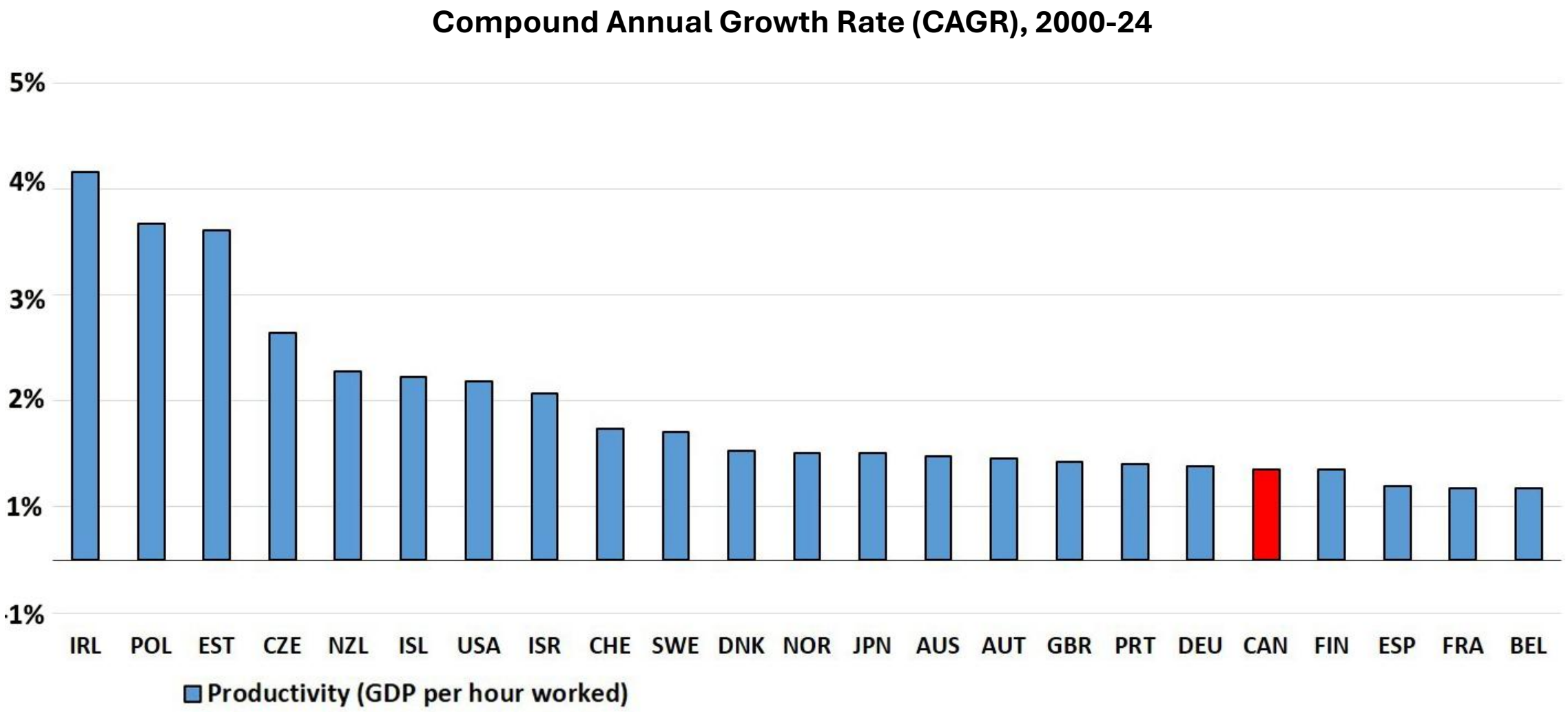
AI and the Modern Productivity Paradox



SFC

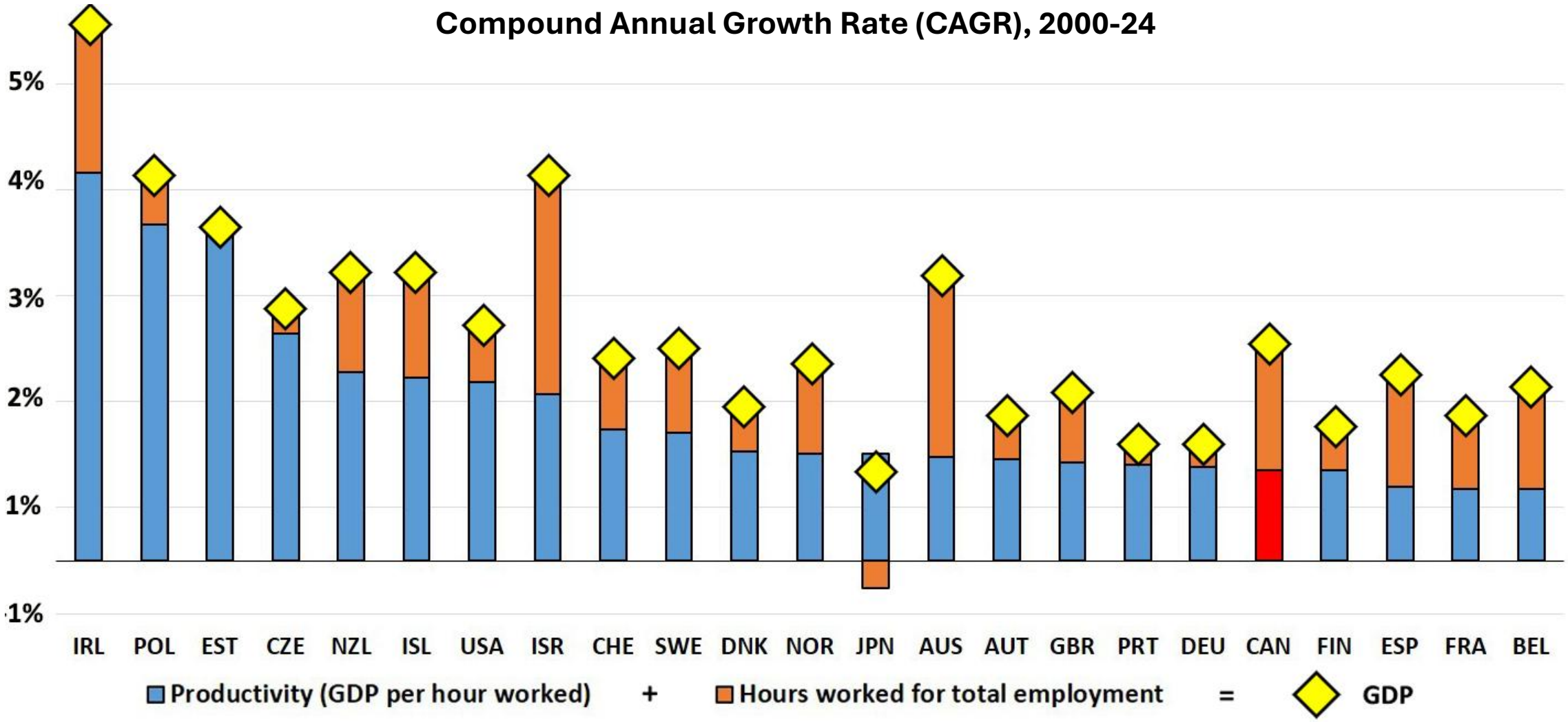
STRATEGIC FUTURES CONSULTING

Productivity Growth in Canada has been lagging other OECD Counties



Source: OECD Productivity Statistics Database

Productivity Growth in Canada has been lagging other OECD Counties



Source: OECD Productivity Statistics Database

Industrial Revolutions

Industrial Revolutions:

1. Powered by GPTs
2. Change how goods & services are produced
3. Widespread labour and social transformations
4. Large productivity gains

General Purpose Technologies (GPTs):

1. Pervasive
2. Able to be improved over time
3. Able to spawn complementary innovations

Examples:

