity (HERD/GDP) (2014 data) 0.90%	Maintain or improve the ranking	3rd	+0.22	+0.26	1. Denmark 0.98	6. Finland 0.72
					2. Sweden 0.91	7. Iceland 0.66
					3. QUÉBEC 0.90	8. Canada 0.65
					4. Switzerland 0.88	9. Estonia 0.64
					5. Austria 0.74	10. Netherlands 0.64
Percentage of R&D funded by businesses (2013 data) 49.4%	Bring Québec into the top 10	15th	-12.22	-11.38	1. Korea 75.68	6. Belgium 61.32
					2. Japan 75.48	7. Sweden 60.96
					3. Germany 65.44	8. Finland 60.84
					4. Slovenia 63.85	9. United States 60.79
					5. Australia 61.91 (2008)	10. Switzerland 60.78 (2012)
Investment by businesses in ICT as a % of GDP (2013 data) 2.38%	Bring Québec into the top 10	12th	-0.80	-0.23	1. Denmark 3.51	6. Austria 3.13
					2. Switzerland 3.28	7. Belgium 2.95
					3. United States 3.25	8. Netherlands 2.78
					4. Sweden 3.23	9. Australia 2.62
					5. Japan 3.23	10. United Kingdom 2.61
Number of research and development workers per thousand active workers (2013 data) 15.4	Maintain or improve the ranking	6th	0.00	+0.60	1. Israel 21.4 (2012)	6. QUÉBEC 15.4
					2. Denmark 19.8	7. Austria 15.3
					3. Finland 19.7	8. Switzerland 15.3 (2012)
					4. Sweden 15.8	9. Slovenia 15.1
					5. Korea 15.5	10. Iceland 14.8

16. For comparison, rankings produced by the Conference Board of Canada are shown in Appendix 2.

Indicator	Objective for the indicator	Ranking	Deviation (in relation to average of the OECD top ten and the leader in Canada)	Deviation (in relation to the 10th OECD country and the 3rd Canadian province)	OECD leaders	
Number of academic research and development workers per thousand active workers (2013 data) 4.8	Maintain or improve the ranking	10th	-0.7	+0.1	1. Denmark 7.2	6. Switzerland 5.5 (2012)
					2. Iceland 6.5	7. Portugal 5.3
					3. Australia 6.2	8. New Zealand 4.9
					4. Finland 5.8	9. Greece 4.8
					5. United Kingdom 5.5	10. QUÉBEC 4.8
Number of commercial research and development workers per thousand active workers (2013 data) 9.8	Maintain or improve the ranking	7th	-1.1	+0.9	1. Israel 17.7	6. Austria 10.7
					2. Denmark 12.0	7. QUÉBEC 9.8
					3. Finland 11.3	8. Slovenia 9.7
					4. Korea 11.2	9. Switzerland 9.7 (2012)
					5. Sweden 11.0	10. Japan 8.9
Labor productivity (2015 data) 45.7	Improve the ranking	20th	-24.2	-20.0	1. Luxembourg 95.0	6. United States 68.3
					2. Ireland 91.8	7. France 67.1
					3. Norway 82.3	8. Netherlands 67.1
					4. Belgium 72.1	9. Germany 66.6
					5. Denmark 69.7	10. Switzerland 65.6
Number of scientific publications per 100,000 population (2014 data) 159	Maintain or improve the ranking	12th	-38	+7	1. Switzerland 315	6. Australia 195
					2. Denmark 266	7. Japan 195
					3. Iceland 260	8. Norway 195
					4. Sweden 227	9. Netherlands 188
					5. Finland 199	10. Belgium 166
Proportion of workers with university degrees (public and private sector employees) (2015 data) 26.4%	(*OECD data is not available.*) Improve Québec's ranking in Canada	5th	+1.0	-2.2	1. Ontario 33.9%	6. Prince Edward Island 25.5%
					2. British Columbia 29.6%	7. Manitoba 24.9%
					3. Nova Scotia 29.1%	8. Saskatchewan 23.4%
					4. Alberta 28.4%	9. New Brunswick 23.2%
					5. QUÉBEC 26.4%	10. Newfoundland 20.4%
Percentage of innovative companies (those that use one of the 4 types of innovation: product, process, organizational, or marketing) (2010–2012) 60.9%	(*OECD data is not available.*) Improve the ranking	4th	-0.6	-1.2	1. Ontario 71.2%	4. QUÉBEC 60.9%
					2. Canada 63.5%	5. Rest of Canada 58.7%
					3. Alberta 62.1%	6. Atlantic provinces 45.8%

Appendix 2: The Conference Board of Canada's Innovation Report Card for Canadian Provinces

What does the provincial innovation report card look like?

