CANADA’S INNOVATION GAP
ESTIMATING ITS SIZE; EXPLAINING ITS CAUSES

by
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• **MISSION:** To support independent, assessments (studies) on science that is relevant to issues of public interest

• A non-profit corporation, operational since early 2006. (Analogous to the National Research Council of the US National Academies)

• Assessments are produced by independent panels of experts, comprised of Canadian and international authorities who serve without compensation

• Six assessments completed; two more nearing completion

$30M FEDERAL GRANT SUPPORTS CORE OPERATIONS THROUGH 2015
OUTLINE

• INTRODUCTION & SUMMARY

• MEASURING THE BUSINESS INNOVATION GAP

• INNOVATION AS BUSINESS STRATEGY

• FACTORS THAT INFLUENCE INNOVATION AS STRATEGY

• SOME BROAD PUBLIC POLICY IMPLICATIONS
QUESTION: “If innovation is good for business, why is Canadian business less committed to innovation than most policy-makers believe it should be?”

- Panel of 18 chaired by Bob Brown – majority were senior business people but also included members from labour, academia and NGO communities.

- Panel was asked for a **diagnosis**, not a policy prescription

- Panel’s perspective was long-term, covering many decades, so conclusions remain relevant despite current crisis

- Panel analyzed innovation as an economic process, not simply as an S&T activity
1. Canada’s long-standing productivity growth problem is due to weak business innovation.

2. Business innovation is driven by business strategy.

3. The productivity issue needs to be reframed to focus on the factors that influence businesses to choose – or not to choose – innovation as a key competitive strategy.

4. Public policy has an important role, but the primary challenge is for business to adopt innovation-oriented strategies.
**OUTPUT, PRODUCTIVITY, INNOVATION**

**OUTPUT PER CAPITA**

GDP/Population = \(\text{GDP/Hours Worked} \times \text{Hours Worked/Population}\)

**LABOUR PRODUCTIVITY**

Workforce Composition, **Capital Intensity, Multifactor Productivity**

**INNOVATION**

- Insights of entrepreneurs
- Payoff from R&D
- Improved business models
- Efficient work practices
- Continuous improvement
- Application of leading-edge technology

**REPORT FOCUSES ON INNOVATION BY BUSINESS AND AS BROADLY INTERPRETED**
Canada’s Strong Job Growth Able to Offset Weak Productivity

Canadian GDP per capita as percent of U.S.

Data Sources: Conference Board & Groningen Growth and Development Centre, 2008; Maddison, 2008

ECONOMIES IN CANADA AND THE U.S. HAVE EVOLVED IN TANDEM
CANADA’S RELATIVE PRODUCTIVITY SLIDE

PRODUCTIVITY IN THE BUSINESS SECTOR - CANADA AS % OF U.S. SINCE 1947

Labour productivity difference in percentage terms (U.S. – Canada)

Peak Year – 1984 93%

CATCHING UP

FALLING BEHIND

CANADA’S PRODUCTIVITY GROWTH HAS ALSO LAGGED MOST OECD PEERS

Data Source: CSLS, 2008a
CANADA’S PRODUCTIVITY GROWTH LAGS OECD PEERS

LABOUR PRODUCTIVITY GROWTH: 1985-2006

WEAK MFP GROWTH IS RESPONSIBLE FOR CANADA’S LOW RANKING

Source: OECD, 2008a
CANADA’S MFP GROWTH HAS LAGGED U.S. FOR AT LEAST 45 YEARS

ACCOUNTING FOR PRODUCTIVITY GROWTH DIFFERENCES

LABOUR PRODUCTIVITY GROWTH

CAPITAL DEEPENING

LABOUR COMPOSITION IMPROVEMENT

MULTIFACTOR PRODUCTIVITY (MFP) GROWTH

Data Source: Baldwin & Gu, 2007
GROWTH RATE DIFFERENCE: CANADA MINUS U.S.

Capital Intensity

Labour Composition

Multifactor Productivity (MFP)

Productivity Gap Narrowing

Productivity Gap Widening

Data Source: Statistics Canada, 2007a

CAPITAL AND LABOUR QUALITY NO LONGER OFFSETTING CANADA’S WEAK MFP
WHAT IS “MULTIFACTOR PRODUCTIVITY”? 