1. Steam power
2. Electricity
3. ICT
4. Possibly AI



INDUSTRY 1.0
Steam Power
Mechanization
~1760-1840

INDUSTRY 2.0
Electricity,
Mass Production,
Assembly Line
~1870-1914

INDUSTRY 3.0
ICT, Electronics,
Automation
~1970-2020

INDUSTRY 4.0
Internet of Things
and Robotics
Today (concept)

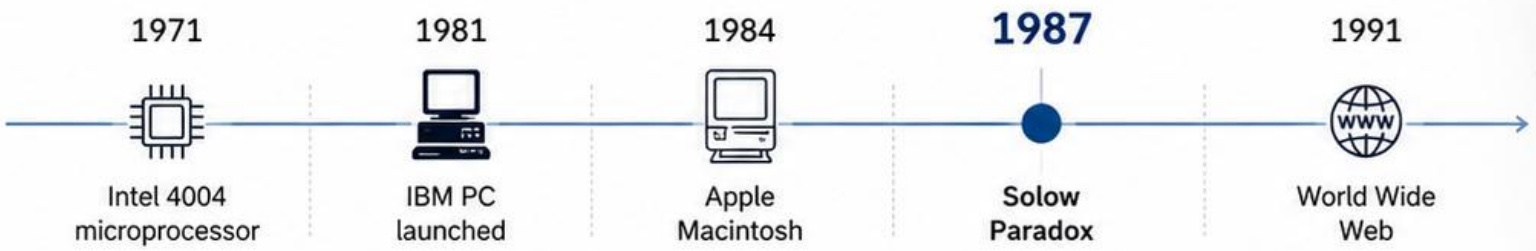
INDUSTRY 5.0
AI Human
Collaboration
Future (vision)

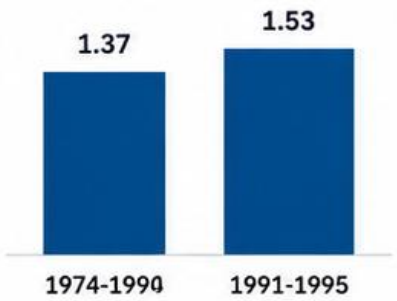
Source: Bresnahan, T. F., & Trajtenberg, M. (1995). General purpose technologies: 'Engines of growth'? Journal of Econometrics, 65(1), 83-108.

“We see the computer age everywhere but in the productivity statistics”

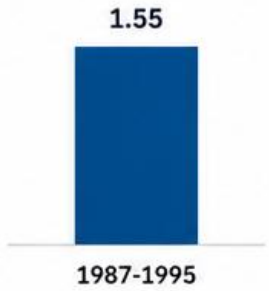


Robert Solow, 1987
Nobel Laureate in Economics





U.S Labour Productivity
(annual average growth)



U.S Labour Productivity
(business sector, CAGR)



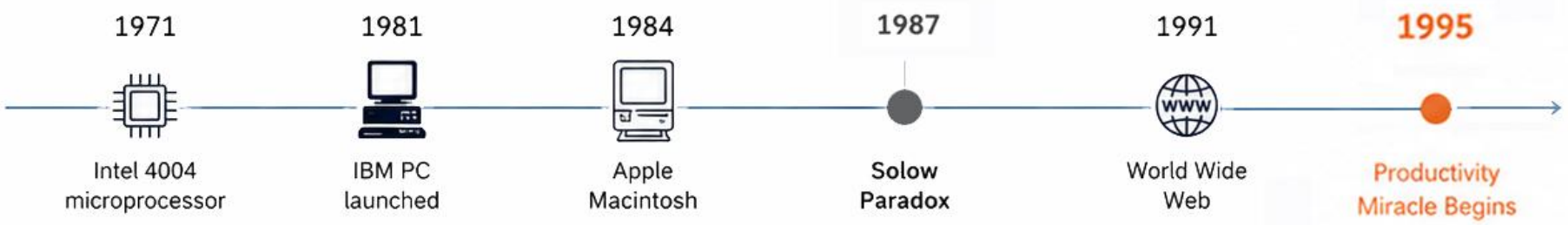
U.S Total Factor Productivity
(business sector, CAGR)

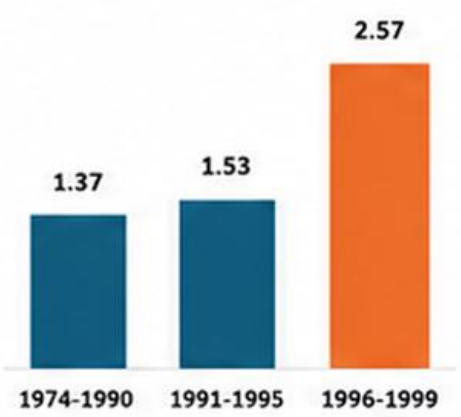


Computers spreading rapidly
through the economy

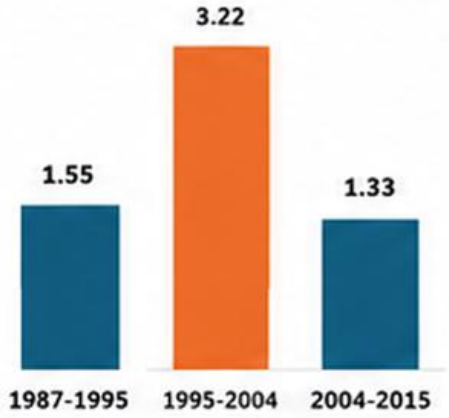
Despite rapid investment in information and communication technologies, productivity growth remained stubbornly weak.

“The U.S. Productivity Miracle, 1995-2004”

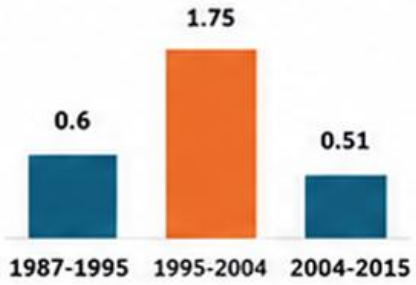




U.S Labour Productivity
(annual average growth)



