Innovation Shifts:

Implications for Canada, Questions for Polytechnics

Polytechnics Canada
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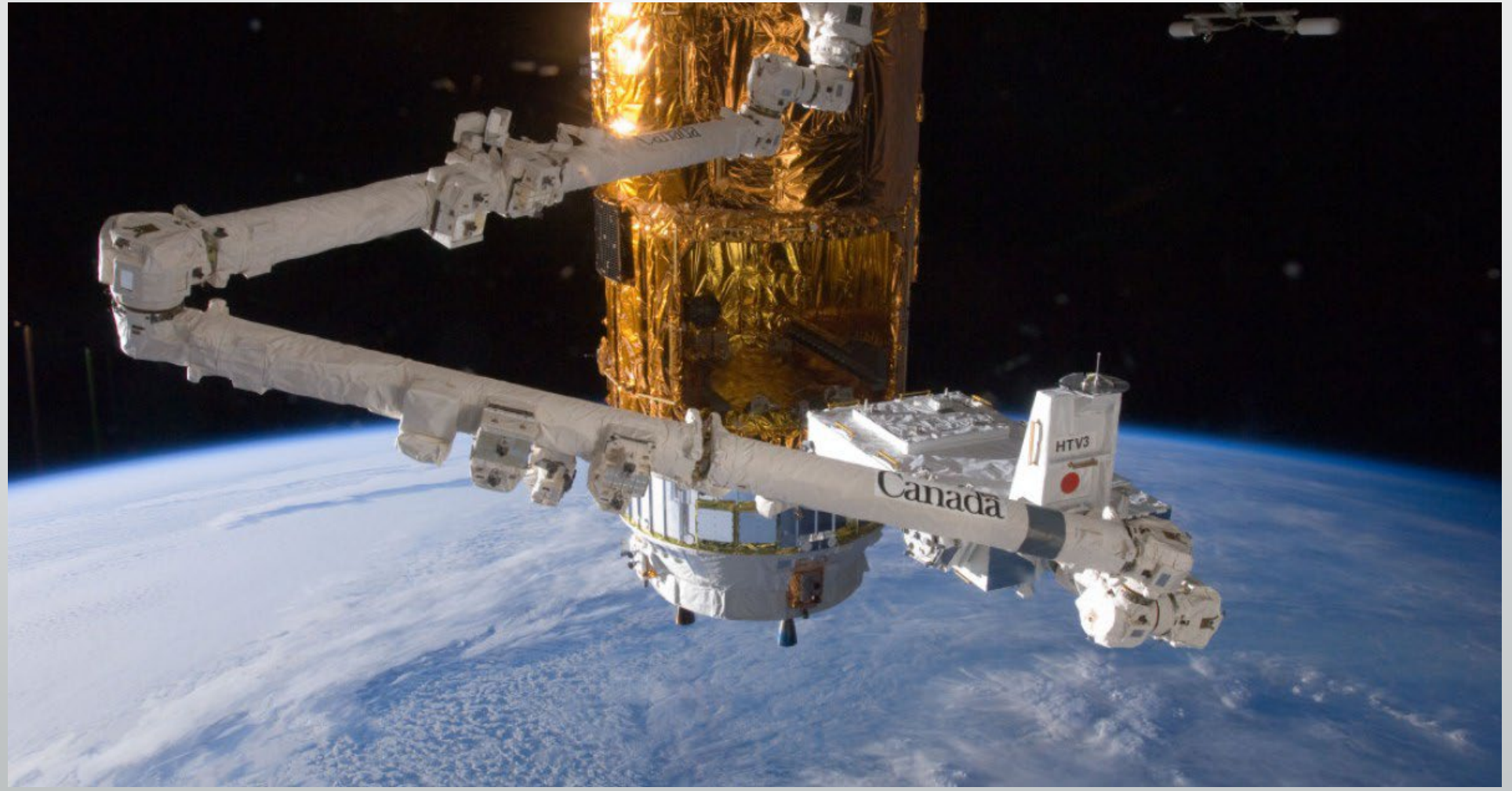
Innovation in Canada

