Strategic planning: Review of external data/information

Briefing theme: Research & Innovation

Background:

- Much has been written from thought leaders and pundits alike about how the pandemic has caused a once-in-a-lifetime disruption to almost all sectors, including post-secondary education. However, the COVID-19 pandemic has not been a change agent so much as an accelerant of trends already well underway. In what some are calling "post-Corona", several real threats and opportunities lie ahead for higher education.
- The following briefing provides a synthesis of these trends that are disrupting the post-secondary sector that are specific to the research and innovation environment. This is pertinent for the University of Calgary to consider as we embark on the development of our next strategic plan.

Key Trends Identified:

- **Declining R&D investment in Canada relative to GDP, at a time of increasing international competition.** Canada is the only G7 country whose R&D expenditures as a proportion of GDP shrank between 2000 and 2020 (Figure 2).[i] According to this indicator, Canada ranked 18th among OECD countries in 2020.[ii] By comparison, while Canada's gross domestic spending on R&D dropped from 2% of GDP in 2001 to 1.6% of GDP in 2021, the United States' gross domestic spending on R&D rose from 2.6% of GDP in 2001 to 3.5% of GDP in 2021.[iii] Further, this was prior to the implementation of the U.S.' Inflation Reduction Act and CHIPS & Science Act, which combined include an investment of more than 460 billion USD in R&D.

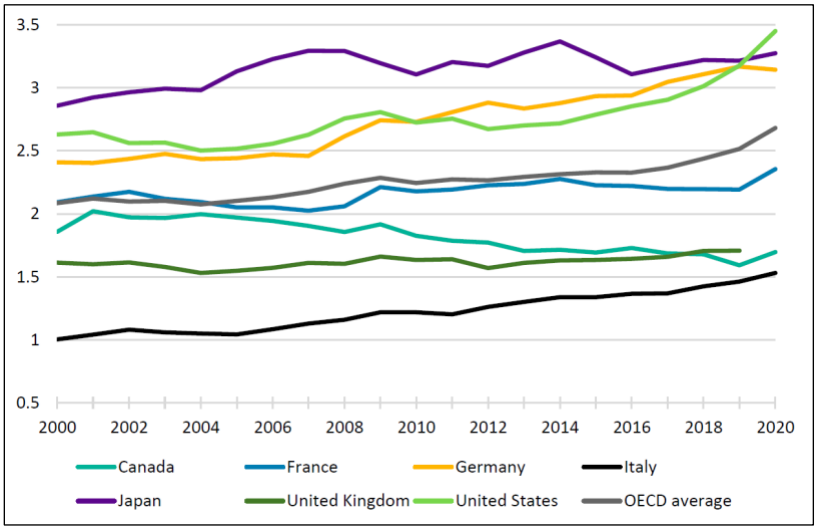

Figure 2. Gross Expenditures on Research & Development in G7 Countries, As a Percentage of GDP, 2000-2020. [iv]

- **Growth in R&D spending by the higher education sector, although the rate of growth in Alberta has not kept up with the rest of Canada.** Canada's gross domestic expenditures on research and development were $41.9 billion in 2020. Universities performed $15.9 billion in R&D in 2020, accounting for 38% of total Canadian research and development.[v]

  Between 2010/11 and 2020/21, R&D expenditures by the higher education sector in Canada grew by 41.3%, from $11.2B to $15.9B. During that same time-period, R&D expenditures by the higher education sector in Alberta grew by 33.2%, from $1.2B to $1.6B. The slower rate of growth in Alberta

compared to nationally is explained by one funding source declining during this time-period in Alberta – the R&D funding coming from the provincial government, which fell by 24.4% between 2010/11 and 2020/21, from $236.1M to $178.5M – all other funding sources grew at similar rates to the national average during this time-period.[vi]

