Quantum Industry and Capital Raising Trends

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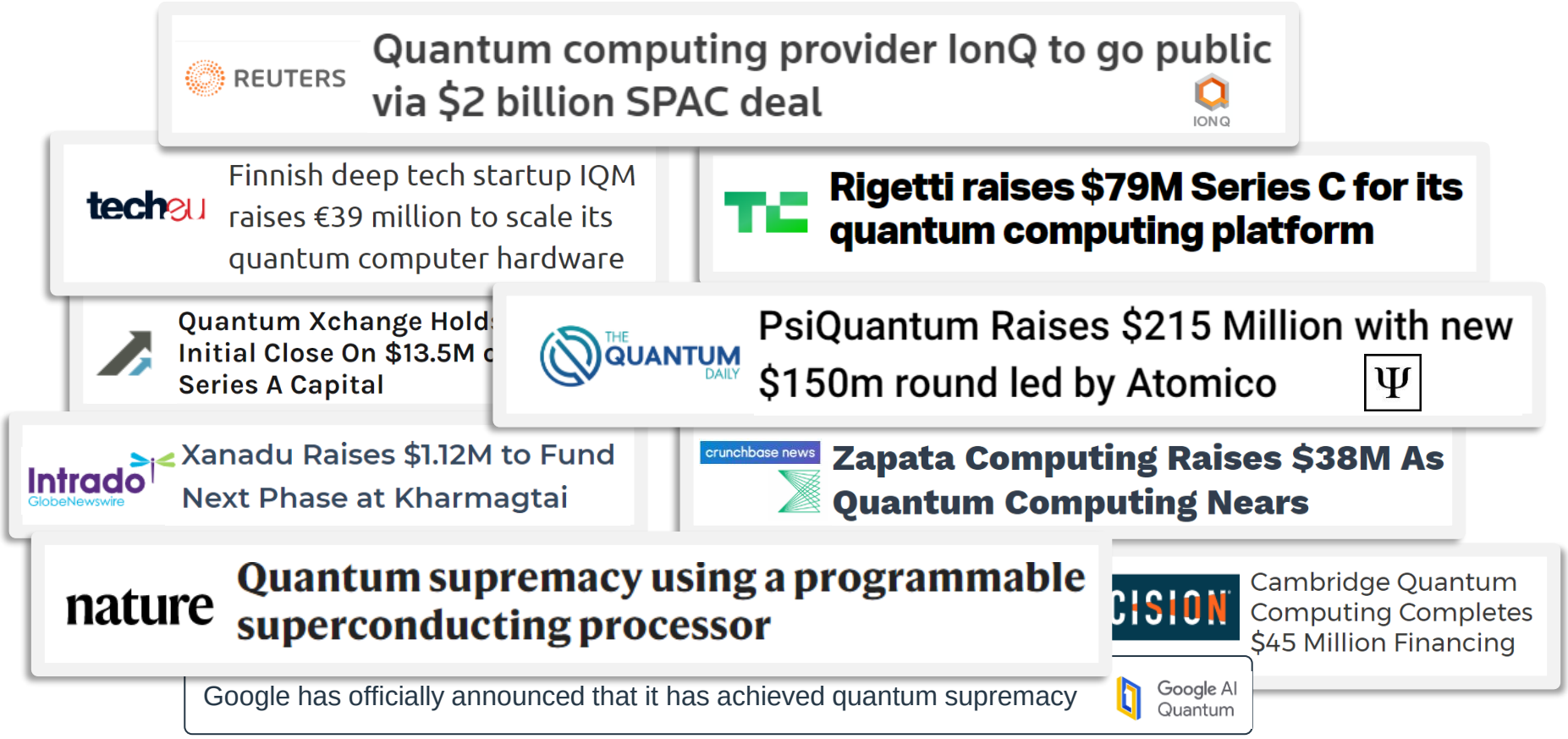
Global headlines show a surge in the number and sizing of capital raising by quantum technology firms…



… However, when you're out raising money, it probably doesn't feel that easy. What is going on?