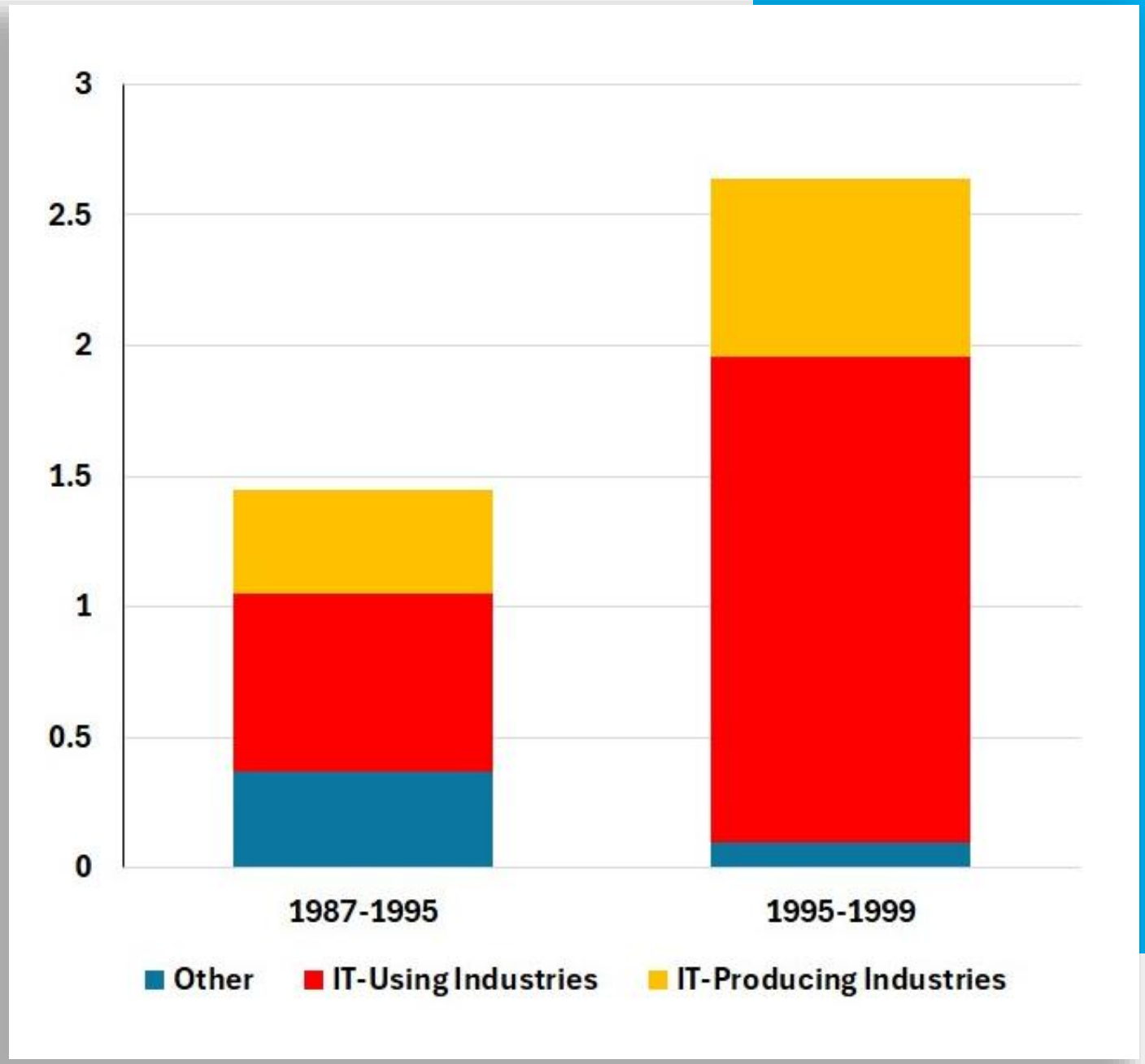
U.S Labour Productivity
(business sector, CAGR)



U.S Total Factor Productivity
(business sector, CAGR)

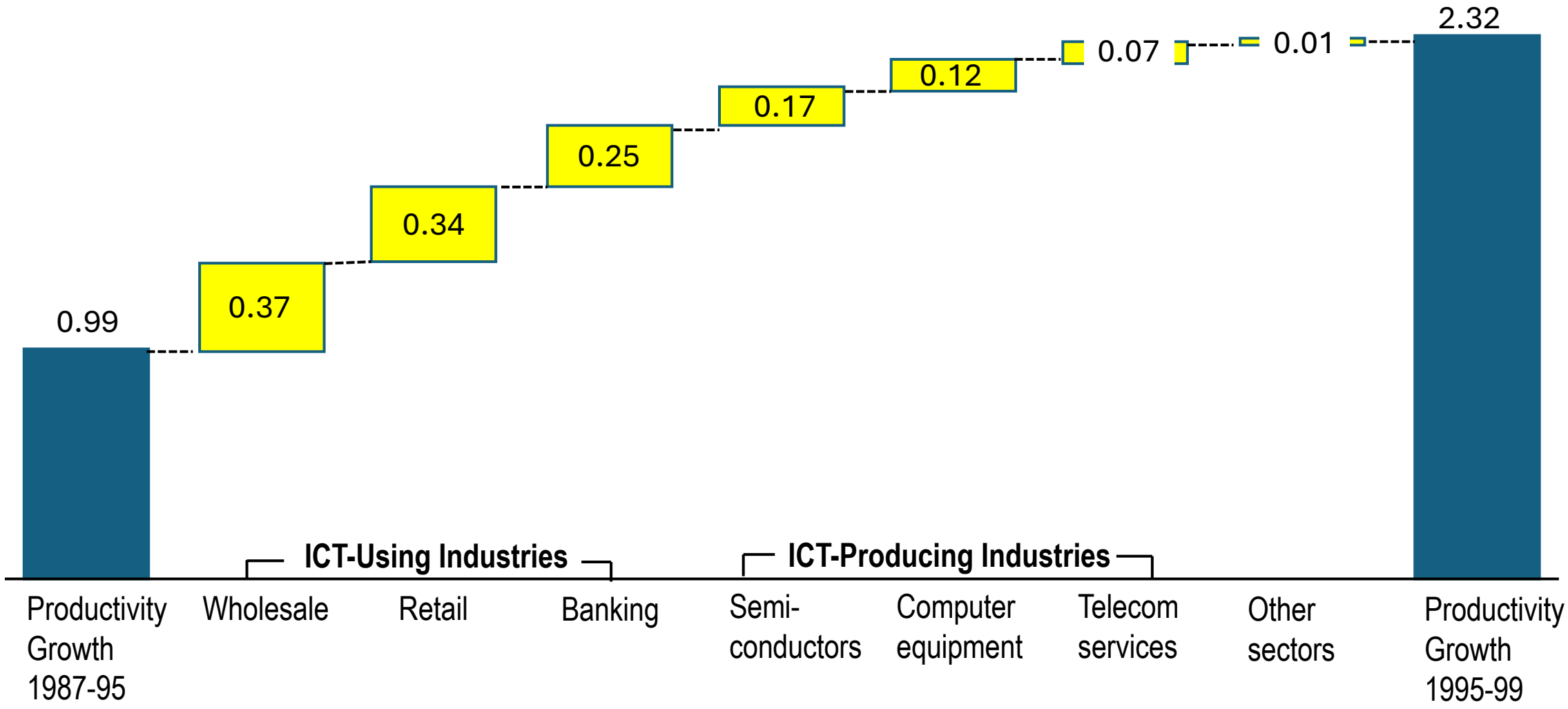
Productivity accelerates rapidly
between 1995 and 2004

Aggregate Labour Productivity Decomposition, U.S., 1987-1999



Source: Stiroh, Kevin J. (2001) : Information technology and the US productivity revival: What do the industry data say?, Staff Report, No. 115, Federal Reserve Bank of New York, New York, NY

Contribution to 1995-99 U.S. Labour Productivity Growth (CAGR)



Source: McKinsey Global Institute. 2001. US Productivity Growth 1995–2000: Understanding the Contribution of Information Technology. McKinsey & Company.

Barcode Scanning

Real-time Inventory

Demand Forecasting

Automated Logistics





SUPPLIERS ADAPT

- Smaller, frequent batches
- Align production with real-time data



COMPETITORS RESPOND

- Copy systems or exit
- Restructure operations



LOGISTICS FIRMS ADAPT

- Redesign distribution networks
- Optimize routing & warehousing

INCREASED PRODUCTIVITY IN RETAIL AND WHOLESALE

SECTOR-WIDE EFFECTS

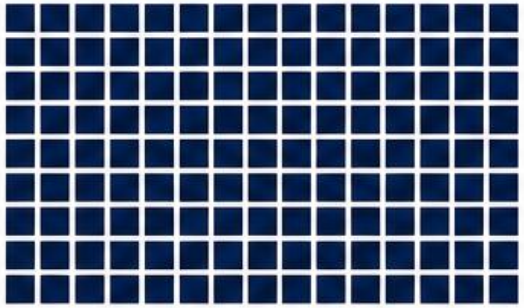
- Improved coordination
- Reduced wastage
- Faster inventory turnover
- Better demand matching

Average cost to the financial institution per transaction

BRANCH (IN-PERSON)



$5.30
per transaction

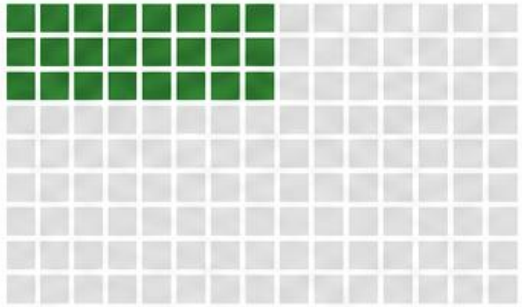


Each square = $0.05
(100 squares = $5.00)