**MFP** = The part of GDP per Hour that is NOT explained by Capital Intensity and Workforce “Quality”

EXAMPLES OF INNOVATION-BASED MFP GROWTH:

- Double stacking rail containers
- Installing a Drive-thru window in a fast food outlet
- Equipping a sales force with BlackBerries

THOUSANDS OF INNOVATIONS, LARGE & SMALL, DRIVE PRODUCTIVITY GROWTH
IS MFP GROWTH THE “STATISTICAL SIGNATURE” OF INNOVATION?

The innovation “signal” in MFP comes mixed with a lot of noise.

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<thead>
<tr>
<th>CONFOUNDING FACTORS</th>
<th>IMPACT ON CANADA-U.S. MFP GROWTH DIFFERENCE</th>
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<tbody>
<tr>
<td>Economic Cycle</td>
<td>Averages out over 1961-2006</td>
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<td>Economies of Scale</td>
<td>Changes since NAFTA should have helped Canada</td>
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<td>Public Infrastructure</td>
<td>Effects likely to be broadly similar in U.S., Canada</td>
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<td>Slowly-varying Factors</td>
<td>Little impact on growth rate differences</td>
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<td>Measurement / Model Errors</td>
<td>Common methodology should minimize effect</td>
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LONG-RUN MFP GROWTH RATE IS A GOOD MEASURE OF BROAD INNOVATION
DISTINCTION BETWEEN MFP GROWTH AND CAPITAL DEEPENING IS SOMEWHAT ARTIFICIAL
ICT DRIVES U.S.-CANADA INVESTMENT GAP

M&E ANNUAL INVESTMENT INTENSITY SINCE 1987

Per Cent of Nominal GDP in Business Sector

1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007

M&E = Machinery & Equipment

Data Source: CSLS, 2008b

ICT HAS BEEN A KEY DRIVER OF MFP & PRODUCTIVITY GROWTH IN U.S.
INNOVATION THROUGH THE LENS OF BUSINESS STRATEGY

Influencing Factors:
- Structural Characteristics
- Competitive Intensity
- Climate for New Ventures
- Public Policies
- Business Ambition

Strategy Choice: INNOVATION AS A BUSINESS STRATEGY?

Inputs to Innovation Activity:
- Capital Investment
- Research & Development
- External Enablers
- Human Capital

Innovation Outputs:
- New Products
- Continuous Improvement
- New & Expanded Markets

Macroeconomic Outcomes:
- Capital Deepening + MFP Growth + Workforce Capability

LABOUR PRODUCTIVITY GROWTH

REFRAMING THE ANALYSIS OF CANADA’S WEAK PRODUCTIVITY GROWTH
## Roots of Canada’s Innovation Weakness

### “Upstream” Role in North American Value Chains

Comparative advantage and history imply:

- Commodity supplier
- Little contact with “end customer”
- Foreign control in many tech-intensive sectors
- Comfortable and profitable niche in North America

### Small and Fragmented Domestic Market

Smaller markets tend to provide:

- Less reward for innovation risk
- Less attraction for competitors from the outside, and thus . . .
- Less pressure to innovate

But success of Finland and Sweden shows importance of innovation-driven export focus

Canadian business has adapted profitably to these conditions.
BUSINESS PROFIT HEALTHY DESPITE WEAK INNOVATION

CORPORATE PROFIT (BEFORE TAX) AS PER CENT OF GDP

Business Profitability in Canada has exceeded that in the U.S. in 83% of years since 1961

Data Source: Statistics Canada, 2007

STRONG AVERAGE PROFITABILITY TENDS TO CONFIRM STATUS QUO STRATEGY
KEY FACTORS THAT INFLUENCE INNOVATION STRATEGY CHOICE

- STRUCTURAL CHARACTERISTICS
- COMPETITIVE INTENSITY
- CLIMATE FOR NEW VENTURES
- PUBLIC POLICIES
- BUSINESS AMBITION

Analyzed in Context of R&D
- Sector Mix
- Foreign Ownership
- Firm Size Distribution

INNOVATION ANALYSIS CONVENTIONALLY FOCUSES ON STRUCTURE AND R&D GAPS
SECTORAL EVOLUTION OF THE U.S.-CANADA R&D GAP


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- **Utilities & Primary Resources**
- **Motor Vehicles**
- **Chemicals (excl. Pharma)**
- **Aerospace**
- **Office Accounting & Computing Machinery**
- **Business Services**
- **Pharmaceuticals**
- **All other Manufacturing**

Data Source: Panel calculations based on OECD’s STAN database

GAP HAS NARROWED FOR MANUFACTURING BUT GROWN FOR SERVICES
“MIX” & “INTENSITY” EFFECTS ON THE R&D GAP

GAP IF CANADA HAD U.S. SECTOR WEIGHTS

GAP IF CANADA HAD U.S. SECTOR R&D INTENSITY

REVISED GAP

Actual observed BI for U.S.

