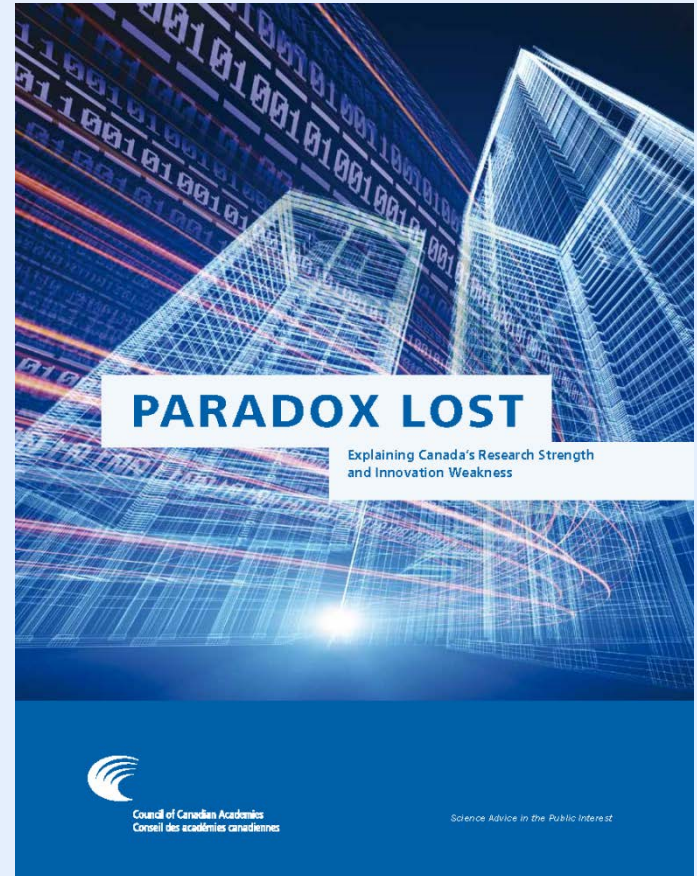


Council of Canadian Academies
Conseil des académies canadiennes

PARADOX LOST

Explaining Canada's
Research Strength and
Innovation Weakness

Ottawa, 1 October, 2013



SYNTHESIS: SEVEN COUNCIL ASSESSMENTS

www.scienceadvice.ca

- ❑ **The State of S&T in Canada (2006)**
- ❑ **Innovation and Business Strategy: Why Canada Falls Short (2009)**
- ❑ **Catalyzing Canada's Digital Economy (2010)**
- ❑ **Informing Research Choices: Indicators and Judgment (2012)**
- ❑ **The State of S&T in Canada, 2012**
- ❑ **Innovation Impacts: Measurement and Assessment (2013)**
- ❑ **The State of Industrial R&D (2013)**

EVIDENCE-BASED AND POLICY-RELEVANT...NOT POLICY-PRESCRIPTIVE

TWO PRINCIPAL CONCLUSIONS

- Canadian academic research, overall, is strong and well-regarded internationally**
- Canadian business innovation is weak by international standards and is the primary cause of our weak productivity growth**

NO SURPRISE...BUT GREATER ANALYTICAL DEPTH IS REQUIRED

THE CONCLUSIONS RAISE PARADOXES

- ❑ **Why hasn't Canada's research strength yielded more business innovation?**
- ❑ **If innovation improves competitiveness, why aren't Canadian business strategies more focussed on innovation?**
- ❑ **Why has Canada prospered despite chronically weak business innovation?**

THE PARADOXES HAVE PERSISTED, SO THEIR ROOTS ARE STRUCTURAL

ASSESSING ACADEMIC RESEARCH STRENGTH

- Why excellence in academic research matters**
- Defining and measuring research strength**
- How does Canada stack up internationally?**
- A challenge to Canada's research community**

WHY (ACADEMIC) RESEARCH EXCELLENCE MATTERS

- ❑ Essential to train the next generation at the leading edge
- ❑ “Price of admission” for access to the latest global knowledge pools and networks
- ❑ Enhances Canada’s attractiveness for investment by knowledge-intensive businesses
- ❑ Sometimes leads *directly* to commercial spin-offs.

