

Innovation Catalysts and Accelerators

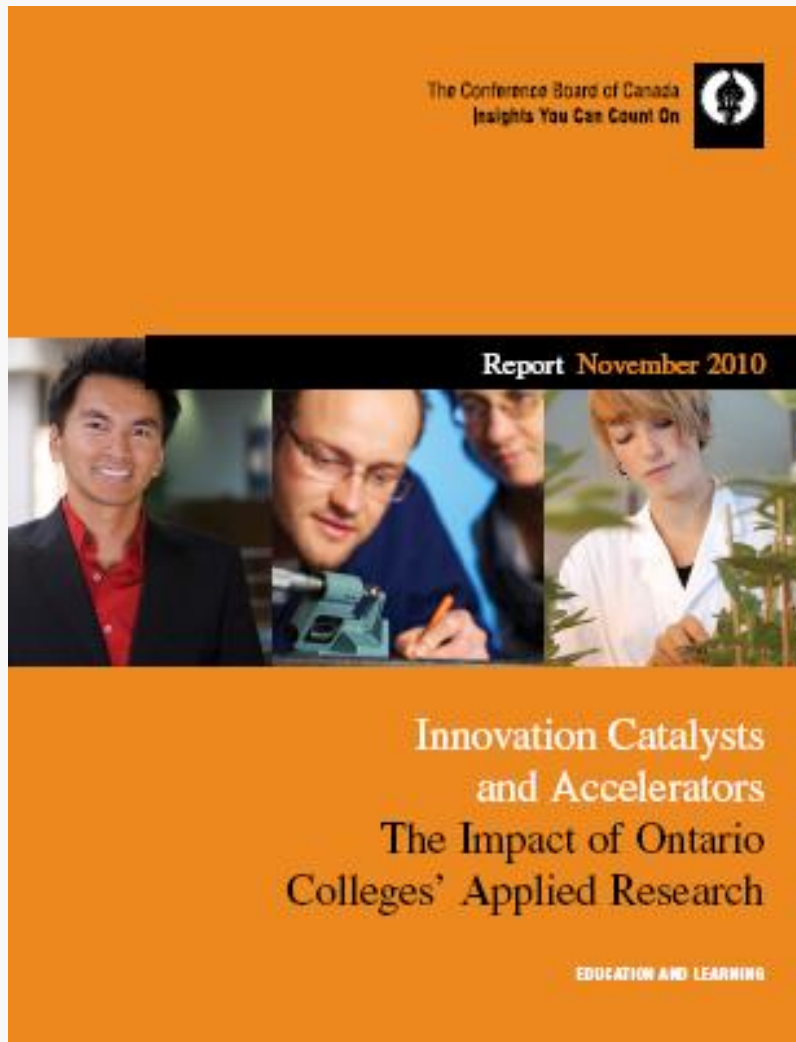
The Impact of Ontario Colleges' Applied Research

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Innovation Catalysts and Accelerators

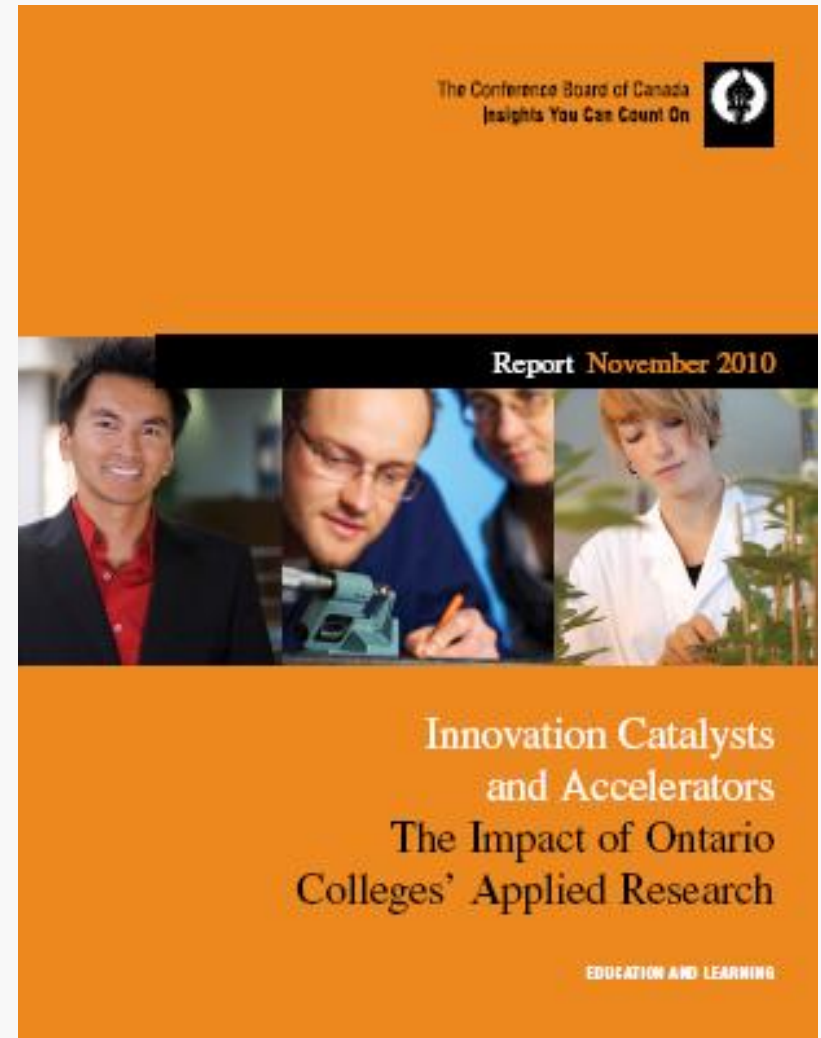


- The Conference Board was engaged by Colleges Ontario to examine applied research (AR) collaborations between colleges and businesses.
- The report details the **contribution** that Ontario colleges' AR activities are making to innovation and productivity.