Agenda

1. Defining quantum
2. Investment trends
3. Financing considerations

First and foremost: What is quantum technology?

Quantum technologies are a **new generation** of **optical** and **electronic devices** that use **quantum effects** to significantly **enhance the performance** over that of existing, ‘classical’ technologies

There are many types of quantum technologies, each with multiple commercial applications across a variety of industries

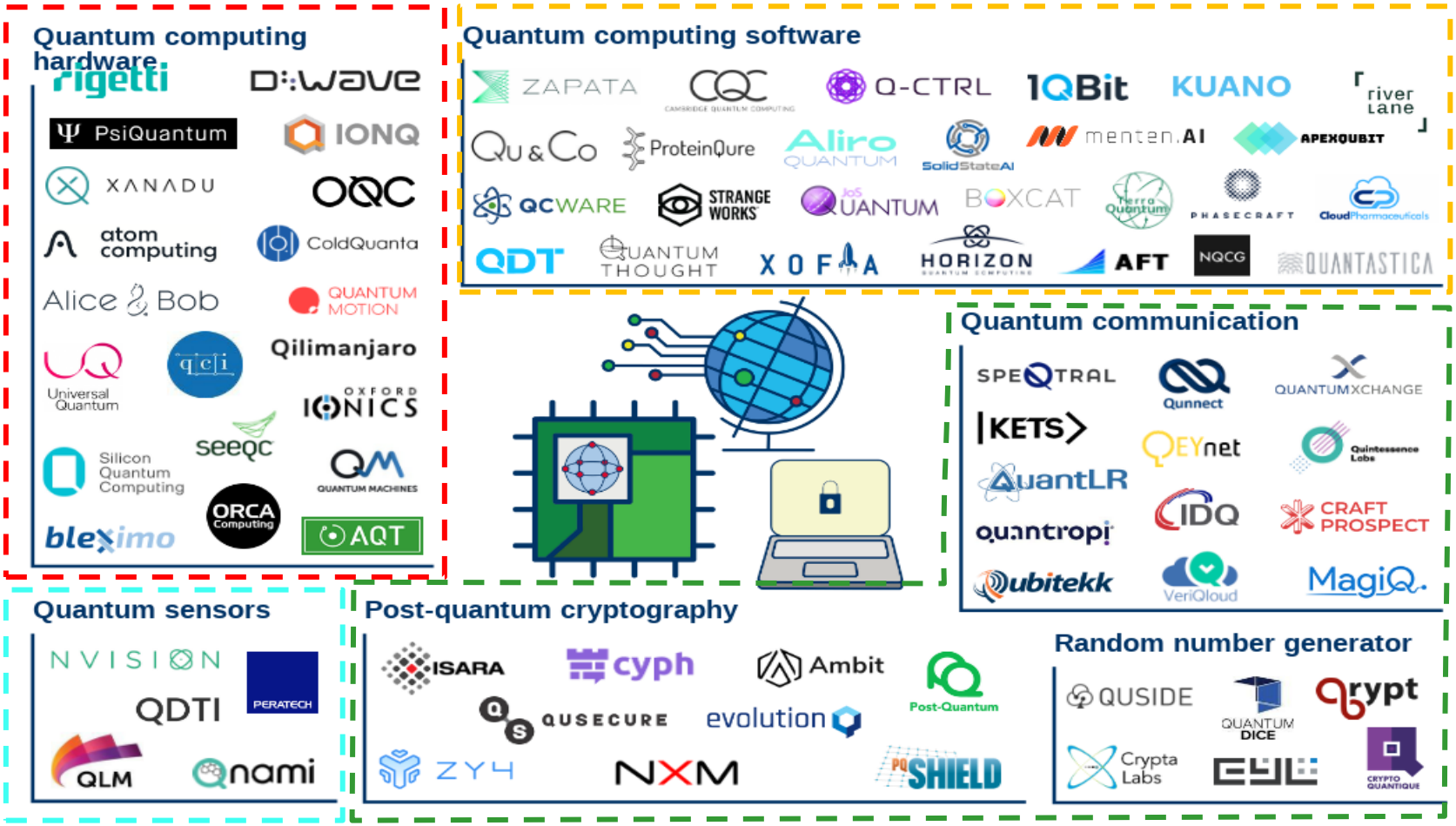
Domains	Description	Example applications