NECESSARY FOR AN INNOVATIVE ECONOMY ... BUT NOT SUFFICIENT

ASSESSMENT OF CANADA'S RESEARCH STRENGTH

THREE DIMENSIONS OF STRENGTH



Magnitude
(3 Indicators)



Quality/Impact
(6 Indicators)



Trend
(5 Indicators)

20 Major Fields and 176 Sub-fields—for example:

- Biology**
 - Ecology, Marine biology, Zoology,...
- Clinical Medicine**
 - Allergy, Cardiovascular, Immunology, Oncology, Pediatrics,...
- Economics and Business**
 - Accounting, Econometrics, Industrial relations, ...
- Engineering**
 - Aerospace, Automotive, Biomedical, Environmental, Mining,...
- Historical Studies**
 - Anthropology, Classics, History of Social Sciences,...

Bibliometrics
(Scopus Data-base)

International Experts
(Survey Top 1% most cited)

Domestic Experts
(Selected survey)

THREE LENSES TO ASSESS STRENGTH

HOW DOES CANADA STACK UP INTERNATIONALLY?

<input type="checkbox"/> Total publications (2005-10)	395,000
<input type="checkbox"/> World rank in number of publications	7 th
<input type="checkbox"/> Share of global total	4.1%
<input type="checkbox"/> Share of top 1% most cited	4.7%
<input type="checkbox"/> World rank in Average Relative Citation index (ARC)	6 th
<input type="checkbox"/> Percent of top-cited saying Canada is in top 5 in their field	37%
<input type="checkbox"/> Growth in number of publications (1999-2004 to 2005-10)	60%
<input type="checkbox"/> Proportion of (20) major fields in which ARC increased	80%
<input type="checkbox"/> % of domestic experts who think Canada is Gaining/Losing ground	15/50

HERD/GDP IS 1ST IN G-7 AND 7TH IN OECD ... BUT RANK HAS FALLEN

A CHALLENGE TO CANADA'S RESEARCH COMMUNITY

Strength metrics vary across fields, e.g.

Share of world publications

High Psych. & Cognitive Sci. (7.6%)

Low Chemistry (2.6%)

Share of top 1% most-cited papers

High Public Health & Services (8.0%)

Low Physics and Astronomy (2.6%)

% international experts ranking Cda. in top 5

High Psych. & Cognitive Sci. (69%)

Low Enabling & Strategic Techs. (17%)

% Canadian experts rating Canada strong

High Ag., Fish, Forestry (78%)

Low Chemistry (53%)

Change in share of world publications

High Public Health & Services (0.78 pct pts)

Low Ag., Fish, Forestry (-0.98 pct pts)

Three questions for the expert communities in each field and sub-field:

1. Are the assessments of strengths/weaknesses in your field broadly valid?
2. If not, where is the methodology deficient and how might it be improved?
3. Where the findings are valid, how can the strengths be sustained and the weaknesses ameliorated?