Report card											
INNOVATION INDICATORS	**Canada**	**N.L.**	**P.E.I.**	**N.S.**	**N.B.**	**Que.**	**Ont.**	**Man.**	**Sask.**	**Alta.**	**B.C.**
Public R&D	B	C	A	A+	C	A	A	B	D	D	C
Researchers	D	D–	D–	D–	D–	C	C	D–	D–	D–	D
Connectivity	C	C	B	D	C	C	B	D	C	B	B
Scientific articles	B	C	C	A	D	B	B	B	B	B	B
Entrepreneurial ambition	A	B	n.a.	B	n.a.	B	A	A	A+	A+	A+
Venture capital investment	B	C	D–	D	D	A	B	D–	D	D	A
Business enterprise R&D	D	D–	D–	D–	D–	C	D	D–	D–	D–	D–
ICT investment	C	D	B	C	D	C	B	C	D	C	C
Patents	D	D–	D–	D–	D–	D	D	D–	D–	D	D
Enterprise entry rate	n.a.	A	A	D	C	D	B	B	A	A	B
Labor productivity	C	B	D–	D	D–	D	D	D	C	B	D

Note: Data for the most recent year available were used. For details on methodology and data sources, see the "Methodology and Data" section of the website.

Source: Conference Board du Canada

Appendix 3: How Policies, Strategies, and Action Plans Fit Together

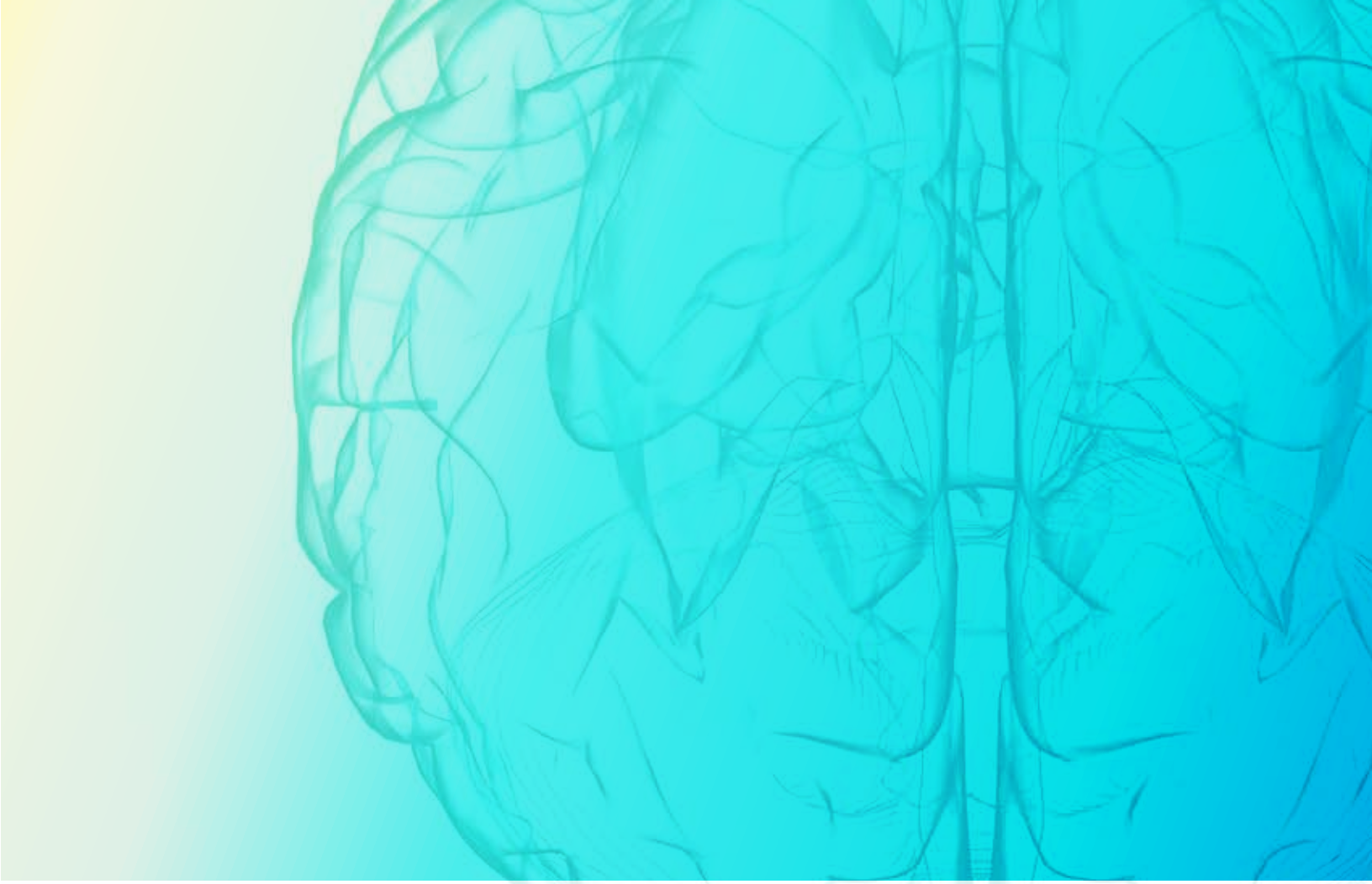
Québec government policies, strategies, and action plans with R&D components and how they fit together