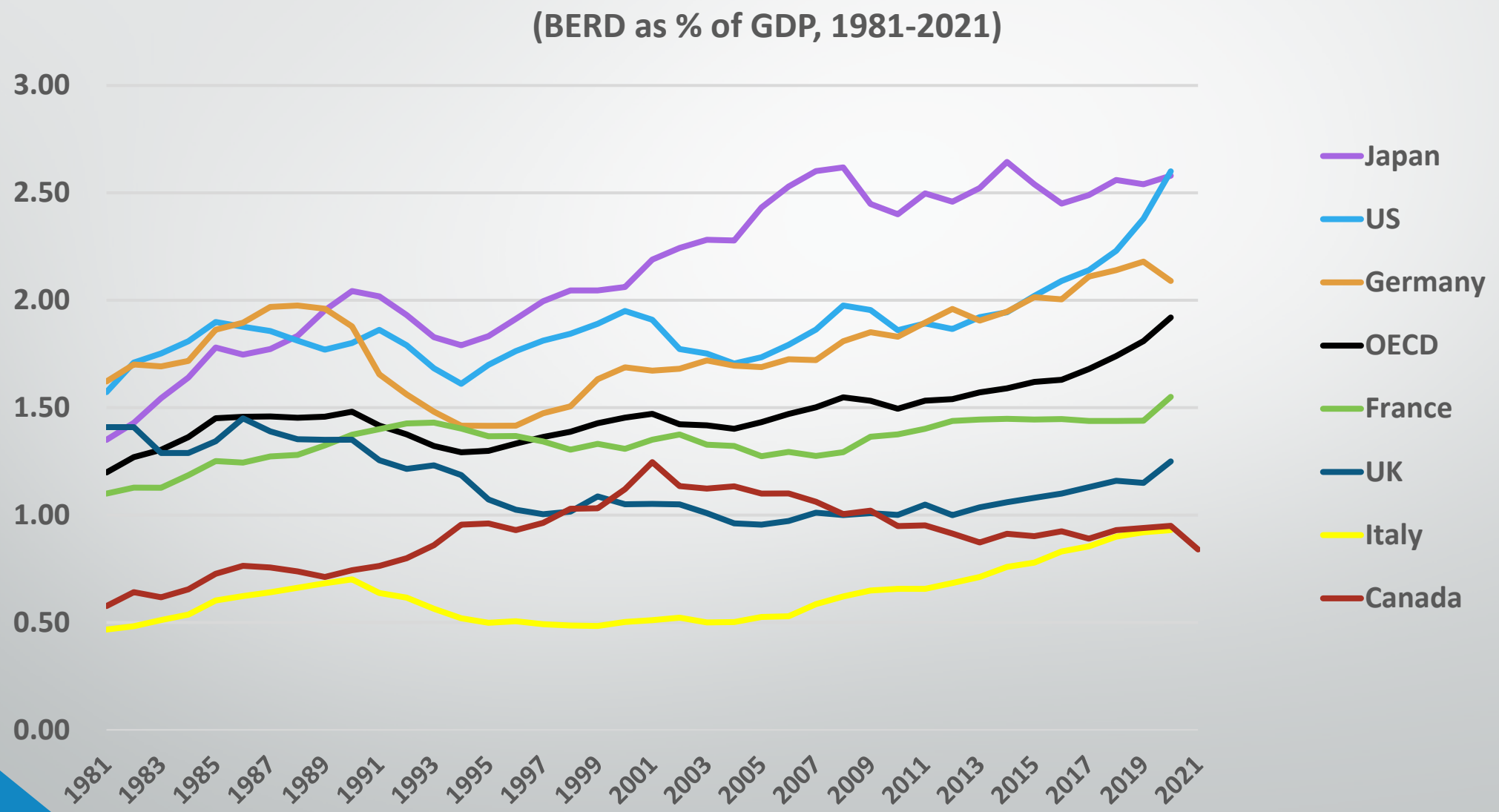


Canada’s innovation performance is weak relative to advanced peers…

Canada’s innovation performance is weak relative to advanced peers…

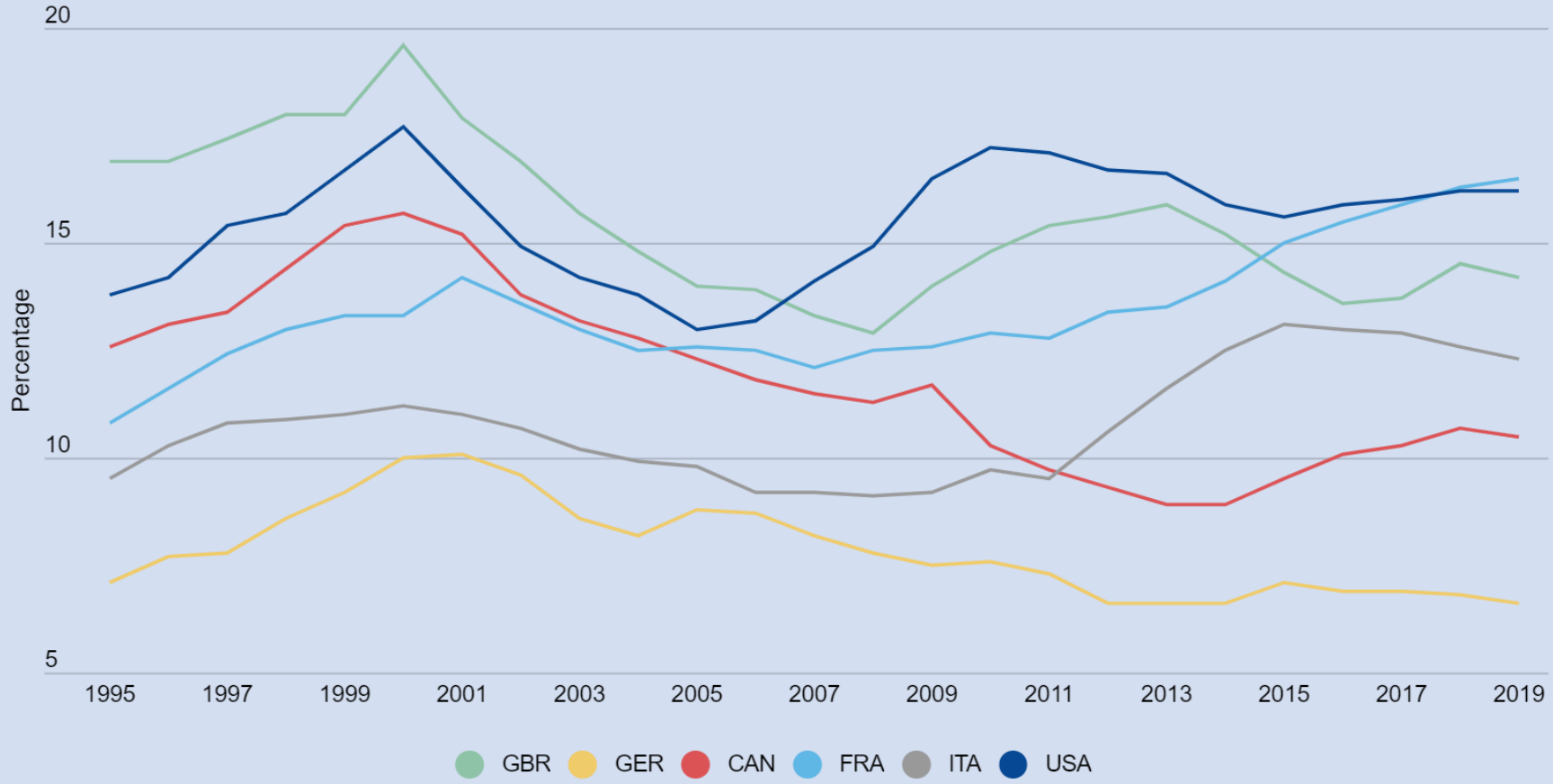
…and getting worse.