BI for Canada with U.S. sector mix

Actual observed BI for Canada

BERD Intensity (BI)


BERD Intensity (BI)


prior to 1996, there are limited sector BI data for the U.S.

Data Source: Panel Calculations based on OECD STAN Database

LOWER R&D SECTOR INTENSITY IN CANADA EXPLAINS MOST OF THE GAP
R&D AND OUTPUT SHARES IN THE AUTO INDUSTRY

BERD INTENSITY: 1987-2002


AUTOMOTIVE PRODUCTIVITY HIGH IN CANADA DESPITE LOW R&D

Data Source: OECD, 2008b
IMPACT OF FOREIGN OWNERSHIP (II)

R&D AND OUTPUT SHARES IN PHARMACEUTICALS

HIGH R&D IN CANADA HAS NOT PRODUCED STRONG OUTPUT GROWTH

Data Source: OECD, 2008b
FIRM SIZE DISTRIBUTION AND THE R&D GAP

R&D INTENSITY AND FIRM SIZE

Total BERD is concentrated in large firms, despite their lower “intensity”

Data Sources: Statistics Canada, 2006

U.S.-CANADA R&D GAP IS CONCENTRATED IN LARGEST COMPANIES
KEY FACTORS THAT INFLUENCE INNOVATION STRATEGY CHOICE

- STRUCTURAL CHARACTERISTICS
- COMPETITIVE INTENSITY
  - Competition spurs innovation
  - Small markets less attractive to competitors
  - Export vs domestic markets
  - Regulation
- CLIMATE FOR NEW VENTURES
- PUBLIC POLICIES
- BUSINESS AMBITION
KEY FACTORS THAT INFLUENCE INNOVATION STRATEGY CHOICE

- STRUCTURAL CHARACTERISTICS
- COMPETITIVE INTENSITY
- CLIMATE FOR NEW VENTURES
  - Early-stage financing
  - Innovation from university research
  - Geographic clusters
- PUBLIC POLICIES
- BUSINESS AMBITION
MULTI-STAGE FINANCING OF NEW VENTURES

“Valley of Death”

- Buy Out
- Go Public

- Family & Friends
- Angel Investors & Mentors
- Multi-Stage Venture Capital

Lots of Canadian early-stage start-ups

Critical shortage of successful tech entrepreneurs (except in ICT)

VC in Canada tends to be small, lacking tech experience

Too few firms grow to sustainable scale in Canada

SUCCESS CREATES ‘ANGELS’ WHO THEN HELP GENERATE MORE SUCCESS
Venture Capital Performance

Net Return* on Previous 10 Years for 2001-07

Internal Rate of Return (%)

Canada

U.S.

VENTURE CAPITAL PERFORMANCE – NET RETURN ON PREVIOUS 10 YEARS

 Poor Canadian Returns Due To:
• Comparative immaturity of VC sector
• Prevalence of VC in an unsuitable vehicle (LSIF)

Data Sources: CVCA, 2007; NVCA, 2008

NO QUICK FIX, BUT MARKET PERFORMANCE WILL BE THE SUCCESS CRITERION
KEY FACTORS THAT INFLUENCE INNOVATION STRATEGY CHOICE

- STRUCTURAL CHARACTERISTICS
- COMPETITIVE INTENSITY
- CLIMATE FOR NEW VENTURES
- PUBLIC POLICIES
  - Macroeconomic Policies
  - Human Capital
  - Trade Liberalization
  - Regulation
  - Taxation (esp. SR&ED)
  - Sector Strategies
  - OECD “Menu”
- BUSINESS AMBITION
THE MACRO CONTEXT FOR BUSINESS EXPENDITURE ON R&D

BERD AS PERCENT OF GDP

1. Tech Boom Collapse
2. Strategic Aerospace & Defence Initiative
3. Creation of NABST
4. “Modern” version of R&D Tax Credit
5. Canada-U.S. Free Trade Agreement
6. Prosperity Initiative
7. Technology Partnerships Canada
8. NAFTA
9. Canada’s Innovation Strategy

Data Source: OECD, 2008c

ONLY THE TECH BOOM / COLLAPSE HAS HAD MAJOR IMPACT
Canada is an ‘outlier’ in terms of reliance on tax-based incentives.