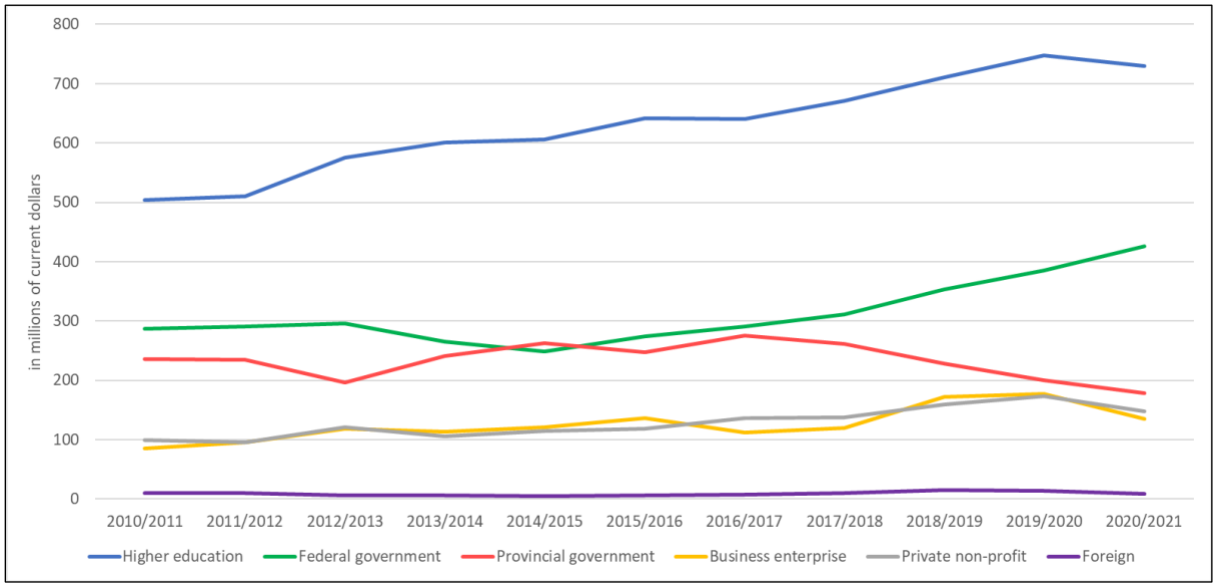

Figure 2. Research and development expenditures in the higher education sector in Alberta, by funding sector, 2010/2011 to 2020/2021 [vii]

- **Rise in private sources of funding (e.g. industry, philanthropy) to fund university research.** Although funding from government sources still makes up the majority of UCalgary's external research revenue (between 50-60% over the last five years), a growing proportion is coming from private sources, including industry, philanthropic partners and community partners.

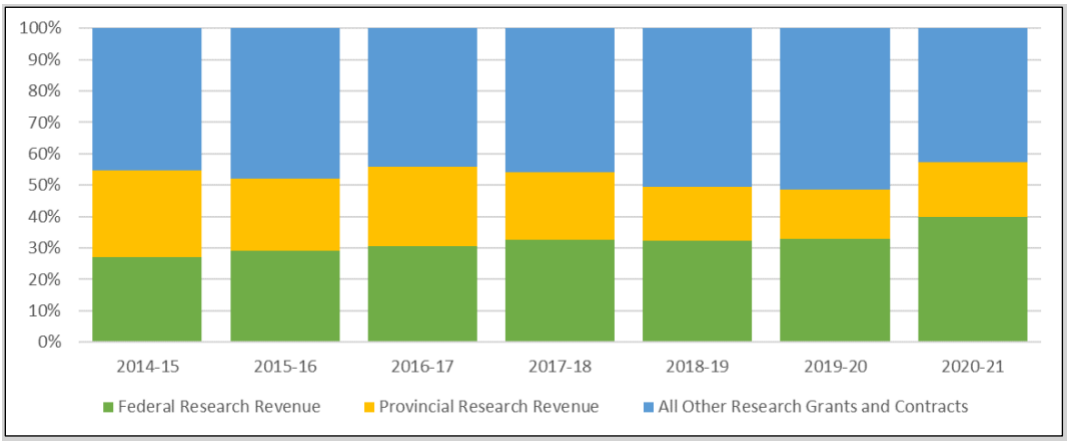

Figure 3. UCalgary's external research revenue by source, 2014-15 to 2020-21 [viii]

- **Funding supports from federal granting councils to support thesis-based graduate students haven't increased in value in 20 years.** A Canada Graduate Scholarship from one of the three federal research funding agencies is $17,500 per year for a master's student or $21,000 per year for a doctoral student – those amounts have not changed since 2003. In return for that funding, the recipients are expected to work full-time on their research, and in some cases are explicitly banned from spending more than 10 hours per week on any other paid employment. This puts graduate student salaries below the poverty line and creates challenges recruiting top talent to Canadian universities.