Business Spending on R&D: A 20 year decline



Technology Adoption: Decades of Difficulty

Information and communications technologies (ICT) investment as a proportion of gross fixed capital formation (GFCF), 1995-2019

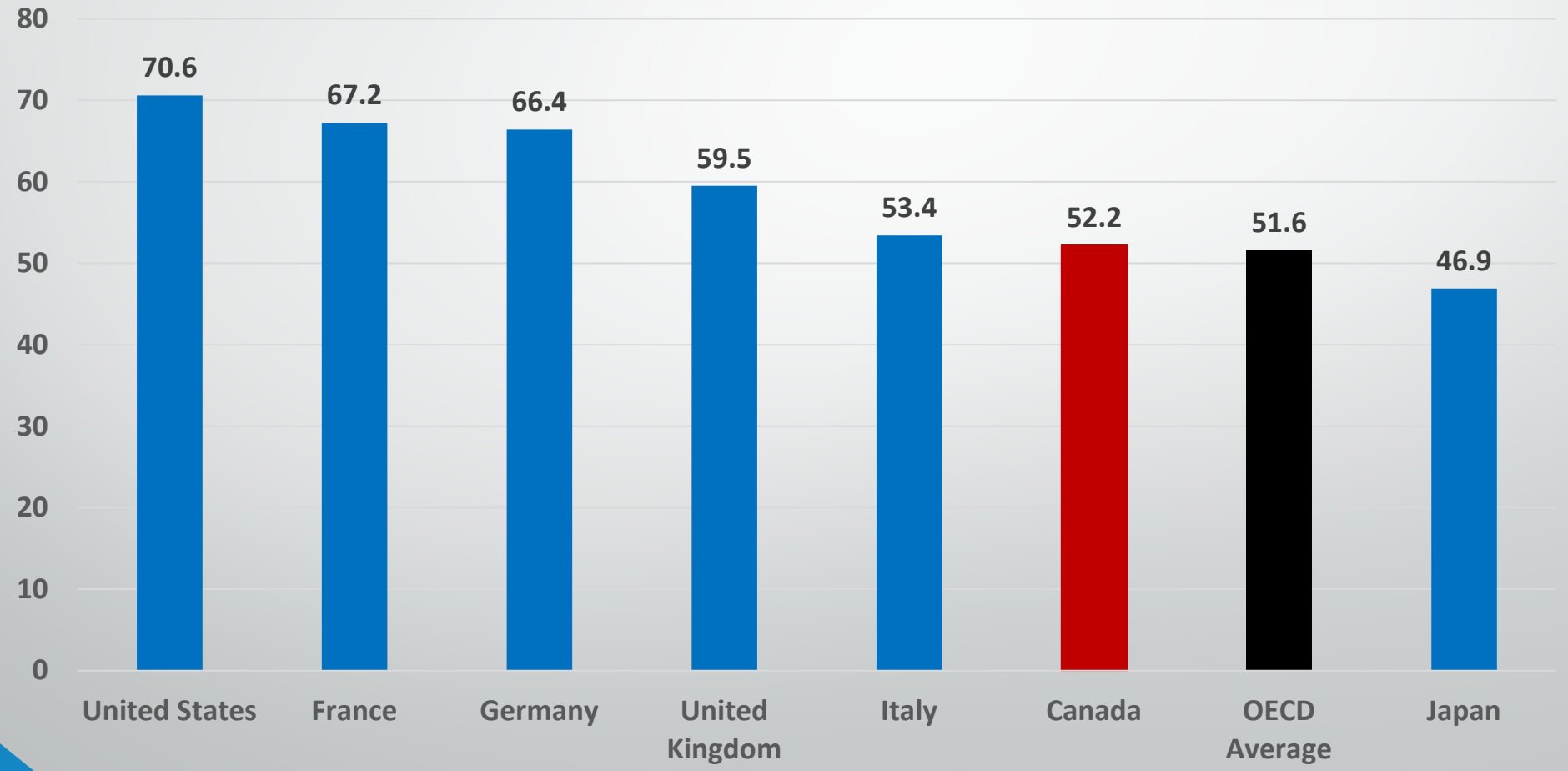


Source: C. Lamb & D. Munro, "Canada's Digital Imperative: Enabling Innovation and Growth Through Technology Adoption" (Toronto: Shift Insights, 2022)

Why does innovation matter?

Canada's Productivity Lags Most G7 Peers

(2018 GDP per hour worked, US$, constant prices, 2015 PPPs)



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Canada’s innovation performance is weak relative to advanced peers…

…getting worse…

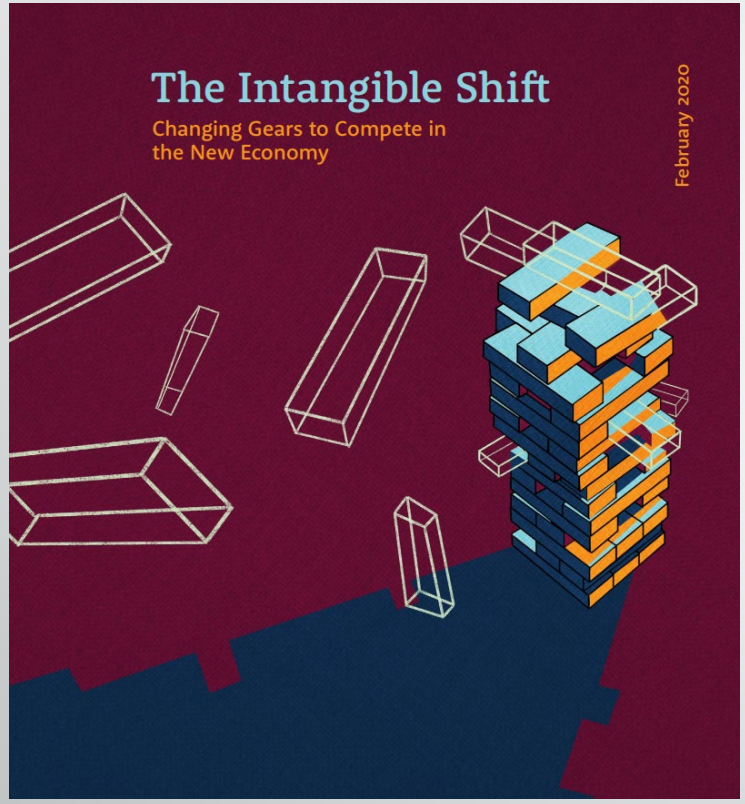
…and harder than it used to be…

Three Shifts

I

The Rise of Intangibles

The Rise of Intangibles



- In Canada and globally, a rising share of economic growth is being driven by ***intangible assets and investments.***
    - Innovation & business models built on data, digital services, brands, design, IP, marketing.
- *Tangible* assets – such as buildings, machinery, equipment and inventories – are contributing a declining share.