Sensing and imaging	▪ **Quantum sensors leverage atoms to sense changes**, because superposition is highly sensitive to the environment (this allows for **extremely precise measurements**)
	▪ Alternative forms of quantum sensors **embed atoms into materials** like diamonds making **well-suited magnetic sensors**
	▪ **Quantum imaging** technology is bucketed into two broad categories:
	  ○ Devices that measure **single photons** (e.g. SPAD). These devices can **see in 3D, look around corners**, etc.
	  ○ Systems that **leverage quantum effects** to **overcome light detection** limitations
		▪ Gravity mapping: Civil engineers can leverage quantum sensors to **measure gravity underground**. This technology would **realize deeper and more efficient results**, while being impacted **less by vibrations**
		▪ MEMS sensors: gravity surveys to **identify optimal natural resource drill points** at a tenth the cost of the status quo
		▪ Medical imaging: May enable **x-ray imaging without a radiation dose**
		▪ Infrared imaging: Enable engineers to **see through gas leaks**

Communications	▪ One of the most pressing issues related to quantum communication is quantum cryptography, which has two primary systems: **Quantum Key Distribution (QKD) and Post-Quantum Cryptography (PQC)** ▪ In theory, with the advent of quantum computers, **factor-based cryptography** will become a **poor defence mechanism** ▪ There are other promising technologies as well, such as: position-based tagging and quantum signatures	▪ Data storage: **Financial and customer data storage** by large institutions (already being trialed) ▪ Secure communication: **Leverage QKD** to transmit top **secret government and military communications**
Computing and software	▪ **Quantum computers utilize qubits**, which unlike regular bits can be a zero, one or both at any given time. This is known as **superposition** ▪ Quantum computers can process **multiple inputs simultaneously** instead of one-by-one	▪ Large number factoring: Large enough quantum computers could **break through existing cryptography measures** ▪ Chemistry simulations: Computing power will enable **simulation of less basic chemistry** to solve problems in **material science and pharma**

Source: The Quantum Age: Technological Opportunities (UK Government Office for Science)

Of the growing number of companies globally defining themselves as “quantum”, a significant portion of the early players are operating in the computing space