ATM

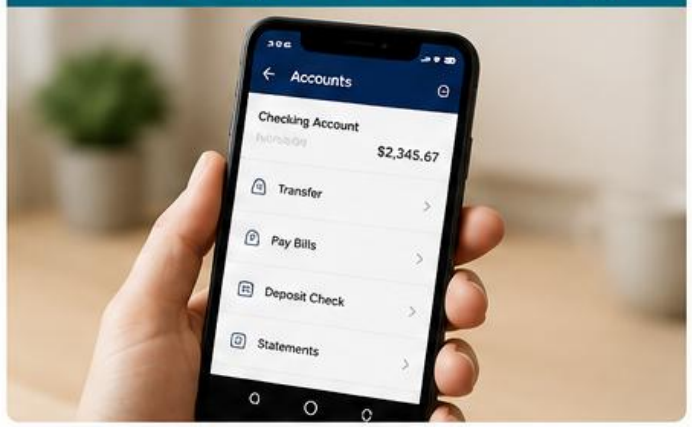


$1.50
per transaction

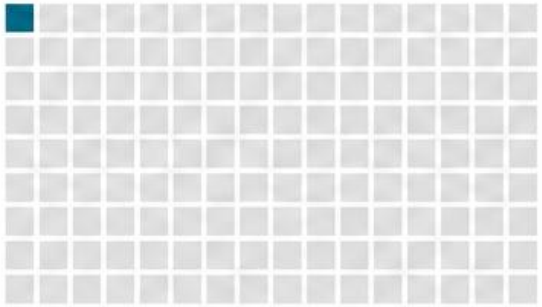


Each square = $0.05
(100 squares = $5.00)

DIGITAL (ONLINE / MOBILE)



$0.04
per transaction



Each square = $0.05
(100 squares = $5.00)

THE DIGITAL REVOLUTION (1990s–2000s)

Technology transforms work—creating new opportunities and reshaping everyday jobs.

RETAIL



WAREHOUSING



BANKING



OCCUPATIONS LOST

(Routine Cognitive & Clerical)

- Traditional Bank Teller
- Back-Office Check-Processing Clerk
- Manual Inventory Clerk / Stock Counter
- Price-Marking Clerk (sticker-gun role)
- Purchasing / Order-Processing Typist (Wholesale)
- Wholesale Telephone Sales Representative
- Middle-Management Administrator (compiling manual sales reports)
- Typing Pool / Data-Entry Clerk (re-keying invoices)

Technology transforms work

From routine tasks to higher-value impact

OCCUPATIONS GAINED

(Technical, Analytical & Relationship-Focused)

- Software Engineer / Systems Architect
- Database Administrator
- Network Engineer / Telecom Installer
- Supply-Chain / Logistics Analyst
- Category Manager (retail strategy) (in-branch sales)
- Mortgage Broker / Financial Advisor (in-branch sales)
- Call Center Customer Service Rep
- IT Security / Cybersecurity Analyst
- ATM Service Technician

RETAIL



WAREHOUSING



BANKING



1990s — Automation Begins — Technology Adoption — New Skills Emerge — New Roles Grow — 2000s+

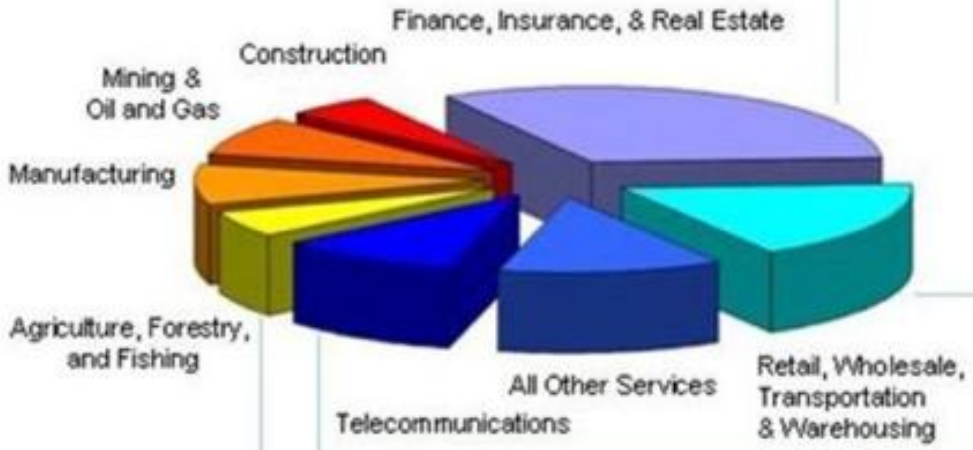
ROUTINE TASKS PREDOMINATE

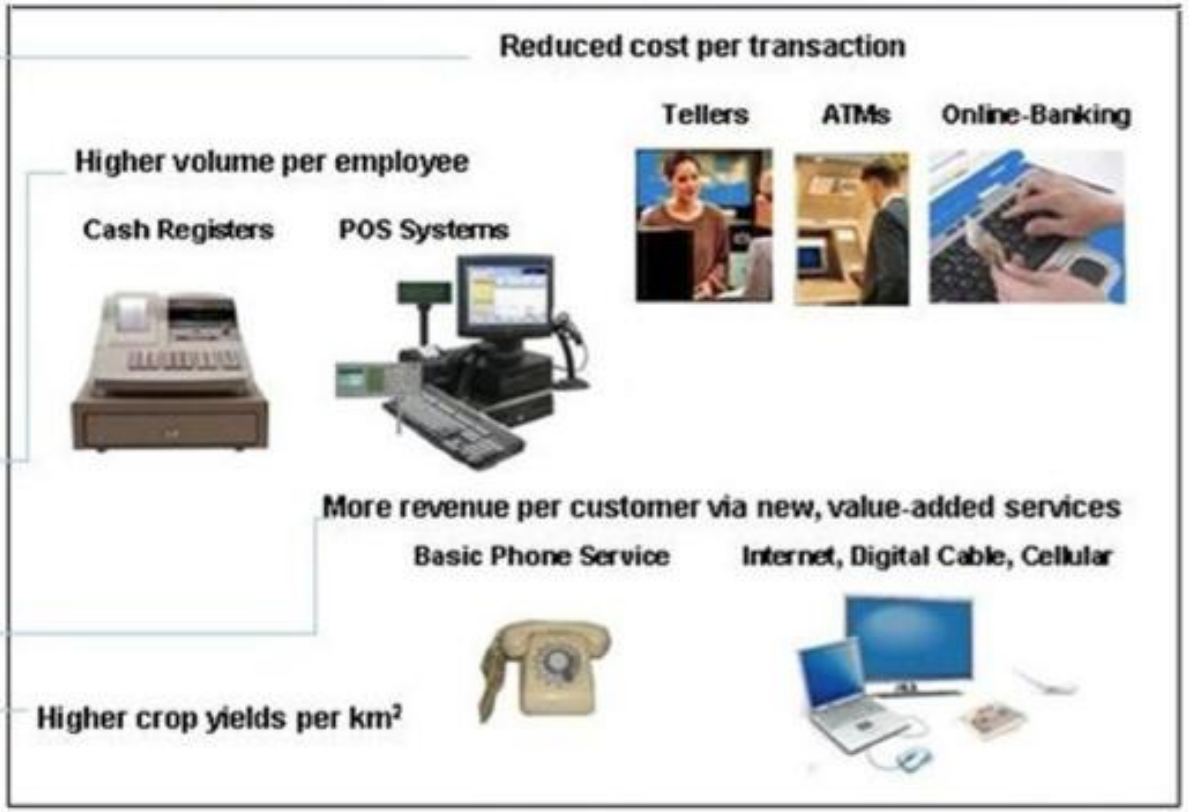
HIGHER-VALUE WORK EXPANDS

Technology changes the way we work—creating new opportunities while making some traditional roles obsolete.