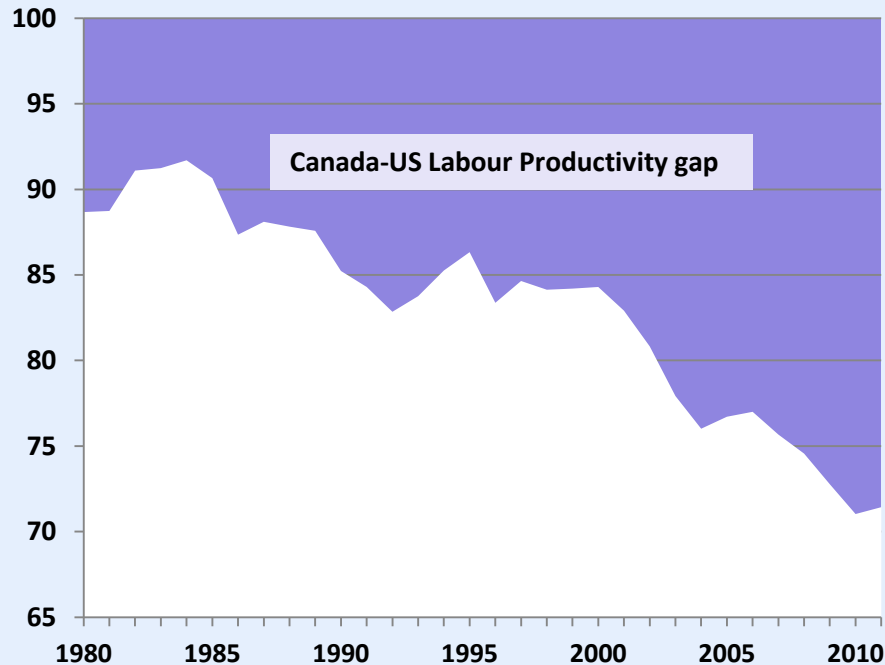
RANKINGS SHOULD INSPIRE CONSTRUCTIVE SELF EXAMINATION WITHIN DISCIPLINES

“PARADOX LOST”

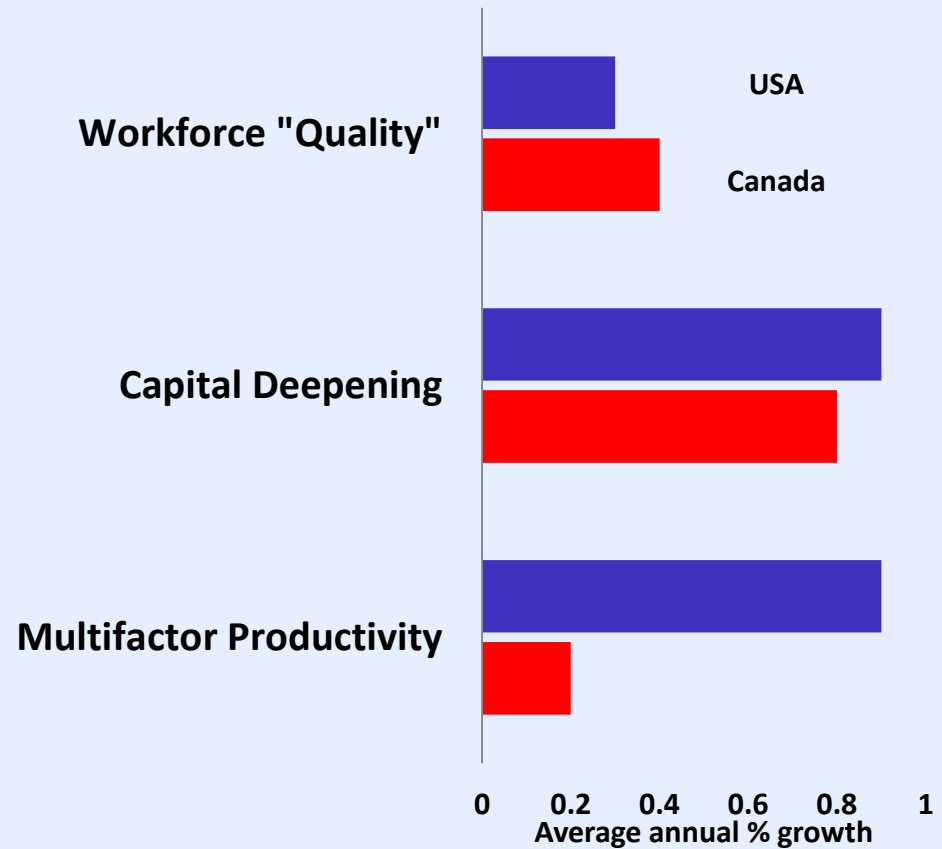
- ❑ The evidence for Canada’s weak business innovation --Productivity and R&D
- ❑ Why strong research does not (necessarily) result in strong innovation
- ❑ Why (most) Canadian business strategies have *always* been light on innovation
- ❑ Why Canada has nevertheless prospered in its “low innovation equilibrium”
- ❑ Summary and Conclusions