Policies, strategies, and action plans	Workforce and skills[1]	R&d and promotion[2]	Commercialization and transfer[3]	Entrepreneurship[4]
Ministère de l'agriculture, des pêcheries et de l'alimentation				
1. Québec phytosanitary agricultural strategy 2011–2021		•		
2. 2013–2018 Action plan: building our commercial fisheries and aquaculture industry		•		
3. Biofood policy (in development)		•	•	
Ministère de la culture et des communications				
4. Digital culture plan (2014–2017)	•	•	•	•
Ministère du développement durable, de l'environnement et de la lutte aux changements climatiques				
5. 2013–2020 Climate change action plan (priorities only)		•	•	
6. Government sustainable development strategy 2015–2020 (objectives only)		•	•	
Ministère de l'économie, de la science et de l'innovation				
7. Government social economy action plan 2015–2020		•	•	
8. Québec aluminum development strategy 2015–2025	•	•	•	
9. Digital economy action plan 2016–2021	•	•	•	•
10. 2016–2020 Québec export strategy		•	•	
11. 2016–2026 Québec aerospace strategy	•	•	•	•
12. Québec life sciences strategy (in development)		•	•	•
13. Québec research and innovation strategy	•	•	•	•
14. Government entrepreneurship action plan (in development)	•		•	•
15. Digital strategy (guidelines only) (in development)	•	•	•	•
Ministère de l'éducation et de l'enseignement supérieur				
16. Action plan for school success (in development)		•		
Ministère de l'éducation et de l'enseignement supérieur et ministère du travail, de l'emploi et de la solidarité sociale				
17. Digital action plan for schools, higher education, and skills development (in development)	•			
Ministère de l'énergie et des ressources naturelles				
18. 2030 Energy policy		•		
Ministère de la famille				
19. Policy on aging and living together (2012–2017 action plan)		•	•	
20. 2015–2018 Joint action plan to prevent and respond to bullying		•	•	
Ministère de la forêt, de la faune et des parcs				
21. Sustainable forest management strategy (2015)		•		
22. Wood innovation work plan (2016)		•	•	
Ministère de l'immigration				
23. Radicalization in québec: prevention, action, detection, and life together –2015–2018 government action plan	•	•		