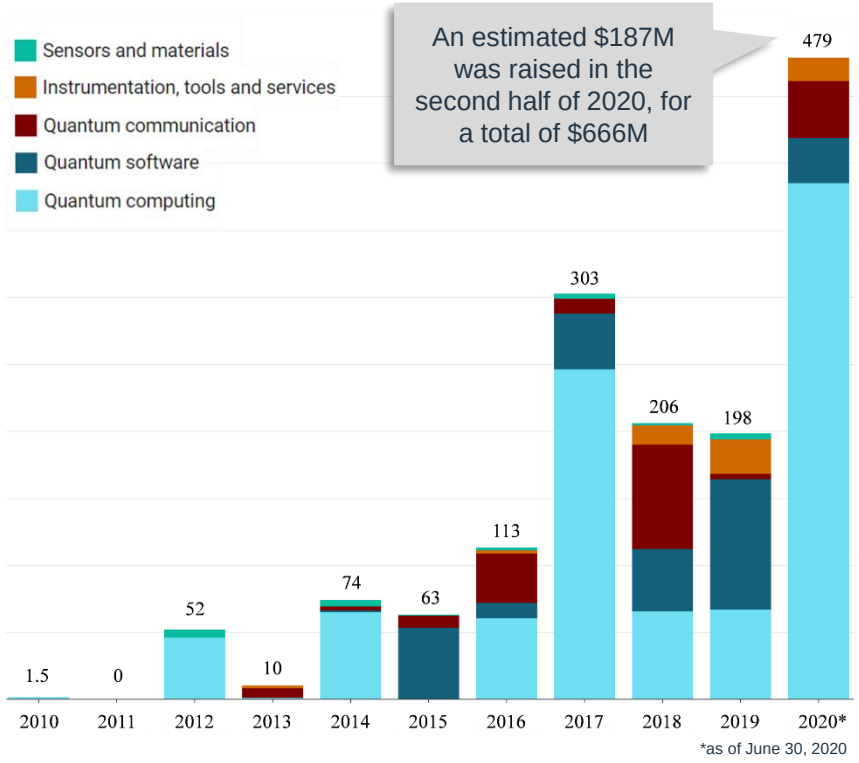
Source: CBInsights

Investment trends are also currently heavily biased towards computing, with ~75% of all capital flowing towards that area

Since 2010, close to $1.5 billion were invested in quantum technology startups, with 63% of capital devoted to companies developing quantum processors (hardware)

Disclosed investments in Quantum Technology Startups

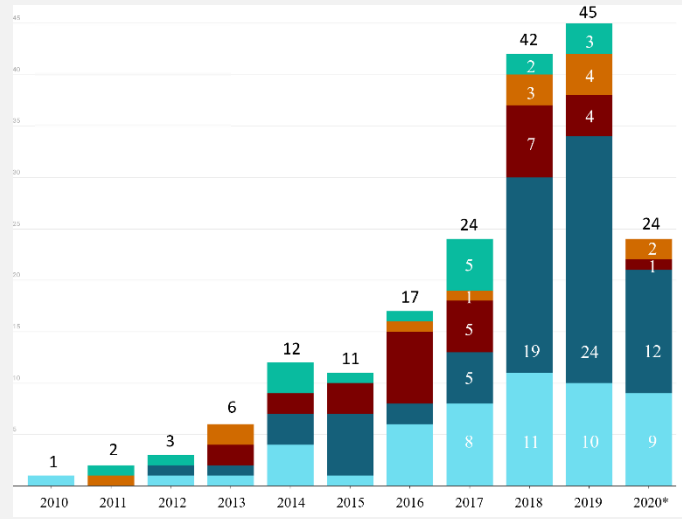
In million, USD, 2010 – 2020



- Computing hardware is currently the hottest segment with larger investments flowing to fewer companies
- Investments in software are being buoyed by computing to a certain extent
- Communication and sensing aren't currently trendy

Disclosed deals in Quantum Technology Startups

In number, 2010 – 2020



Source: Pitchbook, Crunchbase, *Quantum Technologies Patents, Publications & Investments* by Michel Kurek

Why is quantum computing attracting as much capital right now?

The promise of quantum computing is to solve the unsolvable in a few hours of computing time, typically complex problems of a statistical nature

- **Quantum computing is currently generating the most interest because it's the largest market and it has the potential to immediately benefit many industries:**
  - Pharmaceutical;
  - Transportation;
  - Finance;
  - Chemicals;
  - Cybersecurity; etc.
- **However, it presents many technical obstacles and it's probably the toughest problem to solve and the most remote opportunity at the moment**

The good news is that Canada is well positioned from a global perspective to create winners in the quantum sector across all subsectors

Canada is a global leader in quantum technology and has established a strong start-up ecosystem that attracts global talent and capital

Noteworthy developments:

- The pre-COVID Government of Quebec budget earmarked $79.3M for "**technologies that support AI**". Much of that money was meant to serve the quantum market.
- Quebec has booming entrepreneurial activity in quantum due to **Centech's incubator** in Montreal, **ACET** in Sherbrooke, **Entrepreneuriat Laval** and **INO's Quantino incubator** in Quebec city.