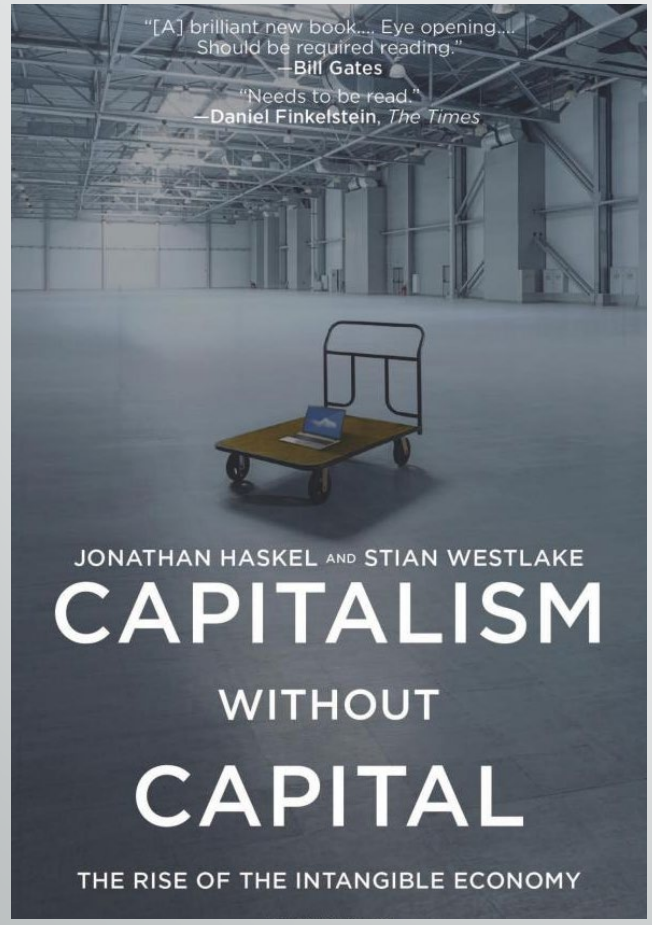
Tim Hortons' Intangible Advantage

Tangible Economy

Intangible Economy

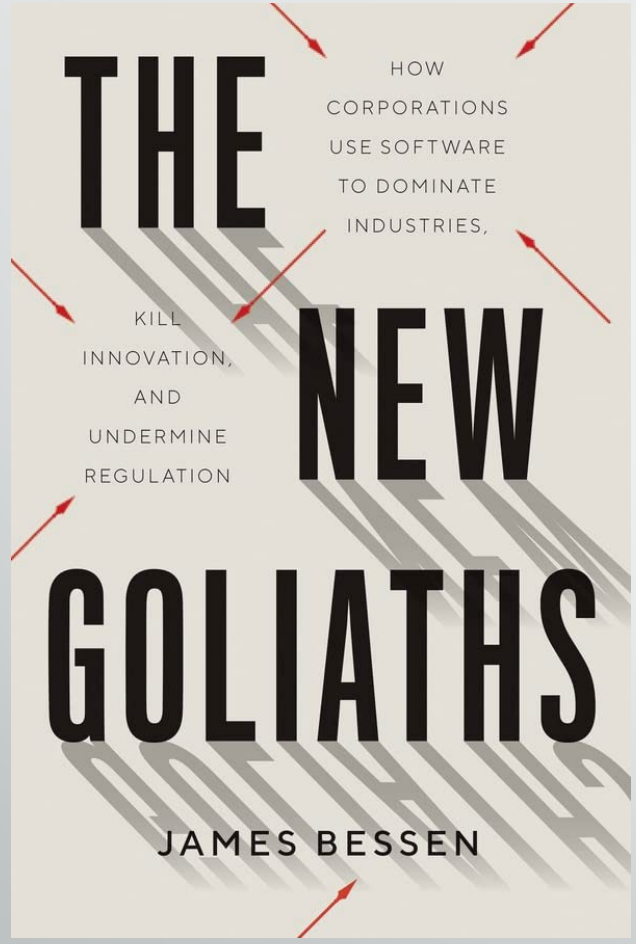
* With a side order of surveillance capitalism.

The Rise of Intangibles



- Firms and countries investing in intangibles see ***better productivity*** and ***economic growth***.
- ***Scalability***: *Rapid, massive growth possible due to production cost of additional units close to $0.* (e.g., analog vs. digital music).
- ***Synergy***: *Opportunity to combine intangible assets to accelerate growth.* (Digital music + data on consumer behaviour).

The Rise of Intangibles



- Huge risks to falling behind.
- **Firms** that capture intangible markets early and grow quickly make it almost impossible for others to catch up (e.g., Google, Apple, Meta/Facebook, Tim Hortons!)

Intangibles: Implications for Canada

Risks:

- ***Piggyback on global tech platforms***
  - *Forgoing data protection and data-based business opportunities*.
- ***Two steps behind on Intellectual Property***
  - *Few patents; weak protection; AWOL in the global rule-setting game.*

Opportunities:

- Strong reputation for ***stable, trustworthy financial services***.
- ***Robust research in AI & Quantum*** – foundation for future intangibles.
- ***Data and digital technologies in agriculture*** – could lead to products and services for global markets.

II

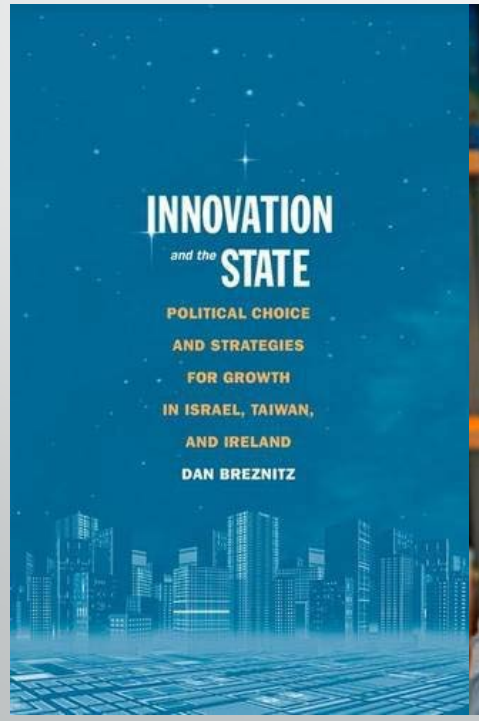
Global Value Chains

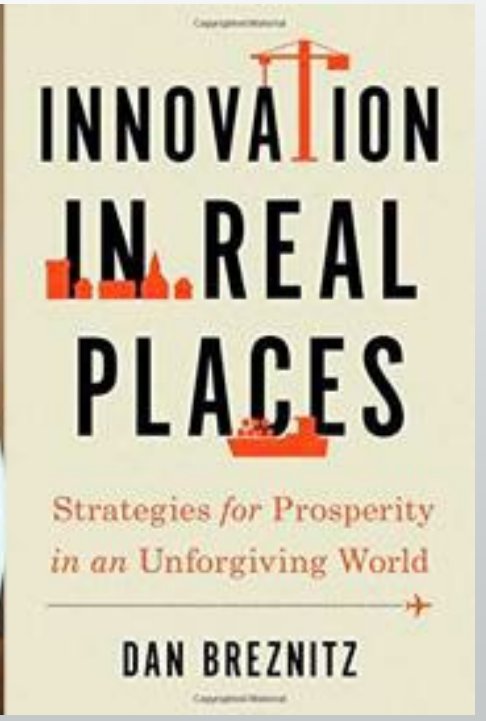
Fragmentation of Global Value Chains

- Big shift in how things are made and how we innovate, at least since the last wave of globalization (1990s to present).
- Products once designed, developed, manufactured, assembled and packaged in one place, are now being designed, developed, manufactured, assembled and packaged in at least as many different places as there are components.