Data Source: OECD, 2008d
Canada has implemented most of the productivity-enhancing measures recommended as a result of OECD analysis.

Business taxes – especially on capital – have been high, but are now competitive and declining.

SR&ED tax credit - $4B incentive in 2007 – is among world’s richest and is by far the largest program of government support for innovation.

Concerted national strategy to “back winners” is difficult – not simply because governments have not been good at picking winners, or dropping losers – but because of Canada’s diverse and regionally-oriented political economy works against concerted action.

Canada’s innovation policies have relied principally on market forces.
KEY FACTORS THAT INFLUENCE INNOVATION STRATEGY CHOICE

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- BUSINESS AMBITION

INTANGIBLES OF “BUSINESS CULTURE” IS THE RESIDUAL FACTOR
**DOES CANADIAN BUSINESS LACK “AMBITION”?**

Why might Canadian businesses be less ambitious than the Americans?

- Arguments often advanced include:
  - Canada’s historical dependence on foreign initiative
  - Less competition in Canada’s domestic market
  - Canadian priorities / values are less commercially focused

- The issue is hotly debated:
  - Are Canadian and U.S. “attitudes” all that different?
  - Most panelists believed that business ambition was a key differentiator.

- Evidence is largely anecdotal based on experience of those who have worked in both U.S. and Canada.

Many international success demonstrate Canada’s innovative potential.
# NEW FACTORS AT PLAY FOR CANADA

## RESOURCE DEPENDENCE
- Volatile
- Unevenly-distributed
- Environmentally-challenged

## US MARKET
- Increasing vulnerability of access
  - Protectionism
  - National security

##Emerging Markets
- Where the BIG growth will be
- Increasingly sophisticated competitors
- Broad spectrum of opportunities

##New Business Leaders
- Less captives of old mindset
- More at home in the world

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**CHALLENGES AND OPPORTUNITIES SHOULD MOTIVATE INNOVATIVE RESPONSES**
There is no one-size-fits-all solution to the innovation puzzle.

- **AUTO SECTOR**: “Weak R&D But Strong Productivity”
- **LIFE SCIENCES**: “Great Promise – Mixed Results”
- **BANKING**: “Balancing Stability vs Radical Innovation”
- **ICT**: “A Catalytic Role for Government”
BROAD POLICY IMPLICATIONS OF THE ANALYSIS

- **TECHNOLOGY INVESTMENT** – Encourage investment in advanced M&E and ICT in particular.

- **COMPETITION & EXPORTS** – Increase exposure to competition and promote an export orientation, especially “downstream” in value chains.

- **NEW VENTURES** – Focus on early-stage financing and generation of potential “angels” to be investors and mentors.

- **BACKING OPPORTUNITIES** – Develop sector strategies to catalyze areas of opportunity.

- **DEEPER UNDERSTANDING** – Increase support for Statcan’s leading-edge work on innovation and productivity.

BOTTOM LINE: NEED TO GET BUSINESS STRATEGY FOCUSED ON INNOVATION
## Expert Panel on Business Innovation

### Business Services
- **Robert Brown (Chair)**
  - CAE; Bombardier*, Montreal
- **Guthrie Stewart**
  - Edgestone Capital*, Montreal
- **John Thompson**
  - TD Bank, IBM*, Toronto

### ICT
- **Savvas Chamberlain**
  - DALSA, Waterloo
- **Brian McFadden**
  - Prestige Telecom; Nortel*, Montreal
- **Jim Roche**
  - CMC*; Tundra Semiconductor*, Ottawa
- **Alexandre Taillefer**
  - Stingray Digital, Montreal

### Life Sciences
- **Nathalie Dakers**
  - CDRD (at UBC), Vancouver
- **André Marcheotere**
  - Merck-Frosst*, Montreal

### Resources
- **Walter Mylnaryk**
  - Kruger Inc., Montreal
- **Charles Ruigrok**
  - Syncrude*, Calgary

### Consulting
- **Marcel Côté**
  - SECOR, Montreal
- **David Pecaut**
  - The Boston Consulting Group, Toronto

### Labour
- **Jim Stanford**
  - CAW, Toronto

### NGO
- **Andrew Sharpe**
  - CSLS, Ottawa

### Academic
- **Meric Gertler**
  - University of Toronto
- **Bronwyn Hall**
  - UC Berkeley (US) ; Maastricht (Netherlands)
- **Arthur May**
  - Memorial University*; NSERC*, St. John’s