ANALYZING CANADA'S BUSINESS PRODUCTIVITY GAP

Labour Productivity: Canada as % of US



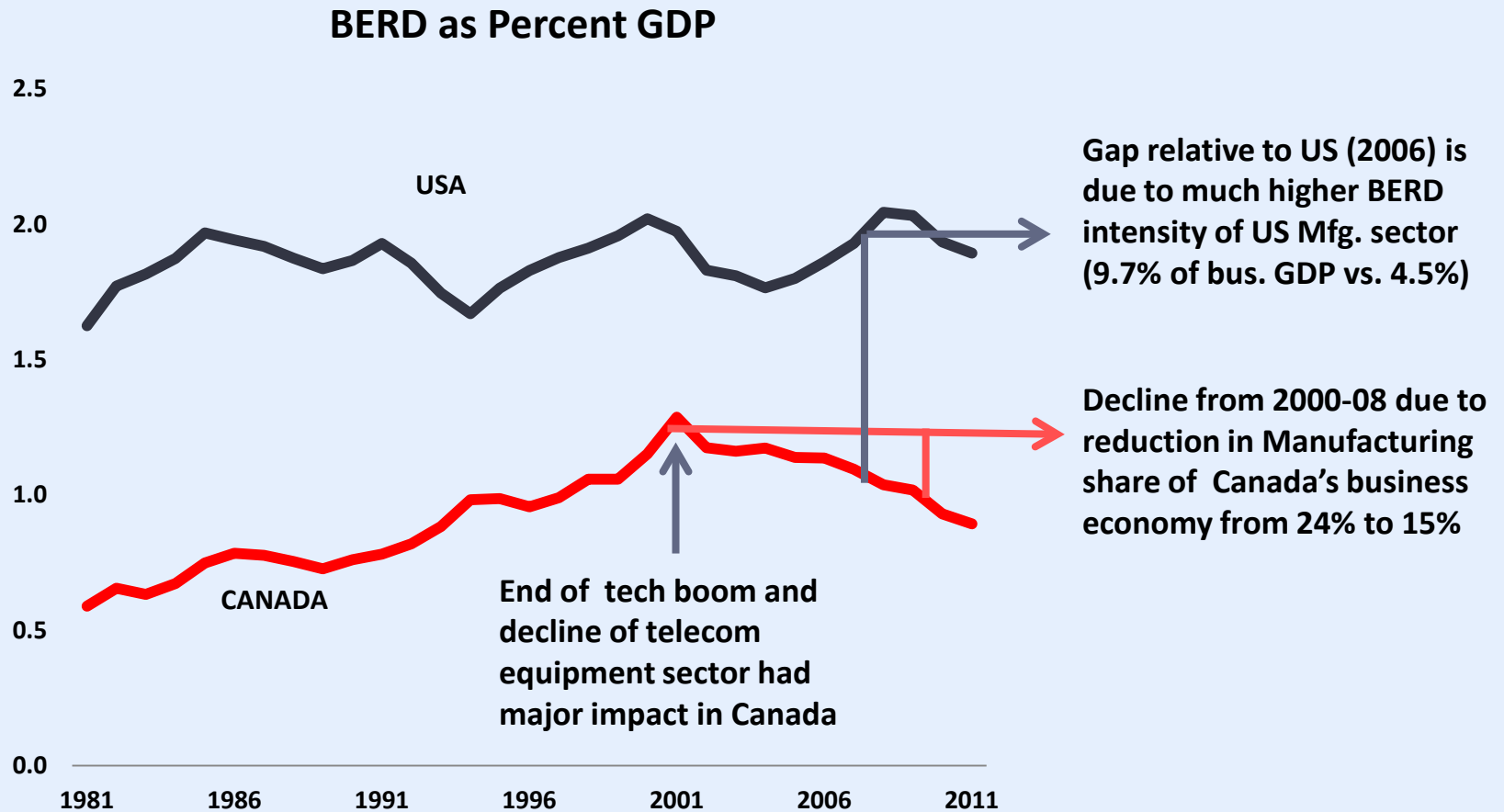
Components of Productivity Growth 1980-2011