Policies, strategies, and action plans	Workforce and skills[1]	R&d and promotion[2]	Commercialization and transfer[3]	Entrepreneurship[4]
Ministère de la santé et des services sociaux				
24. 2015–2020 Interministerial action plan on homelessness	•	•		
25. 2015–2020 Ministerial action plan on the prevention and control of nosocomial infections	•	•		
26. 2015–2020 Mental health action plan		•		
27. 2015–2020 Development plan for palliative and end-of-life care	•	•		
Ministère de la sécurité publique				
28. 2013–2020 Disaster prevention framework		•		
Ministère du tourisme				
29. 2012-2020 Tourism industry development plan	•		•	
Ministère des transports, de la mobilité durable et de l'électrification des transports				
30. 2015–2020 Transportation electrification action plan	•	•	•	
Secrétariat du conseil du trésor				
31. Government strategy for information technology (2015)		•	•	•
Secrétariat aux affaires maritimes				
32. Maritime strategy (2015–2020 action plan)	•	•	•	
Secrétariat à la jeunesse				
33. 2016–2021 Youth action strategy	•	•		
Secrétariat à la condition féminine				
34. Government strategy to prevent and respond to sexual violence 2016–2012	•	•		
35. Government strategy for gender equality (in development)	•			
Société du plan nord				
36. Plan nord toward 2035 – 2015–2020 action plan	•	•		

Legend : • Measure(s) in this area

1. and skills refers to any type of assistance in promoting, recruiting, training, or developing knowledge and skills relating to science, research, and innovation or in ensuring that workers adapt and maintain their employability when innovative organizational change is taking place (e.g., internships, scholarships, etc.).
2. R&D and R&D development refer to help in the creation, development of expertise about, validation, or technological demonstration of new or substantially improved goods, services, and operations (TRL 1 to 6).
3. Commercialization and transfer refers to any type of support for the commercialization (including precommercialization) or transfer of research results to environments where innovative goods and services are used in domestic or foreign markets (TRL 7+).
4. Entrepreneurship includes any assistance in promoting, educating people about, or supporting private or collective technological entrepreneurship.



GLOSSARY

5G technology

The fifth generation of mobile telephone standards, after 4G+. By 2020, 5G technology could support mobile telecommunication speeds of many gigabytes of data per second, up to 1,000 times faster than the 2010 mobile networks and up to 100 times faster than 4G.

Accelerator

An organization or structure that provides short-term support for startups in their growth phase. Support is in the form of training, mentoring, and short-term financing.

Additive manufacturing (3D printing)

Set of techniques used to create products through the addition of materials in layers, often using a computer-assisted design tool.

Applied research

Research with a practical objective aimed at meeting a specific human need. Applied research puts scientific knowledge into practice. It is the intermediate stage between discovery and daily use, or the first step towards converting scientific knowledge into technology. An example is the use of a theoretical understanding of the reading process to research a more effective method of teaching students how to read.

Artificial intelligence (IA)

Ability of machines and systems to acquire and use knowledge and thus behave in an intelligent way.

Basic research

Research undertaken to acquire new knowledge and new areas of investigation, without a specific practical objective. Researchers seek better knowledge and understanding of a substance but do not consider the immediate practical application of the new knowledge they acquire.

Big data

A large amount of data from multiple sources (e.g., bank transactions, social networks, e-commerce, mobile telephones) that must be organized using analytical technology before it can be processed or analyzed.

Blockchain

Technology used to store and send information through computer networks.

Business incubator

An organization or structure that offers support to innovative startups to boost their chances of success. Business coaching is an example of specialized assistance to companies. Specialized assistance may also include access to laboratory facilities, scientific equipment, or financial support.

Cloud computing

On-demand access via the Internet to infrastructure (e.g., networks, servers) and services (e.g., email, management software packages, data storage) in real-time.

Commercialization of innovation

The process of bringing an innovative product or service to the market.

Culture of innovation

According to Nicola Hepburn, an approach that fosters creative thinking and helps extract economic and social value from knowledge. As a result, a culture of innovation generates new or improved products, services, or processes. A healthy culture of innovation has a shared set of values and mutually reinforcing beliefs about the importance of innovation as well as an integrated pattern of behavior that supports research and innovation. A culture of innovation thrives in an ecosystem adapted to its needs.