- **Growing emphasis and expectations from funders (government, industry, donors, community, etc.) that scholars work in an increasingly collaborative inter-/multi-/trans-disciplinary fashion.** The number of individuals and organizations involved in research grant competitions, research articles, research partnerships, and so on, continues to grow over time, increasing the complexities of the process. This is for good reason – there has been a growing body of evidence that shows that teams produce higher impact work than solo researchers. For example, multi-author teams consistently produce more highly cited work across all areas of research. [ix]

  As more researchers work collaboratively and as the size of teams grows, the relationships among team members can become more complex. Team members can be at different research institutions and have different disciplinary backgrounds. Teams can contain researchers at all stages of their careers, from undergraduate and graduate students involved in research to senior researchers. The diversity and geographic spread of people involved in teams makes the research environment more complicated and difficult than when teams were smaller, co-located more regularly, and more homogeneous in terms of discipline or nationality.[x]

- **Universities are increasingly relying on what some call Stanford's "steeples of excellence" strategy – i.e. focusing on a few areas of research excellence, in order to increase chances of attracting large funders.**[xi] Beginning in the 1950s, Stanford University famously began recruiting faculty of national eminence in specific fields where Stanford had proven strength and expertise, amounting a critical mass of scholars that would be globally competitive.[xii] This was a recipe for distinction and created a virtuous cycle of talent attracting talent.

- **Increasing focus on targeting research projects to societal issues of relevance to the surrounding community and on research impact, as opposed to focusing on traditional academic outputs.** For example, more than 2,600 organizations around the world have signed on to the San Francisco Declaration on Research Assessment (DORA) in support of improving assessment of scholarly research by re-thinking their approach to evaluating research and reducing reliance on journal-based metrics.

- **Growth of university-industry partnerships.** When it comes to R&D, external collaboration for industry comes with undeniable merits. While a single firm's R&D resources are generally limited to a specific field or product, external partner collaboration promotes innovation by giving access to a vast pool of global talent, knowledge, and expertise. Furthermore, collaborative R&D can also drive down research expenses by sharing costs amongst partners.[xiii] In some cases, this has even extended to shared research infrastructure. It also offers the university an opportunity to generate a new revenue stream, and create opportunities for students for experiential learning.[xiv] Increasingly today we're seeing universities establish University-Industry Partnership Offices to serve as a central point to coordinate this activity across the university.[xv]

- **Globalization of research, and growth of international research collaborations have come with growing attention towards research security concerns.** Because knowledge passes freely across national borders, scientific research has always been an international endeavor. But this internationalization has intensified over the past few decades. Most nations have realized that they cannot expect to benefit from the global research enterprise without national research systems that can absorb and build on that knowledge. As a result, they have incorporated science and technology into national plans and have established goals for increased R&D investments. They also have encouraged their own students and researchers to travel to other countries to study and work and have welcomed researchers from other countries. At the same time, private-sector companies have increased their R&D investments in other countries to take advantage of local talent, gain access to local markets, and in some cases lower their costs for labor and facilities. These and other trends, including cheaper transportation, better communications, and the spread of English as the worldwide language of science, are producing a new golden age of global science. [xvi]

The world order is changing and research, and university-based research is an increasingly important factor in geopolitics. Universities must share and co-create knowledge on a global scale against a backdrop of foreign interference, security threats and political factors. This requires universities to make a delicate assessment of collaborations based on their academic values.[xvii]

- **Growing push for open data initiatives.** Open data was used extensively through the pandemic by diverse users including researchers, practitioners, journalists, application developers, entrepreneurs and others to develop new insights and applications. This has led to many calling for an even more robust open data ecosystem to ensure that open data can be leveraged in future public health emergencies and beyond.[xviii, xix]

  The movement toward open science has encouraged the efforts of citizen scientists who are eager to monitor, contribute to, and in some cases criticize scientific advances. Review of scientific results from outside a research discipline can provide another check on the accuracy of results, but it also can introduce questions about the validity of findings that are not adequately grounded in knowledge of the research. Moreover, it can alter the relationship between researchers and the public in ways that require new levels of effort and sophistication among researchers involved in public outreach.[xx]

- **Rise in pathways and supports for research commercialization.**
  [Note, recognize we need to add more on innovation when time allows.]

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