The Federal Government invested $305M between 2015 and 2018 and plans to invest **$363M between 2019 and 2025**

British Columbia

- Stewart Blusson Quantum Matter Institute
- Quantum BC
- Quantum Algorithm Institute

Alberta

- Quantum Alberta
- Institute for Quantum Science and Technology

Ontario

- ***Quantum Valley***
  - Transformative Quantum Technologies (TQT)
  - Institute for Quantum Computing
  - Quantum Valley Investment
  - Quantum Valley Ideas Lab
- Quantum Information and Quantum Control
- Creative Destruction Lab
- National Research Council

Quebec

- Institut Quantique (IQ)
- Interdisciplinary Institute for Technological Innovation
- MiQro Innovation Collaborative Center
- IBM Quantum Hub
- Centech, ACET, Quantino

Even if the global race in quantum technology is becoming increasingly competitive with China and the US investing heavily in the field, one legacy advantage of Canada's head start in quantum is a strong talent pool coming out of its main research universities

Source: Canadian government website / announcements / budgets, Medium

Non-dilutive funding is key for initial growth – US public entities have been doing this well for a very long time

Program	Description	Success story
Small Business Innovation Research (SBIR)	▪ Highly competitive program that **encourage domestic SMEs to engage in Federal Research/R&D with the potential for commercialization** ▪ Through a competitive awards-based program, SBIR enables small businesses to explore their technological potential and provide the incentive to profit from its commercialization ▪ **Only United States small businesses are eligible to participate in the SBIR program** – Canada replicated this program for its domestic companies (see ISC on next slide) ▪ **Annual budget of ~$3.2 billion**	▪ Recursion Pharmaceuticals started using computer program to predict treatment for a handful of rare diseases. Today, the 165-employee company is studying dozens of drug candidates and completes half a million robot-run experiments a day. **SBIR acted as the first seed-investor** by providing Recursion a grant in 2015. SBIR created a de-risked environment by giving other private investors confidence in the company. ▪ The company now has two drugs in Phase I clinical trials, one to treat a nervous system disease and one to treat a blood vessel disease that causes seizures and bleeding in the brain. ▪ Other successes: **MBF Bioscience, Luminescent Technologies**
Defense Advanced Research Projects (DARPA)	▪ **DARPA's mission is to make pivotal investments in breakthrough technologies for national security** ▪ They do so by the intermediary of **multiple programs and challenges** ▪ In 2019, DARPA launched an **accelerator for small businesses** to increase the speed at which the private companies would sell their products, services, or research right back to the government ▪ **Annual budget of ~$3 billion** ▪ Works in collaboration with SBIR ▪ A catalogue of their open programs is available on their website	▪ In 1989, LaSen, Inc., a four-person firm based in New Mexico, began developing and building **remote leak detection systems for pipelines, based on sensing chemical signatures using laser light.** With their new LIDAR (Light Detection and Ranging) system for chemical detection, they attracted interest from the Defense Department, resulting in their first SBIR award from the Air Force in 1995. In 2003, LaSen was awarded a follow-on SBIR contract from **DARPA to fully develop smaller and lighter airborne sensors**. ▪ LaSen's system was commercialized in 2005, and the company has since flown its helicopter-mounted Airborne Lidar Pipeline Inspection System (ALPIS) over 300k miles to detect nearly 40k leaks. ▪ SBIR and DARPA supported the company to market, making the nation safer while protecting the environment

Source: Programs respective websites, annual reports

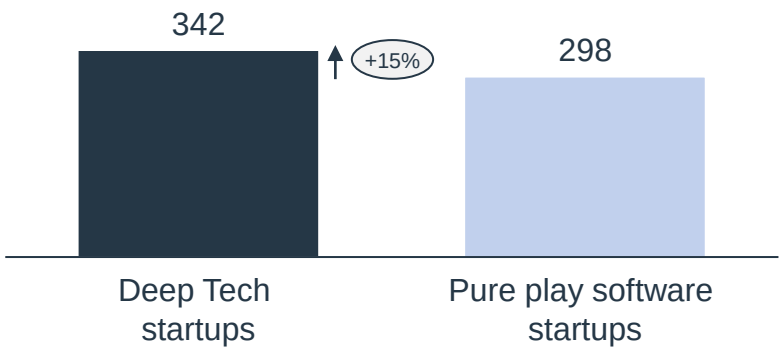
Canada also has analogous programs now and these challenges represent a very attractive source of revenue for quantum startups