Productivity accounted for 80% of Economic Growth in Nova Scotia's Business Sector from 1997-2006

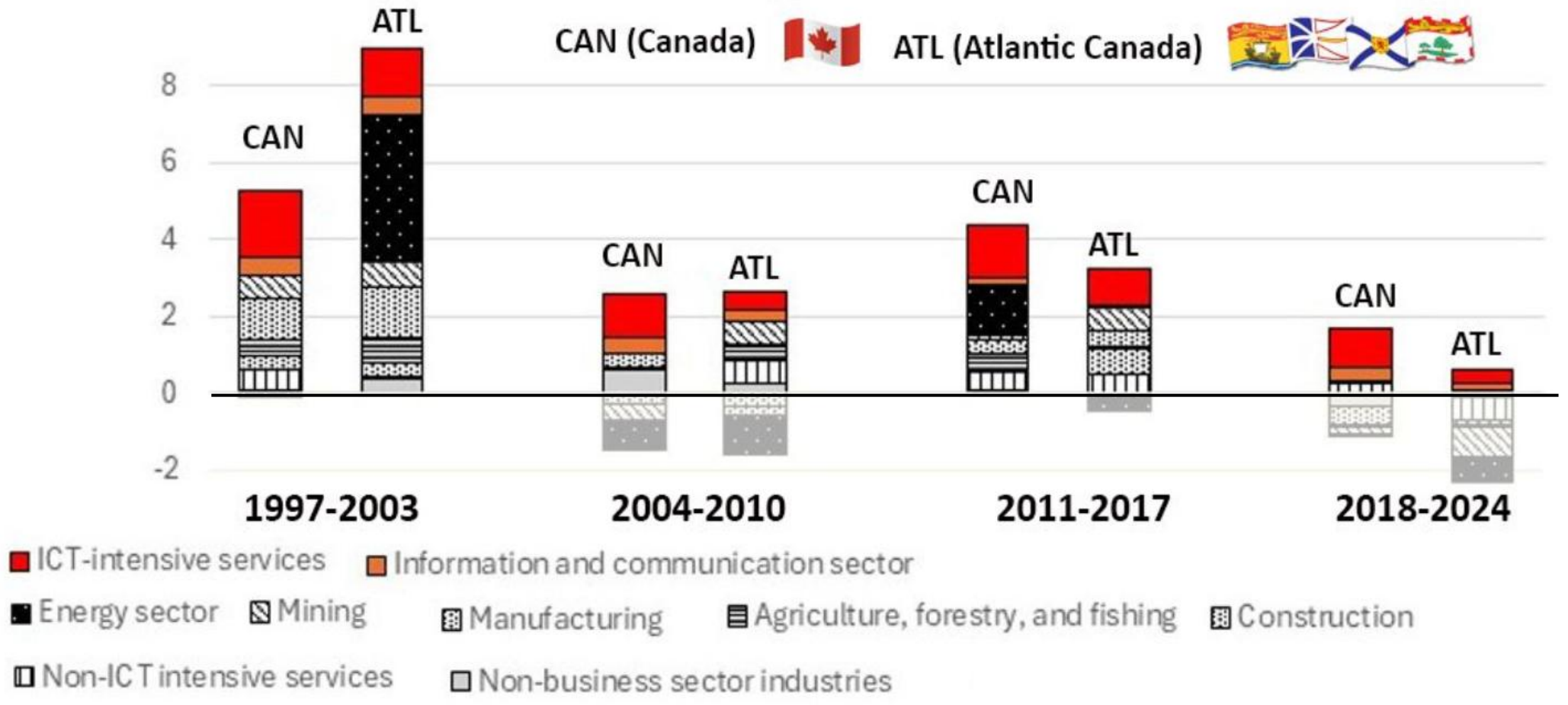
Sector contributions to total productivity growth





Sources: Statistics Canada, CANSIM Tables: 383-0010 and 379-0025; Decomposition Methodology based on Faruqui, U., W. Gu, M. Kaci, M. Laroche, and J.-P. Maynard. 2003. "Differences in Productivity Growth: Canadian-U.S. Business Sectors, 1987–2000." Monthly Labor Review 126 (4):16–29.

Contributions to Change in Labour Productivity (percentage points)



An AI model was used to calculate contributions based on Statistics Canada, Table 36-10-0480-01 (use with caution)

Key Lessons from the Solow Paradox

- **Investment in technology alone did not drive productivity.**
- **The breakthrough came when "complementary innovations" transformed entire sectors.**
- **General purpose technologies (GPTs) can arrive decades before their productivity effects.**

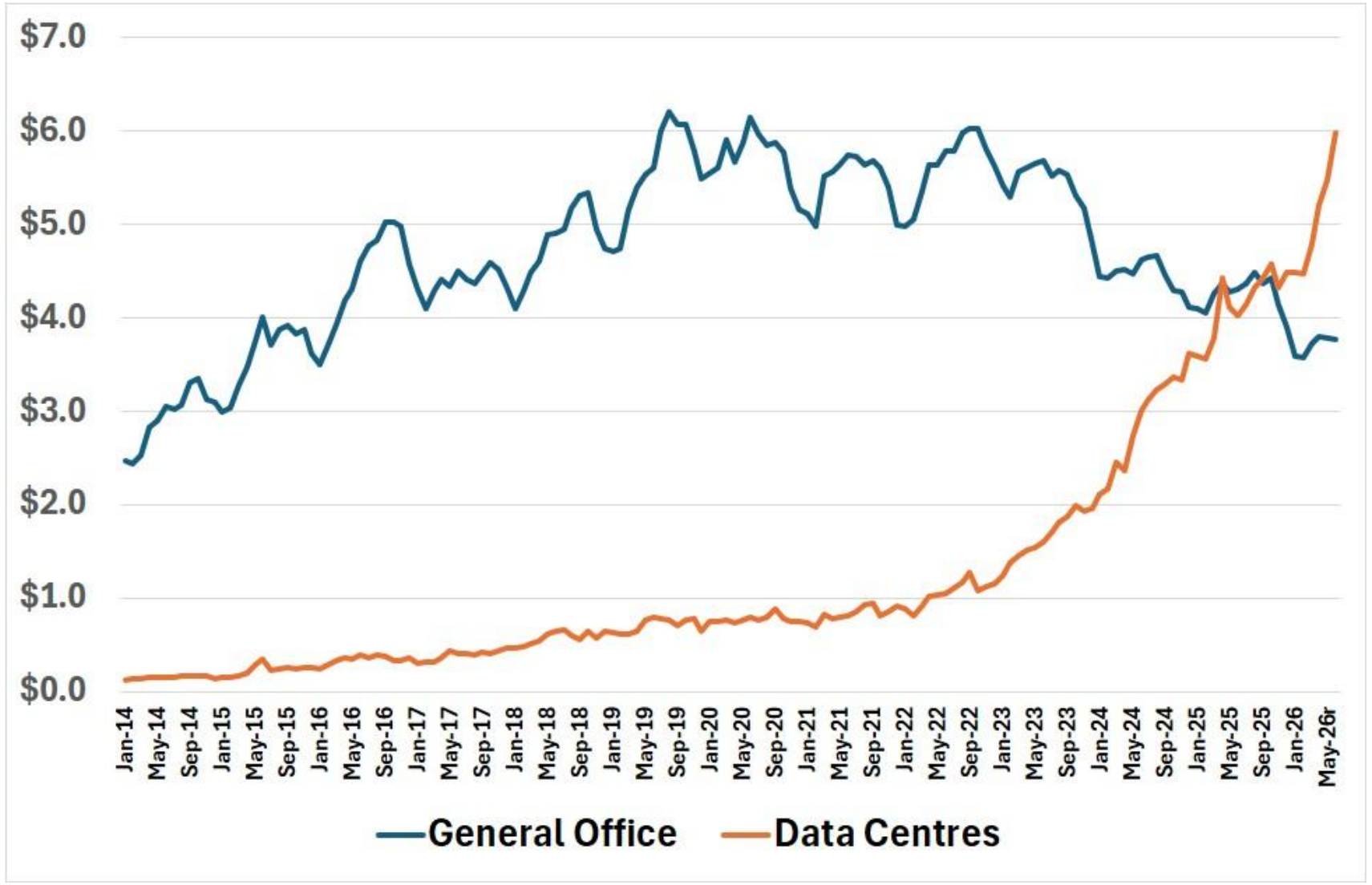
- The central question is whether AI will follow the same pattern: heavy investment first, followed by widespread organizational transformation, and a delayed productivity surge.