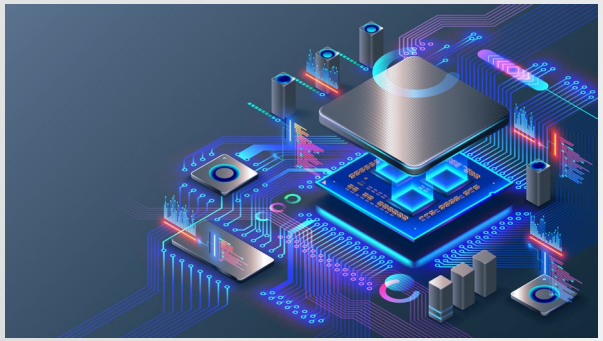
Innovation in Fragmented Global Value Chains

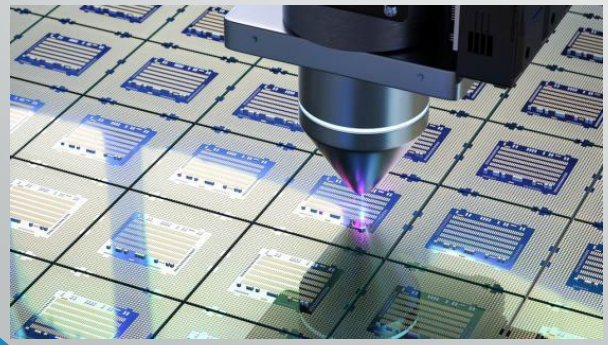
- At each point along globally fragmented production chains, firms & countries pursue ***niche innovation strategies***.
- Innovation success depends on ***finding and mastering niches*** that ***align with local capabilities***.





Semiconductor Value Chains

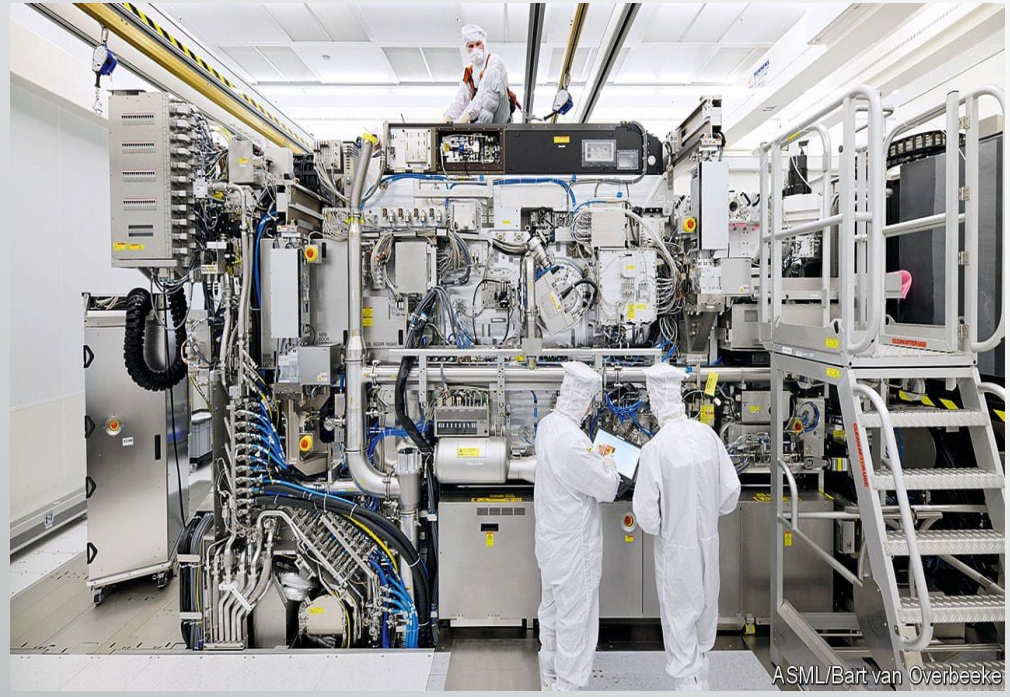




Competitive Advantages/Innovation Niches:

- **U.S.**: R&D; Design; Marketing
- **Japan** (initially), **Taiwan** (later): Production; production techniques and capabilities
- **Ukraine**, others: Raw materials (e.g., semiconductor-grade neon); extraction and transportation innovation
- **Netherlands…**

Global Semiconductor Value Chains



- Netherlands' ASML designs and manufactures **specialized lithography machines** used in semiconductor manufacturing.
- Controls >90% of the global market for high-precision lithography machines.
- Innovation:
  - Making better lithography machines
  - **Manage supply chain of 400,000+ components needed for the machines.**

Global Value Chains: Implications for Canada

- Many businesses & policy-makers continue to think in terms of end products or big fields (e.g., AI; Digital Ag; Electric Vehicles).
- The reality of fragmented global value chains means we need to ***think in terms of components and specialized processes***.
- We need to think about where we have ***local capabilities*** to develop world-beating ***niche advantages***.