**WEAK CANADIAN MFP (A PROXY FOR "DISEMBODIED" INNOVATION)
LARGELY EXPLAINS THE PRODUCTIVITY GAP**

EXPLAINING CANADA'S BUSINESS R&D "GAPS"

R&D is concentrated in Manufacturing and some (often related) services



CROSS-COUNTRY AND SECTOR ANALYSES ARE SUBJECT TO DATA INCONSISTENCIES

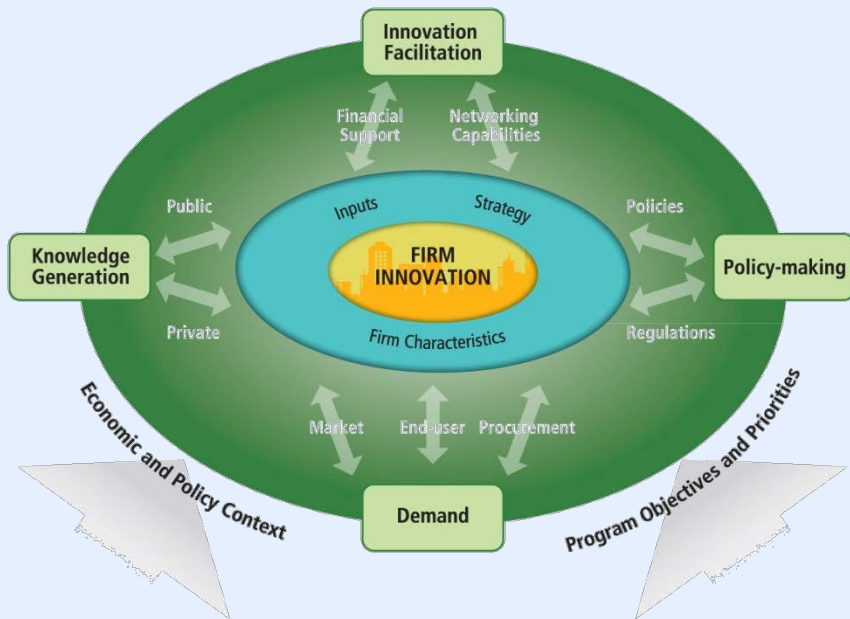
STRONG RESEARCH DOESN'T GUARANTEE INNOVATION

