Presentation on the Quebec quantum sciences and technology landscape

Relations internationales et Francophonie
Québec

Rédaction
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This presentation on the Quebec quantum sciences and technology landscape seeks to support and promote Quebec as a global quantum technology leader. The Department of Economic Affairs and the Department of Communications and Public Affairs under the Ministère des Relations internationales et de la Francophonie (MRIF), in close collaboration with the Ministère de l'économie et de l'innovation (MEI) and Québec Quantique, have developed this outreach tool for foreign Quebec representatives. This presentation will equip representatives with the necessary tools to showcase the Quebec quantum sciences and technology sector and achieve the following objectives: create new partnerships, recruit skilled workers and promote Québec quantum science and tech companies.

The following speaking notes are simply offered as guidance and do not limit the messages that are to be conveyed. The information is grouped and prioritized in such a way as to help you make this presentation your own. Similarly, the hyperlinks and section "For more information" (in the appendix) provide more detailed information on certain sections.

The MRIF also seeks to ensure Québec is presented consistently abroad. All modifications, additions and deletions made to this document must be pre-approved by the MRIF.

This presentation is for the exclusive use of MRIF personnel, including foreign Québec representatives and other personnel active on the international stage.

Multi-faceted Québec

- Québec is a solid player in all quantum sciences and technology sub-sectors.
- Québec's quantum advantage lies with its talent pool.
- Québec is already a renowned international leader in quantum research.

Quantum sciences and technologies

- The objectives of this presentation:
    - offer a brief overview of what quantum technologies are;
    - illustrate Québec's positioning and strengths; and
    - inform on Québec's foreign objectives.
    - (Adapt/build on depending on the audience)

What are quantum technologies?

- Quantum technologies represent a new generation of optical and electronic devices that use quantum effects to significantly enhance the performance of existing traditional technologies.
- This new wave of technology can be referred to as Quantum 2.0.
- Quantum 1.0
    - The first quantum revolution.
    - The two most important examples of these technologies include transistors, lasers, GPS and medical imaging, which rely on the effects of quantum mechanics.
    - This first quantum revolution laid the foundation of our modern digital age and many cutting-edge technologies.
- Quantum 2.0
    - The second quantum revolution allows for the precise control and manipulation of quantum properties such as light and matter, which are entering the engineering stage of applications.
    - Quantum 2.0 is defined as a class of devices that actively create, modify and read quantum states of matter by using the quantum effects of superposition and entanglement.

What is Quantum 2.0?

- In simple terms, Quantum 2.0 makes the impossible possible.

For example:

- **Quantum computing** (+10-year horizon):
    - Quantum computers will perform otherwise impossible computing operations.
    - Quantum computers optimize algorithms and generate new computing opportunities and simulate major issues and new problem-solving approaches.
    - Several scientific fields require powerful computing and analytical capabilities.
    - In agriculture, quantum computers can contribute to the development of sustainable food supply chains in an ever-changing world.

- **Quantum communication** (5- to 10-year horizon):

    - Encrypted communications ensuring absolute security.
    - A safer communication network and next-gen cryptography.
    - Cyber-safe financial transactions, personal medical information protection, connected vehicle transportation, among others.

- **Quantum matter (sensors and imaging)** (5-year horizon):
    - Quantum matter with cutting-edge properties, paving the way to new applications.
    - Quantum sensors offer an unparalleled environmental awareness.
    - Healthcare: diagnosis, understanding of the specificities of diseases, researching new medicines

- **Québec has cutting-edge expertise in three pillars of quantum technologies**

A few examples of Québec companies:

- **QUBIC** (Sherbrooke) is specialized in teledetection;
- **SBQuantum** (Sherbrooke),
- **1QBit** is a British-Columbia based company specialized in software and matter optimization which opened an office in the city of Sherbrooke in 2019;
- **IBM** (Bromont and Espace IBM Q - Université de Sherbrooke)
- **Teraxion** (Québec) is specialized in telecommunications, lasers, optics and photonics.

A few projections of the Canadian landscape

- $8.2B: This is the estimated amount the quantum technology sector would represent in 2030, in addition to employing 16,000 according to the National Research Council Canada.
- By 2040, we expect a 50% adoption rate of quantum technologies. This would represent a $142.4B industry, 229,000 jobs and a $55B (or 3.4%) contribution to Canada's GDP.
- This represents 19% of the Canadian GDP which accounts for $27B and 45,000 jobs for Québec.

Canada and Québec: a robust international position

- Over the past decade, quantum technologies have driven several countries around the globe to make substantial commitments in order to support ambitious national programs and strategies.
- Canada is a global leader in quantum technology. In fact, Canada is ranked fifth among G7 counties for the investments it makes to develop the sector, but first for its investments *per capita*.
- The commercial potential of quantum technologies is becoming increasingly evident.
- Forecasts of the potential market growth of the quantum technology sector vary considerably and timeframes to market are becoming shorter, even if we are not quite there yet.

- It is therefore not surprising that global competition is on the rise as everyone tries to become part of this booming sector.
- Canada must continue to encourage the commercialization and development of industry.