III

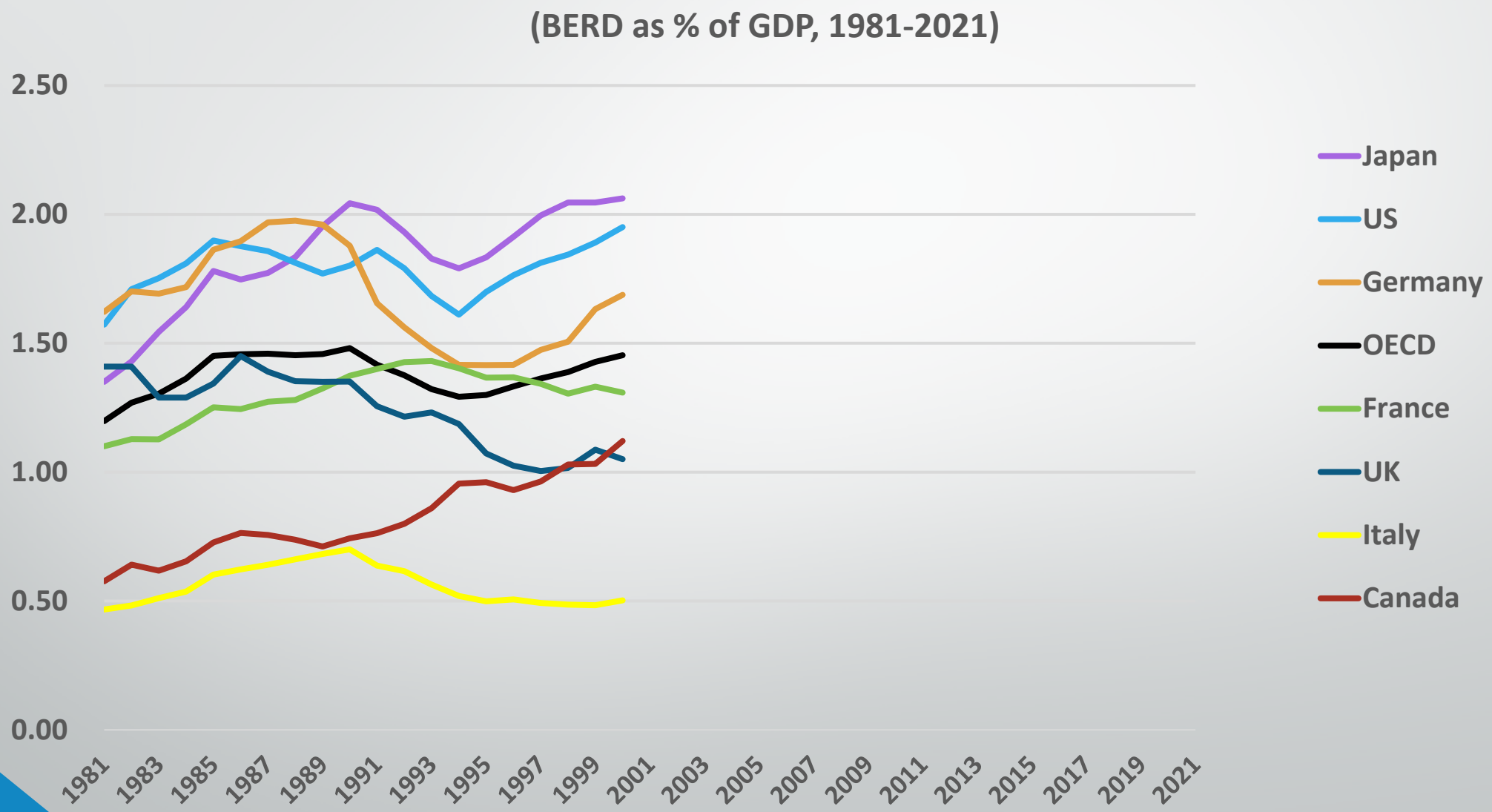
Canada’s Innovation Policy

Canada's Innovation Policy

- ***How do we use policy to improve innovation performance?***

- Question has remained the same, but assumptions underlying how we do that have changed over past two decades.

1990s: A Moment of Innovation Optimism?



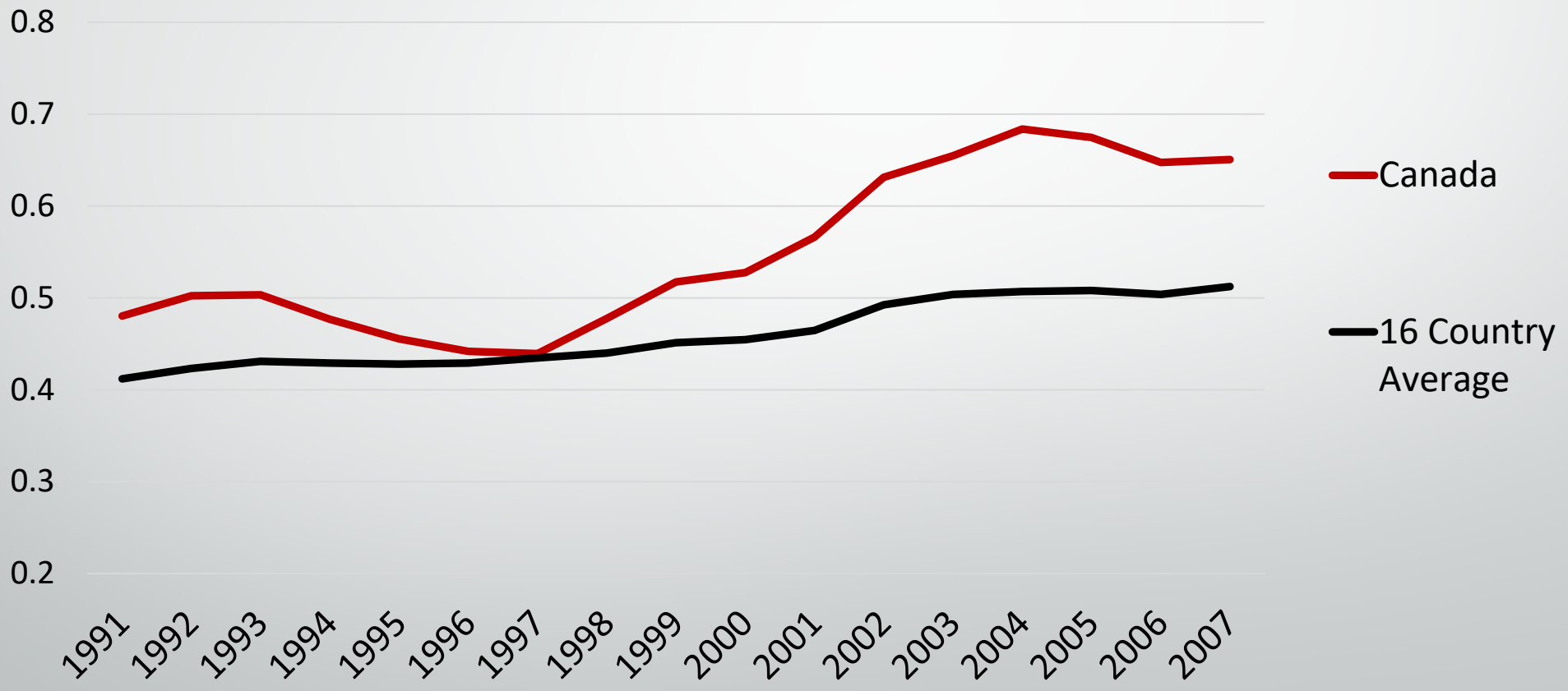
1990s/2000s

- Sense that long-term innovation performance depends on improving *education* and *basic science* – spurred by OECD analysis concluding as much.
- "Get the foundations right and the rest will follow."
- Canada adopts policies focused on ***science and education***.
  - Canada Foundation for Innovation
  - Canada Research Chairs
  - Canada Excellence Research Chairs
  - Student Loans and Supports