Solow, R. M. (1987). We'd better watch out. New York Times Book Review, July 12. (The origin of the "productivity paradox" quip.)

· For the resolution: Oliner, S. D., & Sichel, D. E. (2000). The resurgence of growth in the late 1990s: is information technology the story? Journal of Economic Perspectives, 14(4), 3–22

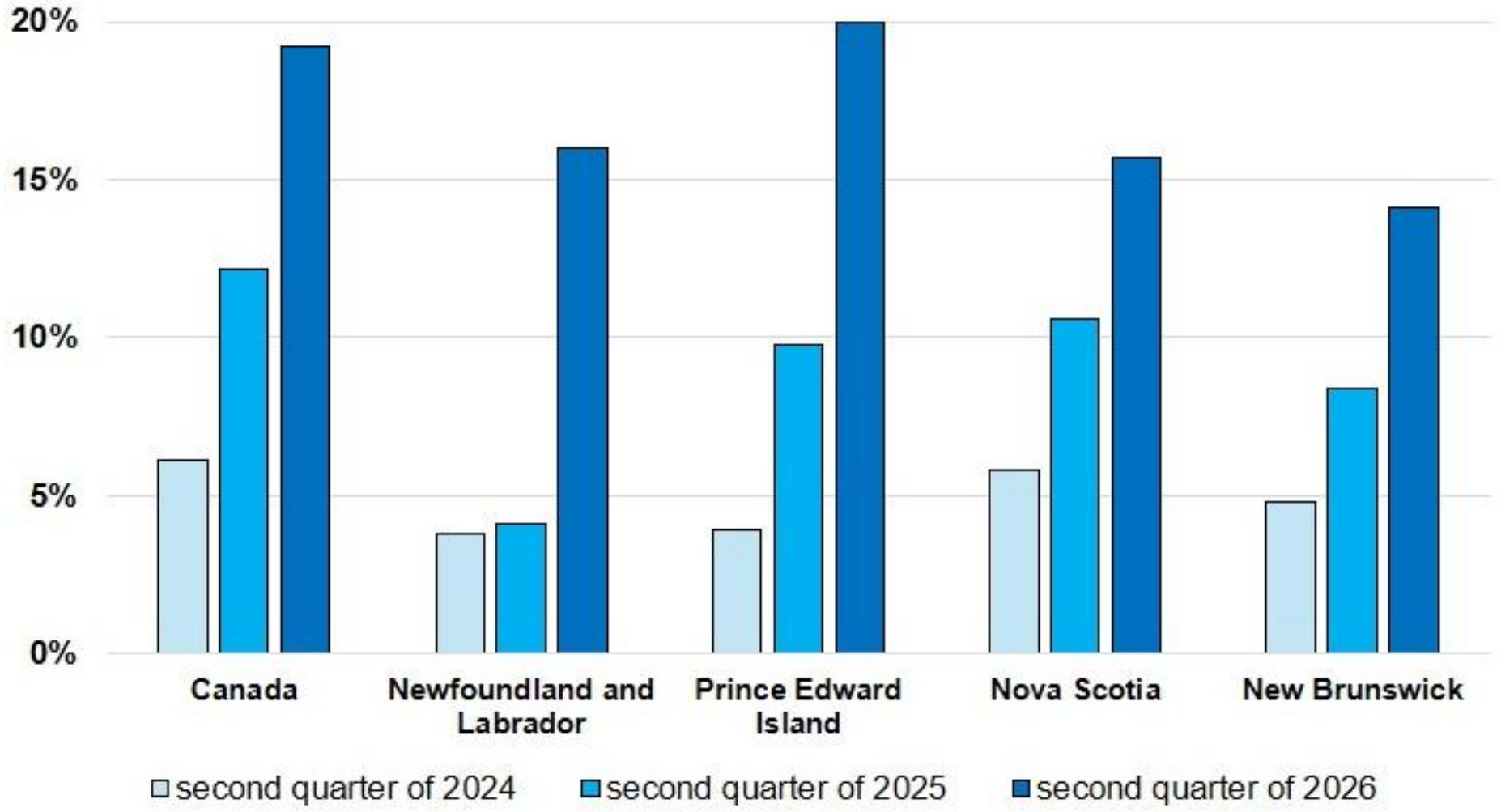
Today: Massive Investments in Data Centre Construction

Monthly Value of U.S. Construction (Billions)



AI Adoption is on the rise among Canadian Businesses

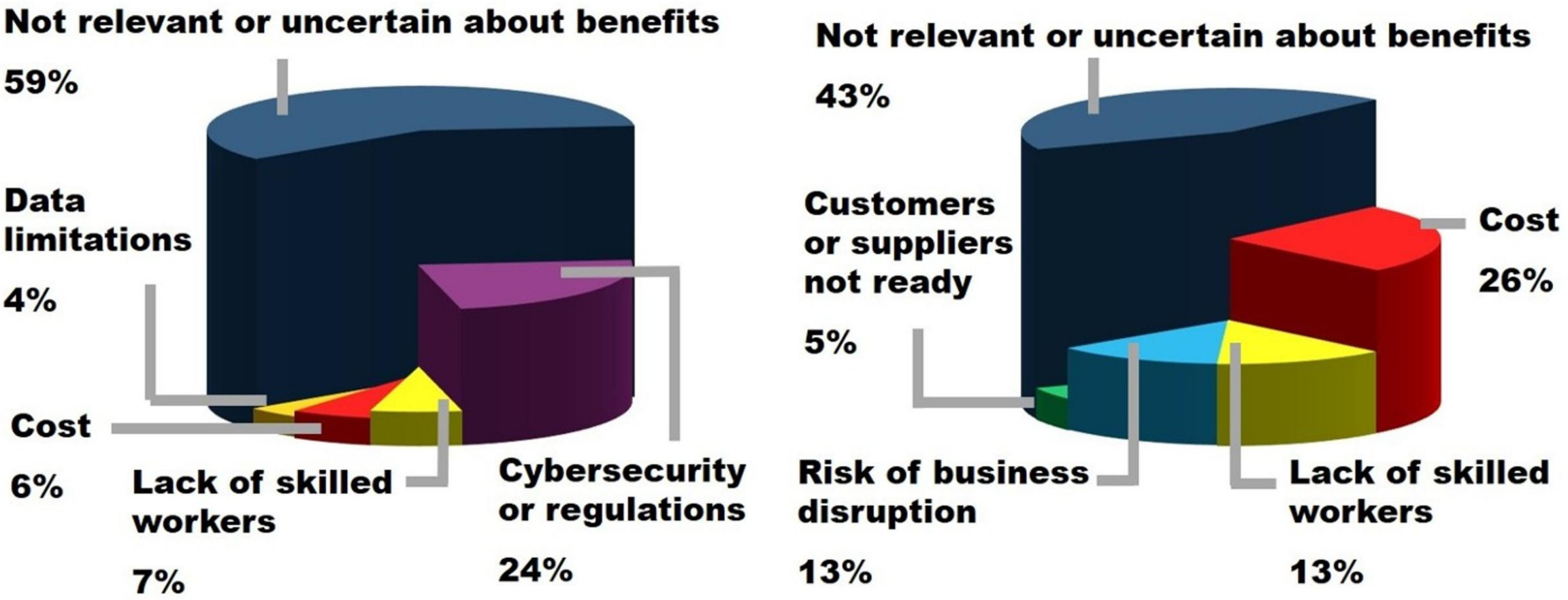
Percentage of businesses that used in producing goods or delivering services over the last 12 months