The “linear”, research-push model of innovation rarely applies

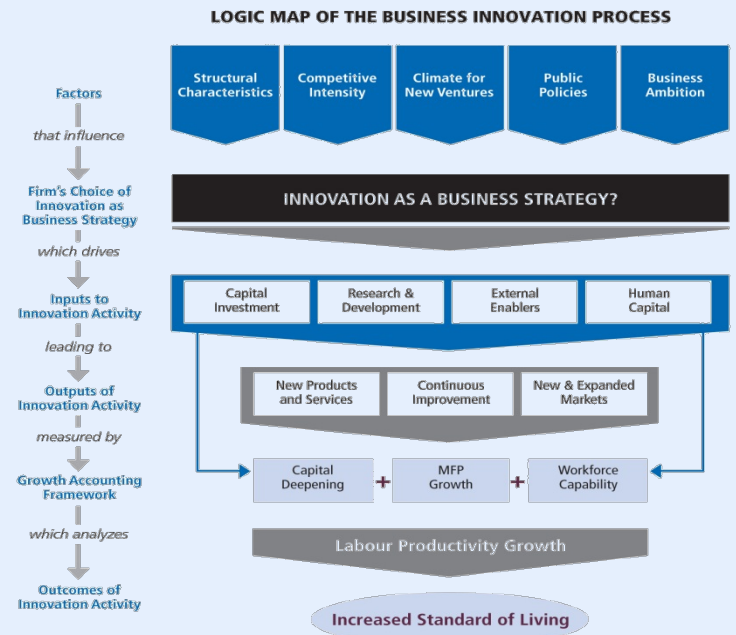


Policy has focussed on the supply-side but the problem is on the demand-side

Firm-centric Innovation Ecosystem



Logic Map of the Business Innovation Process



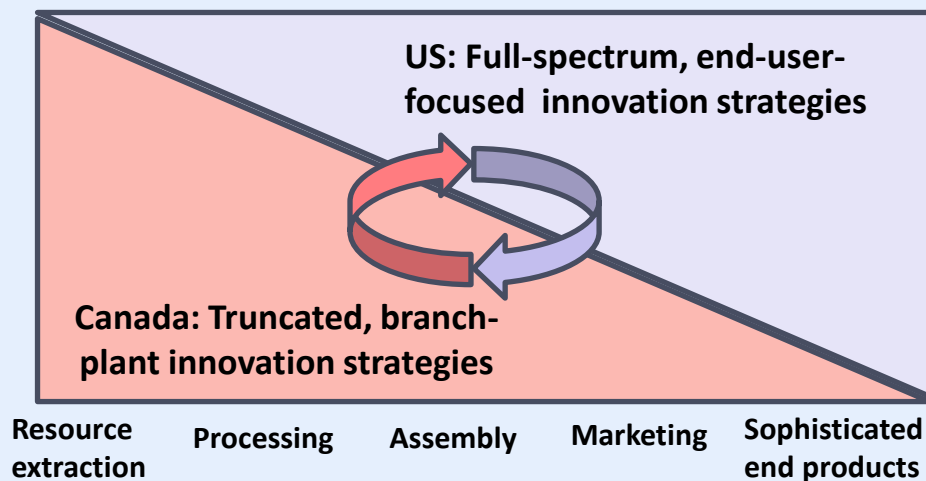
FEW CANADIAN BUSINESS STRATEGIES EMPHASIZE RESEARCH-BASED INNOVATION

WHY BUSINESS STRATEGIES DO NOT FOCUS ON INNOVATION



- ❑ Canada has benefited from unique adjacency to the 20th century's technological and economic leader
- ❑ Canadian industry thus carved a profitable niche in integrated, U.S.-dominated value networks

Complementary Business Strategies



EASIER AND CHEAPER TO GET "INNOVATION" FROM THE U.S.

A PROFITABLE LOW-INNOVATION EQUILIBRIUM

From the Lamontagne Report on Science Policy (1970)

“Since 1916...the main objective of Canadian science policy has been to promote technological innovation in industry....Almost every decade since the 1920s has witnessed renewed attempts by successive Canadian governments to achieve it, but on the whole they have all failed”

Canadian business has been as innovative as it has needed to be.