Source: https://globaladvantageconsulting.com/canada-well-positioned-as-a-world-leader-in-quantum-technologies/

Large-scale investments

- Investments in quantum science research is picking up.
- Several countries have a national quantum national strategy. The Government of Canada announced in its 2021 budget investments of $360M CAD over 7 years. https://cifar.ca/cifarnews/2021/04/07/a-quantum-revolution-report-on-global-policies-for-quantum-technology/
- Québec invests the most in research and development in relation to its GDP.
- Québec has invested heavily in fostering quantum technologies and developing infrastructure and a critical mass of researchers.
- In 2019, Québec announced it would be investing CAD $100M in quantum technologies over 7 years.
- Québec is also the most active Canadian province in terms of the support it offers to research and innovation in this sector.
- The Ministère de l'Économie et de l'Innovation has implemented a call for projects that is specific to quantum technologies. This call for projects is directed at Québec start-ups and SMEs that wish to develop an R&D-based innovation project. The objectives are as follows:
    - ensure the development and consolidation of innovation efforts in quantum technologies;
    - strengthen the technological innovation capabilities of businesses and translate technological enhancements and transfers into economic benefits; and
    - establish Québec as a global leader in the development of quantum technologies.

The Québec ecosystem

- Québec has complementary industry know-how that drives the development of quantum technologies.
    - Montréal is a hub of quantum communication expertise. Montreal is a global leader in AI and the second most important technological center in Canada.
    - The city of Bromont, located in the Eastern Townships, is a global leader in quantum materials. It is one of the most important microelectronic centres in North America.
    - The city of Québec is a cradle of optic-photonic development and quantum material expertise.

- The city of Sherbrooke is home to a state-of-the art quantum research centre — the Institut Quantique. It brings together experts in quantum computing, communication and materials. An innovation hub?

Research and development clout

- Québec has incredible clout in the field of quantum technologies thanks to:
  - the critical mass of scientists and infrastructures;
  - world-renowned Québec researchers;
  - its forward-thinking approach, placing Québec at the forefront of quantum development; and
  - the opportunity and will to develop solid industrial sectors.
- Canada is a mayor player in quantum technology research.
- However, Québec is of the most important quantum technology hubs in the country because it stands out internationally for its expertise in quantum photonics, cryptography and communications.
- There are several stakeholders already investing in developing this sector:
  - universities;
  - incubators and accelerators;
  - research networks; and
  - support partners, among others.
- The IBM Quantum Hub at IQ positions Québec as an industry leader at the provincial, national and international stage.
- What makes Québec particularly unique is its collaboration and communication with other industry research centres.
- Québec is internationally recognized for its ability to cement national and international collaborations.

Talent is the key Québec holds

- Québec has all the ingredients required to launch and grow quantum technological companies:
  - World-class researchers and research centres study various quantum technology sub-sectors.
  - The necessary infrastructure in place to support the entire value chain and develop end-to-end quantum technological innovations, including design and industrial deployment.
  - Access to financing and support partners provides companies the necessary leverage to develop and build synergies;
  - Irrefutable interdisciplinary research expertise in quantum technologies, advanced materials, photonics and AI; and
  - an exceptional talent pool.

- However, labour needs are real. Québec is working to attract international talent to the province.

A unique ecosystem

- Several players work together to attract talent and investments. The Ministère des Relations internationales et de la Francophonie (MRIF) and Investissement Québec International (IQI) work hand-in-hand to attract direct foreign investments to develop Québec's quantum technology ecosystem.
- The Ministère de l'Économie et de l'Innovation (MEI) also supports businesses and universities by way of provincial funding programs and applied research funding programs (PROMPT and PRIMA for quantum technologies). These programs allow businesses to participate in international research consortiums.
- The MEI offers tax credits to businesses that hire foreign experts.
- The Ministère de l'Immigration (MIFI) has full oversight of the economic immigrant selection process and can therefore identify immigrants who have the skills sought by the quantum technology sector.

Québec Quantique

- Founded in the autumn of 2020.
- Québec Quantique is a community of interest that wishes to bring together quantum industry players, universities and research centres. It is primarily financed by the Government of Québec and it seeks to catalyze and ensure concerted action among local players around innovative and structuring projects for Québec.
- Québec Quantique aims to promote the **adoption of quantum technologies by Quebec companies and organizations** by engaging directly with identified stakeholders.
- Its mission: use quantum sciences and technologies as a lever for the economic and social development of Quebec and position the latter as one of the leaders in the field on the national and international scene.
- Its vision: ensure that quantum technologies are adopted by a majority of Quebec organizations by 2030.
- Québec Quantique specifically seeks to:
    - mobilize and ensure concerted action among local players in the field around innovative and structuring projects for the province of Quebec;
    - promote the influence of the Quebec ecosystem in Canada and abroad;
    - attract talent, companies, investors, researchers and students;
    - act as a gateway to facilitate the qualification of requests from outside the Quebec ecosystem;
    - contribute to the monitoring, awareness and strategic reflection on economic development opportunities for Quebec;
    - communicate the actions and results of the players involved.
- The Ministère de l’Économie et de l’Innovation is Québec Quantique’s main financial partner.
- The Ministère des Relations internationales et de la Francophonie is a major financial partner in the international outreach initiatives undertaken by Québec Quantique

Québec’s strengths:

- **Innovative**: a breeding ground for research and development.
- **Agile**: an integrated innovation chain.
- **Skilled**: world-class researchers and a large skilled labour pool.
- **Forward-thinking**: Québec researchers have been on the avant garde of quantum computing since 1984.
- **Unique**: a world-renowned AI hub.
- **Collaborative**: coordinated efforts to ensure overall industry success.
- **Affordable**: Operating costs are some of the lowest in Canada and the United States, and several incentives are available to support major projects and innovation.

Québec's international objectives

- develop and foster collaborations, partnerships and relationships;
- showcase Québec quantum technological developments;
- recruit talent (students, researchers, entrepreneurs, among others); and
- participate in international/national quantum strategies (state name of our region).