Program	Description	Success story
Innovative Solutions Canada (ISC) 	▪ **Two streams of funding (grants) done through challenges** dedicated to Canadian innovators who want to start, grow and get to market: 1. **Funding to prove the feasibility of a solution and build a prototype** i. up to $150k to develop a proof of concept; ii. successful companies could receive up to an addition $1M to develop the prototype; iii. once the prototype is completed, participants are on the pathway to commercialization with the Government being potentially their first customer. 2. **Funding to test an innovation in real-life settings** – done through calls for proposals ▪ **Budget: ~$100M annually** ▪ Open challenges are available on their website	▪ Based in Winnipeg, MB, **CEM Works** is developing physics-based simulation tools for modelling wireless communication between connected vehicles and infrastructure in smart cities. Additionally, the solution will promote the use of frequency selective engineered surfaces (FSES) in designs of next-generation connected vehicles as well as FSES-enhanced building materials for smart cities. ▪ The company is currently conducting extensive R&D into new algorithms for predicting the behaviour of FSES and smart cities. ▪ Participation in the ISC program significantly helped CEM Works to improve the position in the competitive field of computer-aided engineering (CAE) tools. It allowed them simultaneously invest in advanced R&D as well as in the creation of the unified cloud-based platform that is scalable and easy to use.
Innovation for Defense Excellence and Security (IDEaS) 	▪ IDEaS makes use of several program elements to enhance the Canadian Innovation ecosystem for defense and promote modernization of defense and security business ▪ Program elements include: ○ Competitive Projects – up to $1.2M over 1.5year ○ Contests – Big $ prizes varying per context ○ Innovation Networks – up to $1.5M over 3year ○ Sandboxes – possible $ available for travel ○ Test Drive – varying funding per test drive ▪ **Budget: $1.6B over 20 years** (starting in 2018)	▪ Competitive project: **Changing the cyber game** ▪ The Department of National Defense launched a challenge looking for innovative approaches to access, interpret, and compare all available evidence on how current cyberspace activities get attributed. ▪ **Sapper Labs,** a company building a cyber protection platform capable of identifying the perpetrators of sophisticated cyber threats, has been identified as an innovator to tackle this challenge. ▪ The system will accelerate the Canadian Armed Forces' ability to act against advanced threats to Canadian assets.

Source: Programs respective websites, annual reports

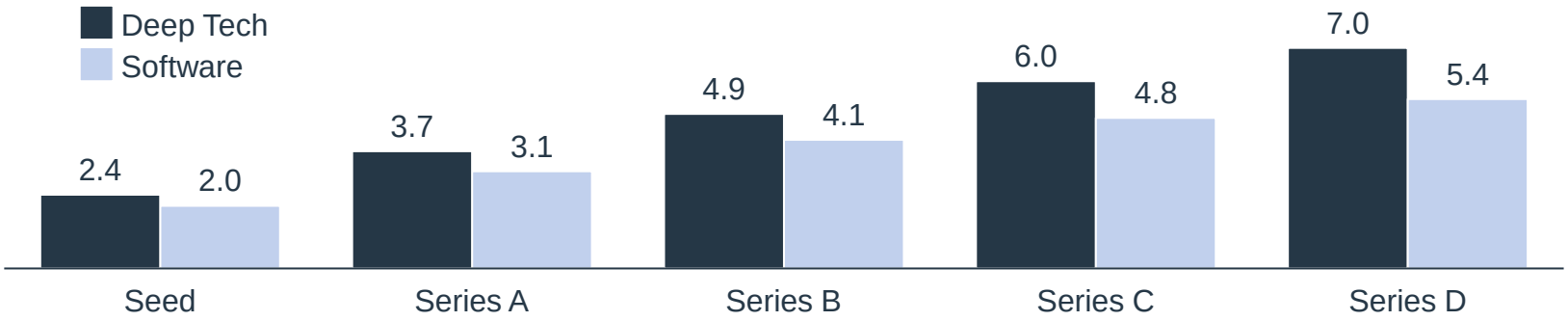
Over their lifetime, deep tech companies need more capital than software startups on average, but timelines for their development are often comparable