Digital technology

Information and communication technology incorporated and used in all functions and departments of a business or organization to collect, store, analyze, share, and send digital information to employees, customers, and suppliers.

Emerging technology (or disruptive technology)

According to the World Economic Forum, technology that

- arises from new knowledge or the innovative application of existing knowledge;
- leads to the rapid development of new capabilities;
- is projected to have significant systemic and long-lasting economic, social, and political impacts;
- creates new opportunities for and challenges to addressing global issues; and
- has the potential to disrupt or create entire industries.

Thanks to its vast potential for innovation, emerging technology can result in new commercial products, new approaches to the protection of human health, and improvements to health care.

Emerging technology is also a challenge for regulatory entities because the products it creates can be used in many different industries and applications, with potential risks and benefits that are unknown. Moreover, the rapid development of emerging technology calls for a prompt overhaul of regulatory schemes to ensure effective oversight for products created using this type of technology.

Hub

A geographic area centered on a dominant industrial sector comprising companies, research centers, and training organizations that share a vision, resources, and development strategies. These entities seek to optimize their individual performance, stand out from the competition, and develop international visibility.

Industrial research

Scientific work aimed at achieving a breakthrough or expanding knowledge of environments, automation, equipment development, or industrial testing.

Industry 4.0

The fourth industrial revolution, bringing digital technology to industrial processes. Under Industry 4.0 smart factories are characterized by continuous, instant communication between the various tools and workstations along the production and supply chains. The Industry 4.0 concept is a new way of managing production methods. So-called smart factories allow for more flexible production and more efficient allocation of resources, setting the stage for a new industrial revolution. For example, Industry 4.0 factories might use

- PLCs to manage production;
- sensors capable of collecting, processing, and sending information;
- software for managing the lifecycles of their products; or
- any of the emerging technologies in advanced manufacturing

Information and communication technology (ICT)

Technology arising from the convergence of IT and advanced multimedia and telecommunication technology (including the Internet). Information can be produced, accessed, distributed, and shared, and users can communicate efficiently, because content is processed faster and stored in a memory.

Innovation

Creation and introduction of new or substantially improved goods, services, or processes to a market or a variety of user environments. Examples would include new or substantially improved production or distribution methods, marketing methods, or organizational methods. Innovation exists in many different forms, including process innovation, product innovation, social innovation, and organizational innovation.

Innovation marketing

Marketing techniques or practices specific to innovation.

Innovative company

A company that has introduced a major change or a new feature in at least one of the four innovation categories: product innovation, process innovation, organizational innovation, and marketing innovation.

Inspirational project

A large-scale initiative within the scope of the QRIS to support new research and innovation projects addressing specific issues. Inspirational projects tackle well-defined, known problems associated with performance and with Québec's societal challenges (e.g., Learning Prototypes in Innovative Fields, the artificial intelligence supercluster).

Intellectual property

The intangible or intellectual nature of works or creations and the legislation governing these properties. There are six types of intellectual property: patents, trademarks, industrial designs, confidential information, copyright, and layout designs of integrated circuits.

Intermediation organization

An organization that specializes in projects undertaken jointly by businesses and research entities. These organizations serve as a platform for the development and funding of collaborative research and cocreation projects that bring businesses, nonprofit organizations and entities, and public research institutions together.

By collaborating in this way, participants can share the costs and risks involved in certain research projects, bring public research into alignment with industrial research and research on social innovation, facilitate the transfer of knowledge, and foster strategic alliances. In addition, intermediation organizations help obtain the funding needed for demonstration projects and ultimately for the transfer of technology to companies that will use it.

Internet of things (or connected systems)

A communications network that can process data from all types of machines and devices, extracting information to simplify operations, facilitate decision making, and generate savings for businesses (for example, smart meters, remote medical follow-up, farmland irrigation management, devices for tracking and monitoring truck fleets).

Knowledge-based society

A society that relies on the depth and value of its citizens' knowledge, expertise, and know-how.