Source: Statistics Canada, Tables: 33-10-1167-01, 33-10-1004-01, and 33-10-0825-01

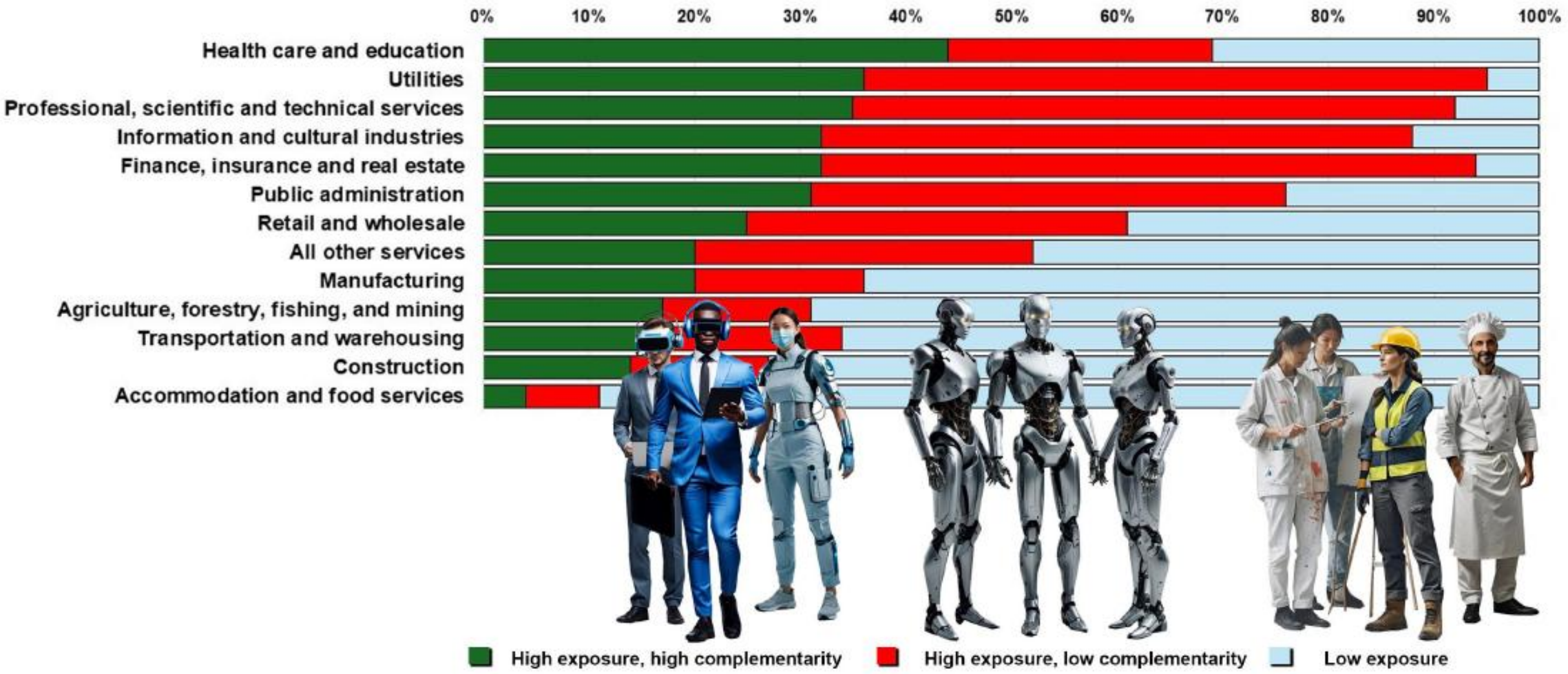
Faster and Cheaper

Barriers to Technology Adoption among Businesses, Nova Scotia

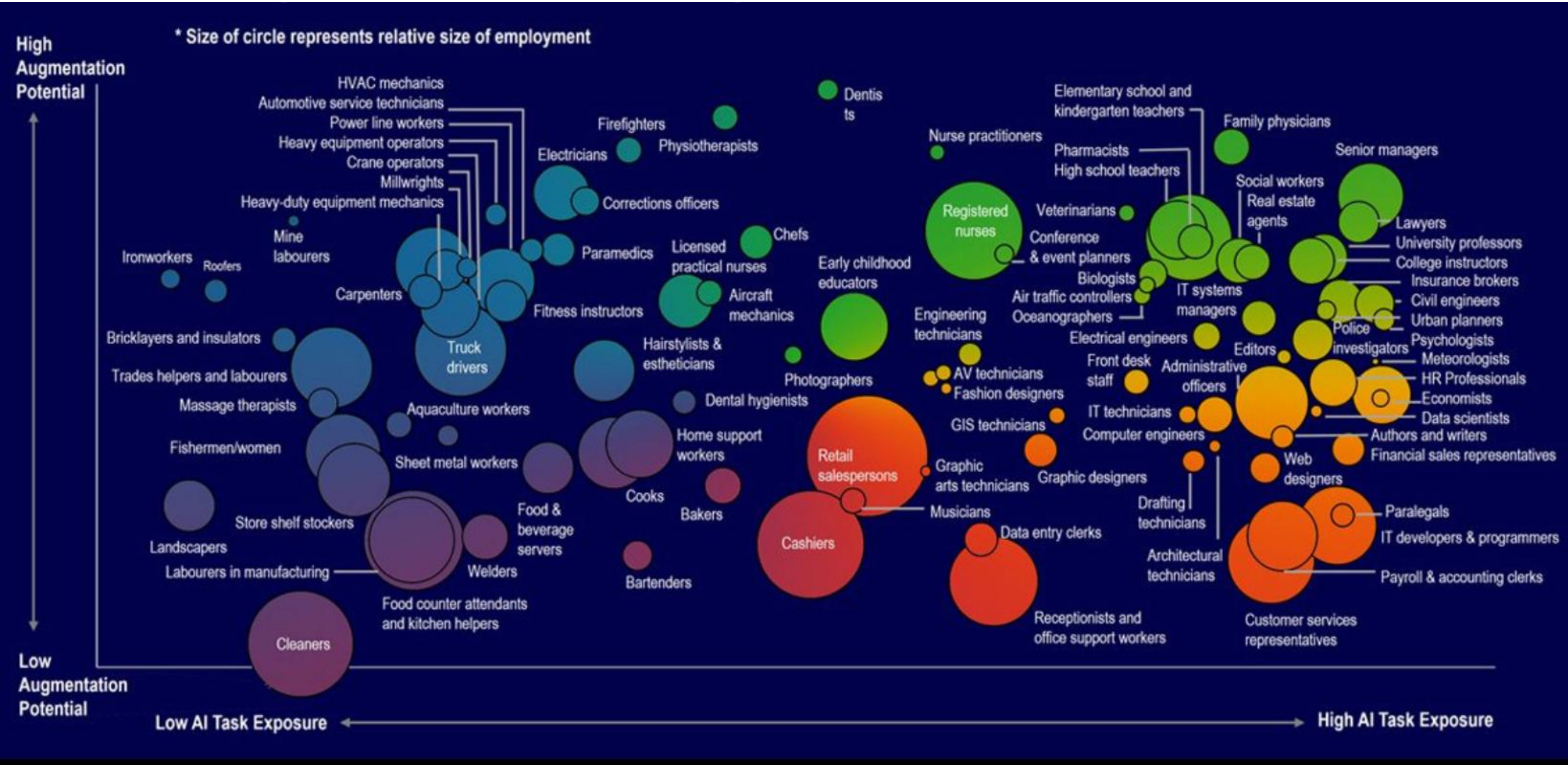


Sources: Statistics Canada, Table: 33-10-1169-01, and Corporate Research Associates, 2008