Amount raised prior to attaining "unicorn" status
In million, USD, average[1]



- While the most successful **deep tech startups raised slightly more capital**, on average, than software to attain a $1bn valuation or more, **they have done so in a slightly lower amount of fundraising rounds**
- Drilling down into the fundraising behavior of global deep tech companies reveals that **they tend to fundraise on a cycle similar to software companies**, every 12-18 months with growing round sizes

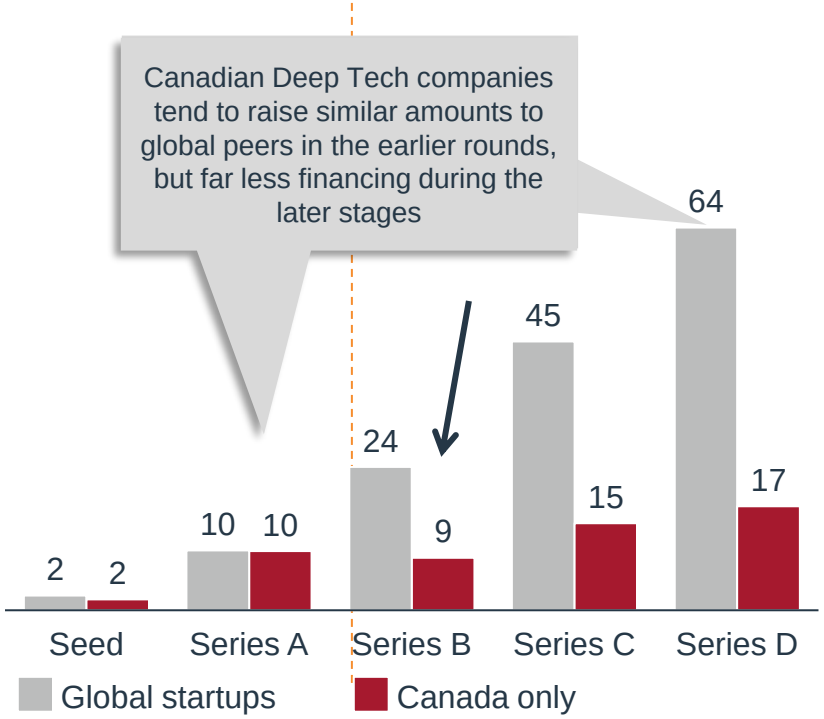
Expected time to reach each investment stage
Average # of years since inception[1]



Source: Pitchbook, Internal BDC data
1. Includes global startups that have reached > $1bn valuation between 2005 – 2019

Series B is a common choke point in Canada if you don't yet have significant revenue but still need the big cheques – Silicon Valley VCs will typically be looking for $10M/y revenue for example

Amount raised by deep tech startups in Canada vs globally[1]
In million, USD, average



You can mitigate this risk by:

- Finding ways to general early revenue traction;
- Bringing strategic partners onboard ;
- Finding specialized foreign capital into the mix earlier rather than later

Source: Pitchbook, CB Insights, BDC Capital team analysis
1. Canadian cohort includes all BDC portfolio companies that raised their initial round in 2005 or thereafter

Capital raising is a necessary (but not sufficient) condition to building a fast-growing startup. Planning ahead and keeping a few mental notes may save you some time and brain damage down the line.

If you plan on raising capital for your quantum company, here are a few elements you should keep in mind:

1. You will probably need more capital than you think to reach full development;
2. There are a variety of programs available to help you in your journey to commercialization that can fit along your product roadmap while providing non-dilutive funding;
3. Serie B seems to be a choke point for quantum companies – plan you fundraising ahead of time to mitigate this capital crunch as much as you can;
4. Keep in mind that investors are not all scientists and/or data gurus – keep it simple and focused on the end-user needs.

Questions?

Thank you