- Corporate profit margins, in aggregate, have long matched or exceeded those in the US ... So where is the motivation to change?
- Strong job growth has offset the impact on per capita GDP of poor productivity, and a weak \$C made productivity growth less urgent
- As the \$C strengthened since 2002, putting heavy pressure on manufacturers, a commodity boom has mitigated the *overall* impact, despite regional strains

BUSINESS STRATEGY WILL NOT CHANGE UNLESS THE SUCCESS FACTORS CHANGE

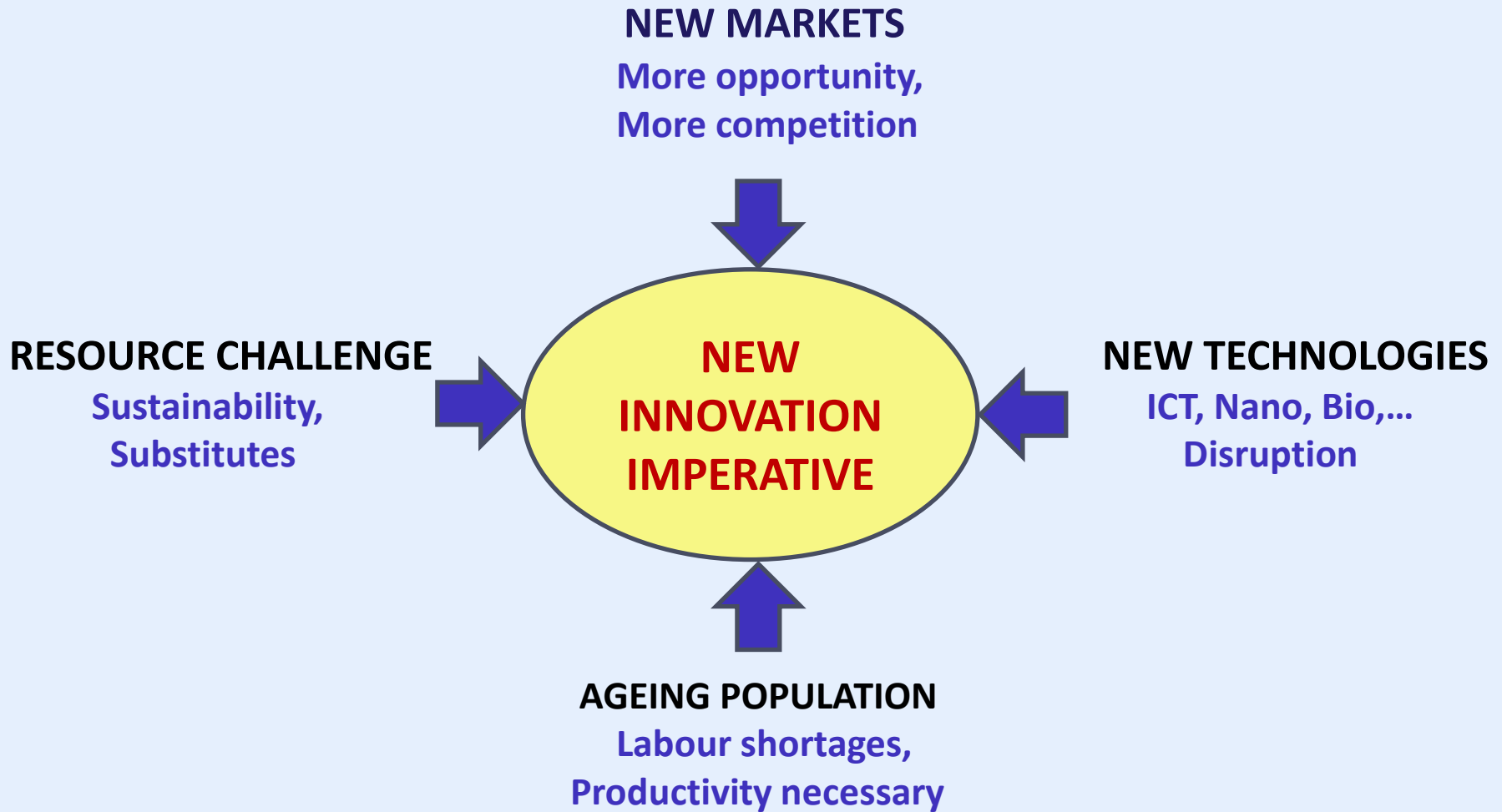
PERSPECTIVE FROM V.O. MARQUEZ--1972

C.E.O. Northern Electric (forerunner of Nortel)