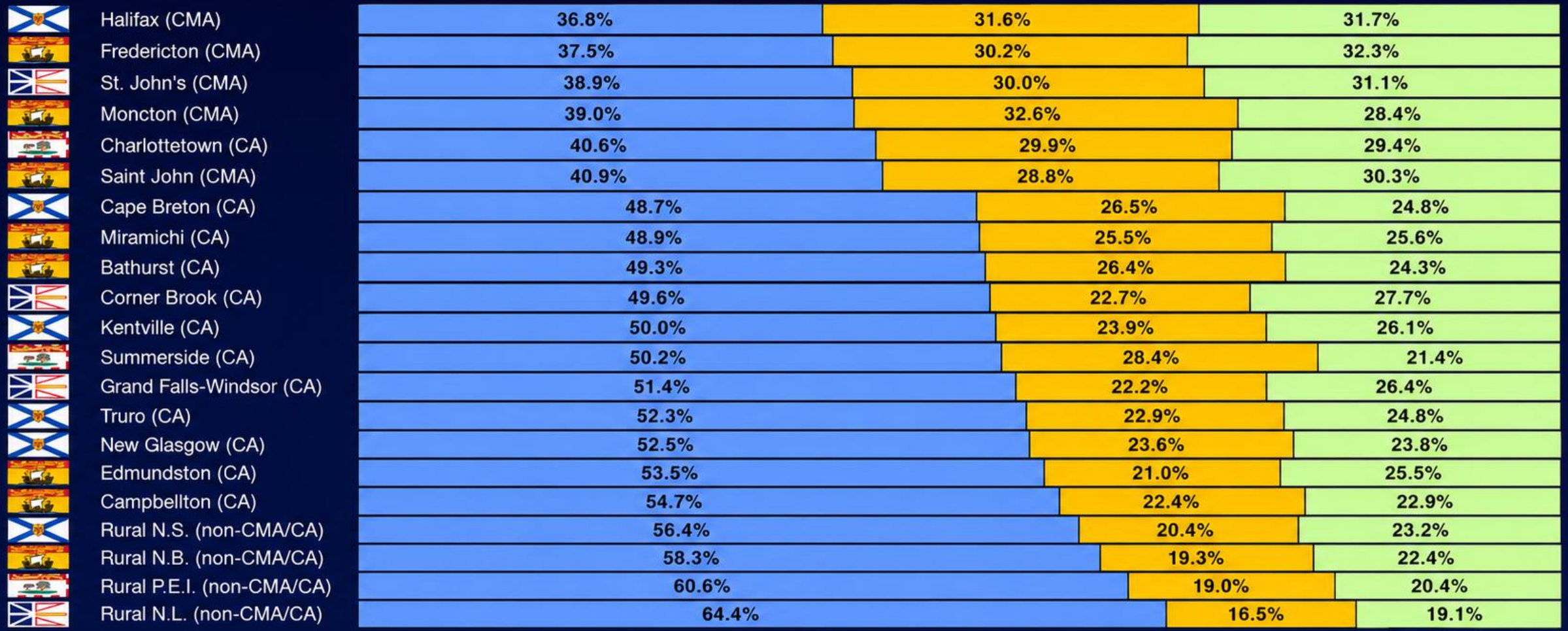
60% of jobs in Canada could be exposed to AI-related transformation



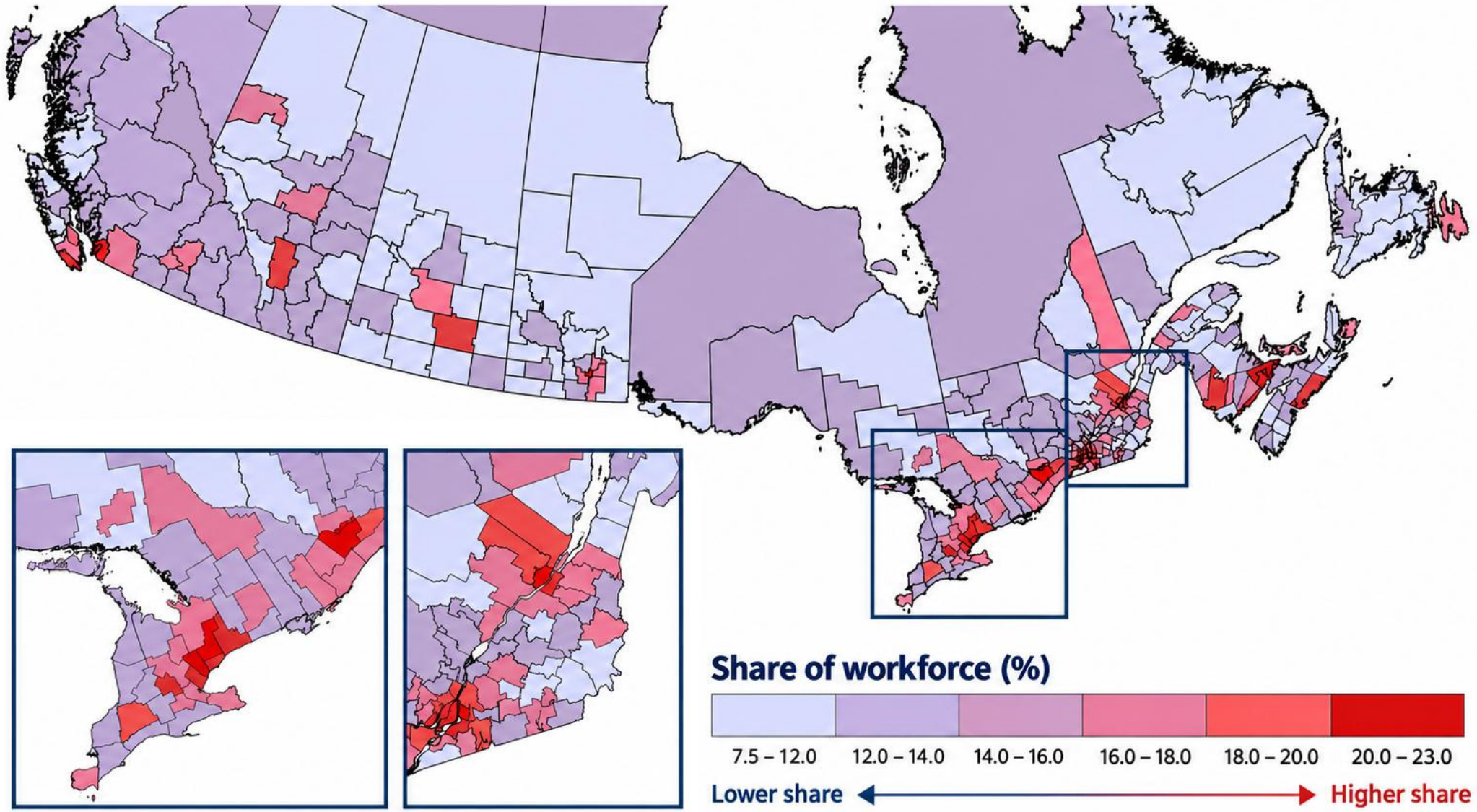
Potential Impact of AI on 100 Occupations in Atlantic Canada



Potential Impact of AI in Atlantic Canada



Share of the workforce with 20 of the most exposed occupations to AI



Four Possible AI Futures

AI Adoption (High)

Complimentary Innovation (Low)

Complimentary Innovation (High)

AI Adoption (Low)

Wasted Investment

- AI confined to firm-level automation
- Complementary redesign absent
- Mass unemployment
- Solow paradox entrenched



AI Supercycle

- Fast, autonomous innovation & rapid diffusion
- AI designs complementary innovations
- AI + quantum accelerate R&D
- Highest productivity in history



AI Winter

- AI catastrophic event triggers shock
- Trust in AI collapses
- AI Investment and innovation stagnates
- Declining productivity



Frontier Fortress

- Frontier firms create monopolies, hoard AI talent & block diffusion
- Innovation is kept proprietary
- Inequality increases
- Productivity growth limited