Knowledge transfer

Processes and activities aimed at leveraging knowledge obtained through research, to encourage decision makers to use or adopt such knowledge. Transfer is a catalyst for innovation, whether technological, organizational, or social.

Literacy

Reading and writing abilities that people need to function in society. The required level of knowledge changes over time and varies from one society to the next. Knowledge acquired must allow individuals to read and understood three types of texts:

- Narrative texts (newspaper articles)
- Schematic texts (road maps)
- Quantitative texts (loan interest calculation)

Literacy levels can be used as economic indicators. The higher an individual's literacy level, the better his or her chances of earning a living.

Nanomaterial

Material with dimensions on a nanoscale.

Nanosatellite (or microsatellite)

Miniature satellite.

Neurotechnology

Methods of artificial interaction between the brain and the nervous system to study, access, and manage the structure and function of the neuronal system.

Open data

Raw, non-identifying data that is not subject to copyright, is produced or collected by a public or private entity, and is publicly available on the Internet. Ideally, this type of data is accessed in open (non-exclusive) format so it is easy to reuse. Statistics, business registries, data on cultural facilities (such as attendance figures and admission fees for museums and libraries), accessibility for people with limited mobility, and the locations of electric vehicle charging stations are examples of open data. When combined with other sources, open data can be reused in the development of websites and mobile applications for use by the public. One such example is an application to check for road construction along a given route.

Open innovation

The addition and involvement of new internal and external partners to help develop a company's innovations. In practice, this type of innovation is based on knowledge sharing and cooperation within the company and externally with stakeholders in the same environment, i.e., customers, startups, suppliers, research laboratories, and even competitors.

Peak energy storage technology

A system that collects and stores energy, which is then released according to demand.

Public innovation

Implementation by a public-sector organization of new or substantially improved operations or products (OECD).

Research and development (R&D)

A process that combines human and material resources to increase the stock of knowledge, including knowledge of humans, culture, and society, and the use of this knowledge to devise new applications.

Research collaboration or partnership

Cooperation between two or more organizations working on a project, and which consists of the pooling of material, intellectual, human, and financial resources to solve a problem or meet a need.

Research development

Activities that add to the value of research results and, more generally, showcase knowledge. Research development is more than simply using research results for commercial purposes. It also involves the implementation and exchange of knowledge in all fields.

Researcher

According to the *Frascati Manual*, researchers are specialists who design or create new knowledge, products, processes, methods, or systems and who manage the related projects. Researchers are permanent, full-time faculty members who teach in postsecondary education. They may also hold a full-time position in a technology transfer college or a private or public research institution. All researchers are paid from the host institution's regular budget.

Science

According to Merriam-Webster, "knowledge or a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through scientific method."

Scientific culture

For societies, all the ways in which a society can appropriate science and technology. For individuals, scientific knowledge and the ability to use this knowledge to identify problems that can be solved with science, to acquire new knowledge, to explain scientific phenomena, and to draw evidence-based conclusions from science-related issues.

Smart city or jurisdiction

The use of all new electronic and digital technology to improve residents' quality of life through the improved management of urban housing, transportation, energy, and communication.

Social innovation

Change implemented by an organization or a community in its approach or practices in order to improve the well-being of individuals or communities or solve a societal problem by looking beyond current practices.

Startup

A company looking to expand internationally and seeking an economic model that will ensure strong, rapid growth over one to three years. Startups are high-risk businesses. Their chances of success are unknown and hard to assess. They are often less than two years old but can be established companies undergoing transformation and adopting new business models. A startup's value is based in full or in part on digital technology and its use across all sectors.

Synergy

The combined actions, interventions, or influence of multiple participants resulting in a performance improvement that is more than proportionate to the mere addition of their strengths and means.

Synthetic biology

The application of science, technology, and engineering to facilitate and speed up the design, manufacture, and modification of genetic material using living organisms.

Technological innovation

New techniques and processes created and implemented in conjunction with existing technology.

Technology readiness level – TRL

Measurement used to assess the maturity of an innovation in development.

Économie, Science et Innovation
Québec