Results

Canada Pulls Away From Peers on Higher Education R&D

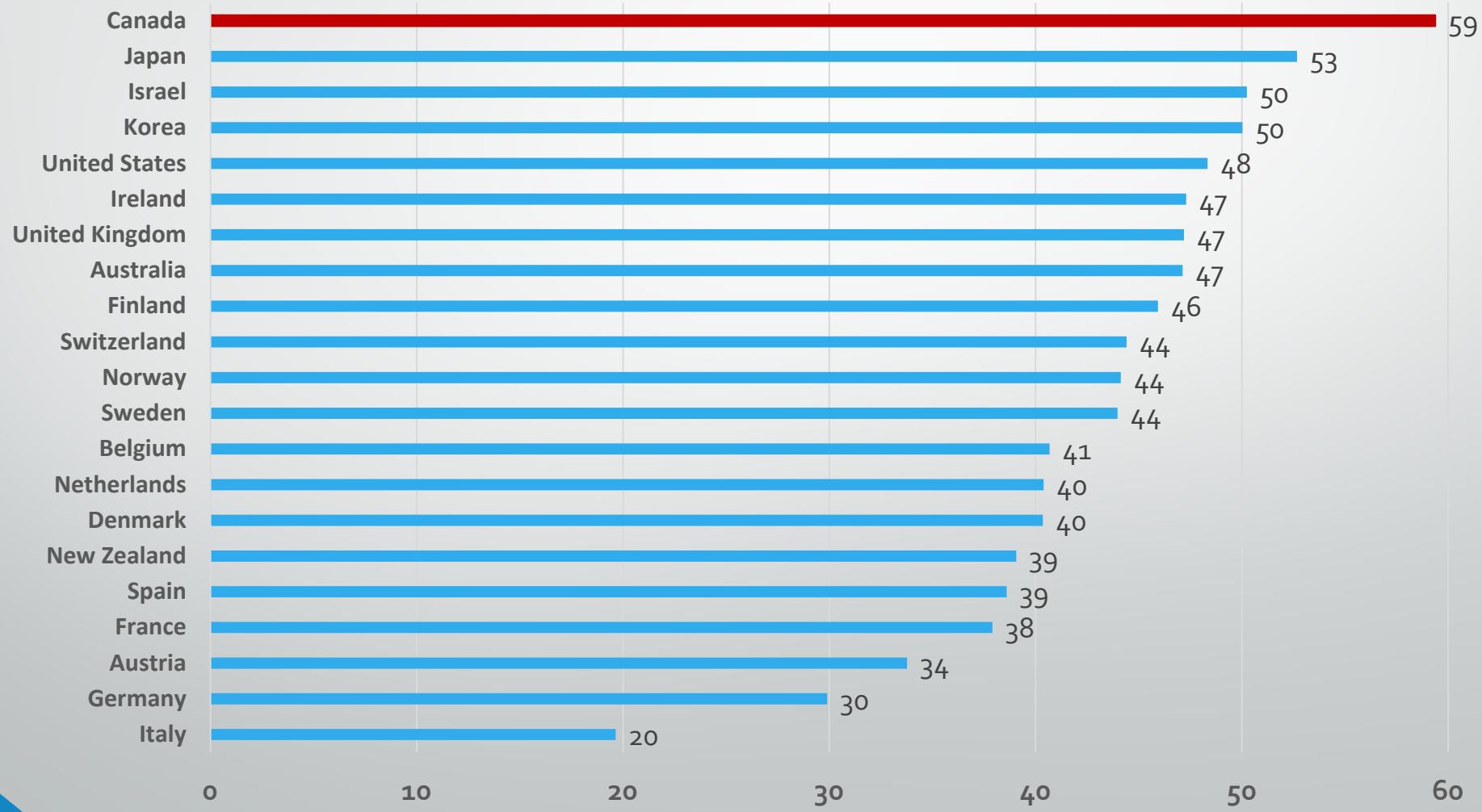
(HERD as % of GDP, 1991-2007)