It is uncertain whether any incentive plan to stimulate the growth of domestic technology and innovation, or to make corporations expand aggressively into foreign markets, can achieve significant success when it is applied to companies in which the drive to do these things has not already been forced to emerge because of exposure to a real stimulus from the economic environment. What we seem to need in Canada are “small catastrophes”.

--Business Quarterly 37(4); 1972

DISRUPTING THE LOW-INNOVATION EQUILIBRIUM

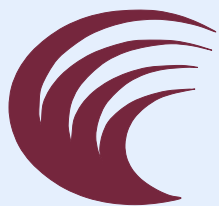


BUT... SHOCKS ARE USUALLY NEEDED TO CHANGE ENTRENCHED BEHAVIOUR

SUMMARY AND CONCLUSIONS

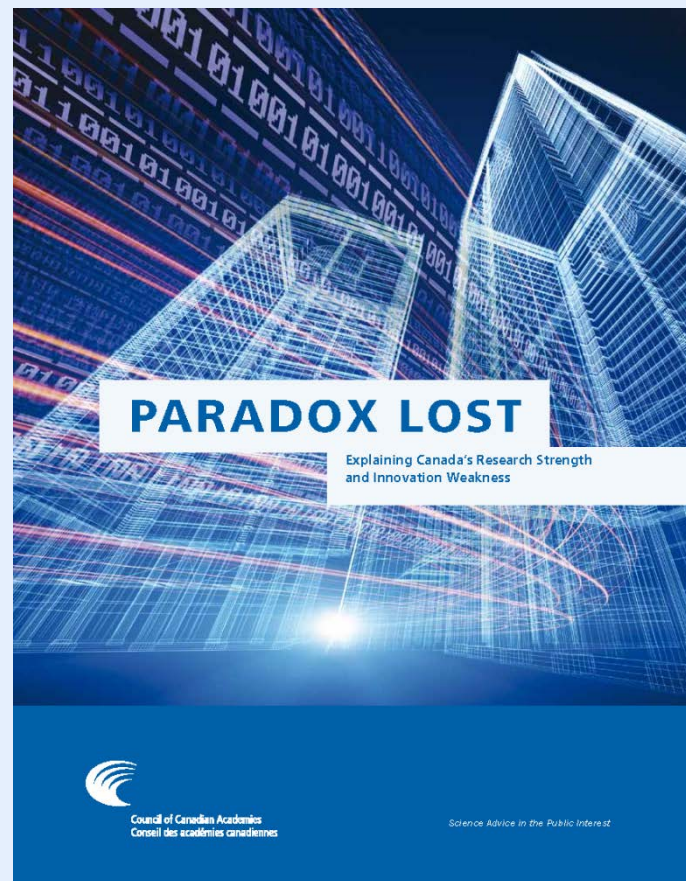
- ❑ The business innovation “problem” in Canada has a pedigree as old as the country itself.
- ❑ History shows that Canadian business has profitably adapted to its low-innovation equilibrium and behaviour will not change unless competitive conditions change.
- ❑ Conditions are in fact changing in ways that require innovative responses from businesses to compete and survive.
- ❑ The objectives of public policy for innovation, and business motivation to become more innovative, should therefore finally be aligned, portending a more committed and fruitful engagement.
- ❑ In broad terms innovation policy should:
 - Address the innovation “ecosystem” from a firm-centered perspective
 - Place much greater emphasis on innovation *demand-pull* (e.g. competition, procurement, trade, regulatory standards)
 - Sustain Canada’s research strengths which continue to be needed to support business innovation.

The full report is available for download from the Council's website, www.scienceadvice.ca



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