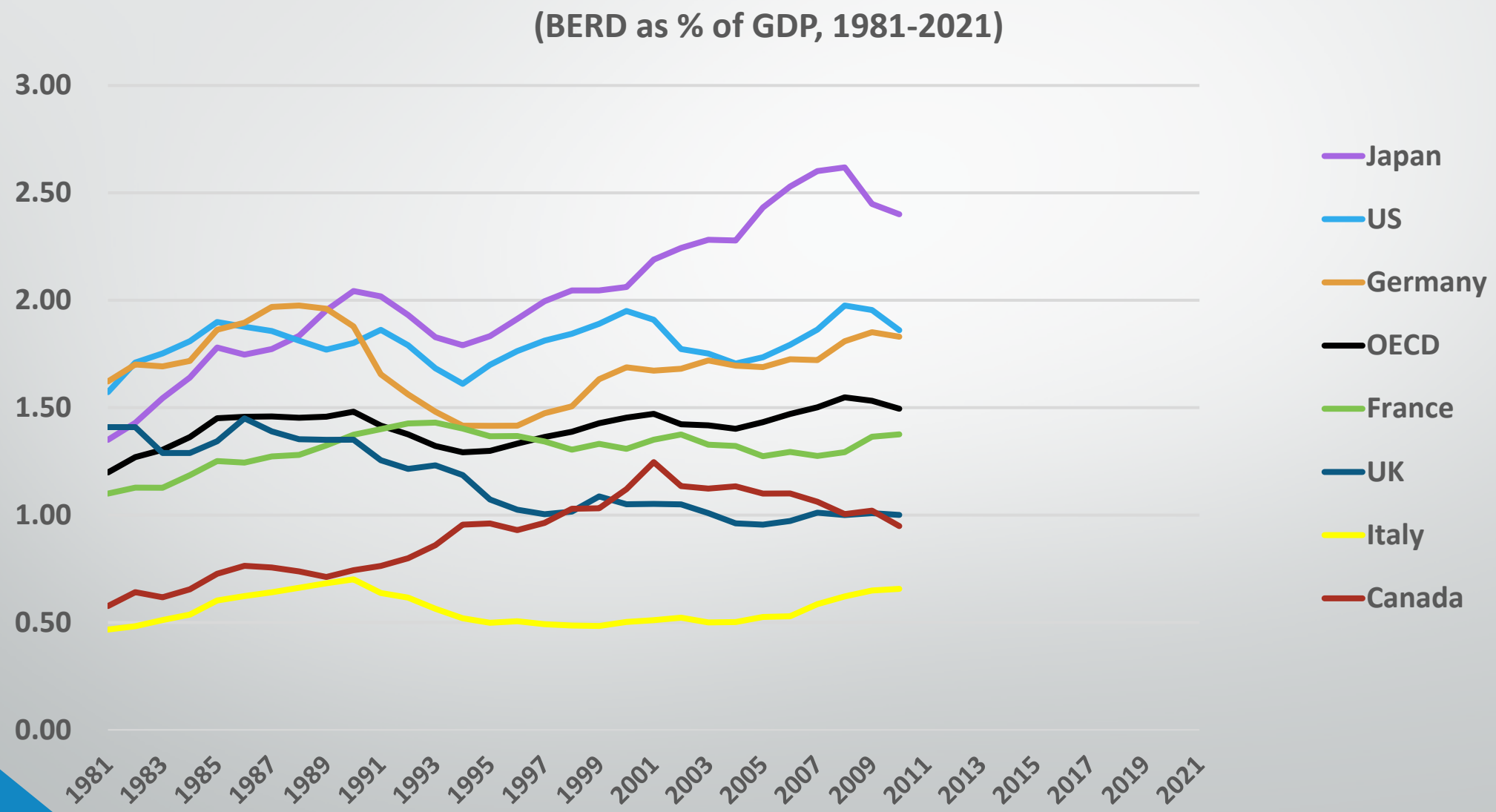
Results

Canada becomes world leader in post-secondary educational attainment

(percent aged 25-64 with post-secondary credential, 2019)



The Long BERD Slide Begins



Nortel – Canada's R&D Darling – Collapses

2000:

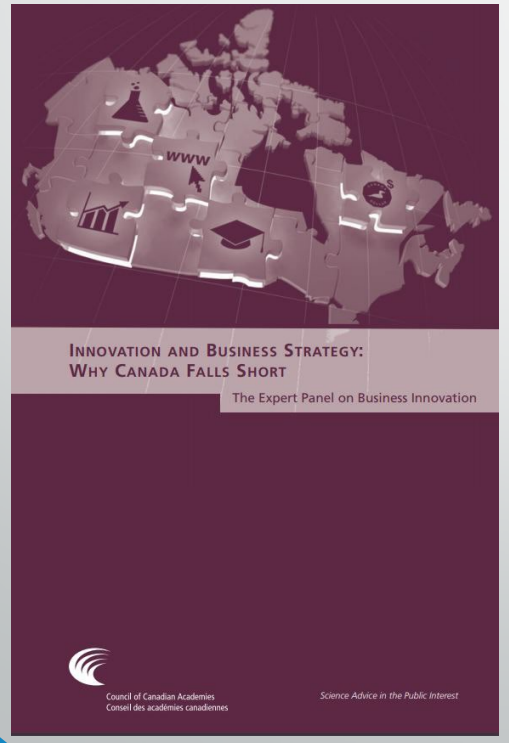
- Nortel spent $6B on R&D
- Canada's total BERD was $13B.

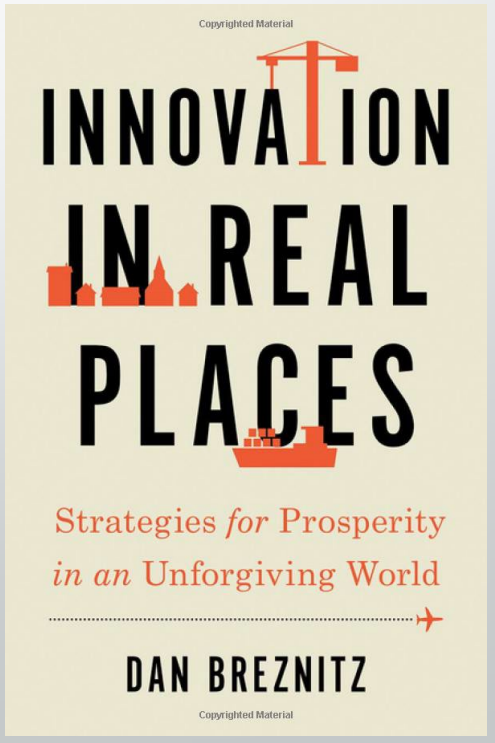
2009 (the year Nortel filed for bankruptcy):

- Nortel spent $864M on R&D
- Canada' total BERD was $16B
- Our new "darling", RIM/Blackberry, spent $1.1B.

2010s/2020s

- Increasing recognition that Canada's long-term innovation problem is a *business* innovation problem.
- "Stop pushing string uphill and start pulling."





2010s/2020s

- Policies focused on investments to spur ***applied research and business innovation***.
  - Industrial Research Chairs for Colleges & Polytechnics
  - Venture Capital Action Plan
  - Strategic Innovation Fund
  - Superclusters (Global Innovation Clusters)
  - Canada Innovation Corporation
- Successful or not (or TBD), these interventions shift to a firm-focused + demand-side approach over research + supply-side.

Three Shifts

Questions for Polytechnics

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- What do polytechnics already do, and what more can you do, to ***support innovation in the intangible economy***?

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- What ***research and talent capabilities*** do polytechnics have, and what ***innovation niches*** can you identify (with local communities and industry partners) to help seize opportunities in fragmented global value chains?

Questions for Polytechnics

- What do polytechnics already do, and what more can you do, to ***support innovation in the intangible economy***?
- What ***research and talent capabilities*** do polytechnics have, and what ***innovation niches*** can you identify (with local communities and industry partners) to help seize opportunities in fragmented global value chains?
- What ***contributions do polytechnics make to firm-focused innovation***, and what ***additional contributions*** can you make to ensure recognition as important innovation agents in the shifting policy landscape?

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