Innovation Catalysts and Accelerators

- Identifies **strategies and challenges** in funding, completing, and achieving benefits of AR.
- Offers **recommendations** about how to better support the AR contribution to innovation, competitiveness, and prosperity.



An Innovation Lens

- The Conference Board regularly examines and assesses Canada's innovation performance and tries to identify ways to improve that performance.
- As part of our *How Canada Performs* initiative, we produce annual innovation *Report Cards* for Canada and 16 peer countries.
- We believe that innovation matters: It affects our productivity, living standards, quality of life, etc.





A Report Card on Canada

REPORT CARD		
Innovation		
1	Switzerland	A
2	Ireland	B
3	U.S.	B
4	Japan	B
5	Sweden	C
6	Germany	C
7	U.K.	C
8	Netherlands	C
9	Finland	C
10	France	C
11	Denmark	C
12	Belgium	D
13	Austria	D
14	Canada	D
15	Australia	D
16	Italy	D
17	Norway	D

Note: Data for the most recent year available used.
Source: The Conference Board of Canada.

- Canada ranks 14th among the 17 peer countries on innovation.
- A consistent “D” performer since the 1980s.
- Canada outspends OECD peers on *government* spending on R&D, but trails on *business* R&D spending.
- This indicates less-than-ideal innovation activity *at the firm-level*, especially among SMEs.
- Only 2% of Ontario firms perform research vs. 3.3% of Quebec firms and 3.5% of U.S. firms.
- <http://www.conferenceboard.ca/HCP/Details/Innovation.aspx>



Why Innovation Matters

- So long as Canadian businesses lag on innovation, we will continue to face threats to our standard of living, and resources for health, education, and other programs will become increasingly scarce.
- Stimulating innovation, especially among Ontario's SMEs, will be critical in averting this scenario.



Innovation Catalysts and Accelerators: Motivating Questions

What can be done to stimulate more business innovation and R&D activity?

Can Ontario colleges' applied research activities stimulate innovation and competitiveness?



What is Applied Research?



What is Applied Research?

- Applied research is research “directed primarily toward a specific *practical* aim or objective.” (OECD).
- Differs from *basic* research in that it is driven *not* primarily by the curiosity of the researcher, but instead by *needs and problems* identified by firms, governments, and other organizations in the private and public sectors.
- At Canadian colleges and polytechnics, applied research includes assistance with proof of concept, testing, benchmarking, development, prototyping, and modelling.



Some Examples

Niska North Inc. and Collège Boréal

- Collège Boréal's applied research division recently unveiled a prototype designed to make use of wood residues produced by forest harvesting activities.
- Developed in partnership with forest company Niska North Inc. and the Town of Chapleau, the prototype is being used to extract various essential oils from wood chips which have potential uses as decongestants, cosmetics, for aroma therapy, and other products—i.e., activities further up the value chain.
- Designed by Matthieu Desbois, a 3rd-year student in Collège Boréal's Chemical Engineering Technology program.



Niska North Inc. and Collège Boréal



Source: Matthieu Desbois, Collège Boréal

Rudolph's Specialty Bakeries and George Brown College

- Rudolph's Specialty Bakeries in Toronto wanted to use a vacuum cooling chamber (originally designed to cool cakes) to speed up its bread-cooling process.
- But, the technology created holes in the loaves of denser breads, forcing them to revert to the slower air-drying method.
- The company asked researchers at GBC to examine the problem and propose experiments that involve manipulating or controlling different variables (such as the rate of cooling in the chamber and ambient air temperature outside the chamber) to find a solution.
- Results pending.



Innovation Catalysts and Accelerators: Project Goals and Objectives

1. Understand the **contribution** that Ontario colleges' applied research activities make to innovation and productivity performance;
2. Quantify the **economic impact** (or potential impact) of colleges' (and partners') applied R&D spending;
3. Identify **strategies and challenges** in securing funding and completing applied research, innovation, and commercialization projects; and
4. Make **recommendations** to government and colleges about how to better support the applied research contribution to innovation, competitiveness, and prosperity.



Methodology

- Literature and Data Reviews
- Economic Impact Model
- Online Survey (n=181)
- Key Informant Interviews (n=150)
 - Federal and Provincial government officials; private/public sector clients; Ontario/other province college HARs, faculty; experts, association reps, other stakeholders in Ontario/other provinces.
- Detailed survey of 14 Ontario colleges on AR spending, student involvement, and outcomes.
- Analysis and Preparation of Final Report



Innovation Catalysts and Accelerators: The Impact of Ontario Colleges' Applied Research

Findings



Innovation and Productivity

Gaps and Barriers

- *Why* are Canadian firms not innovating and investing in R&D as intensively as one might expect given the importance and benefits of doing so?
- What prevents businesses, esp. SMEs, from engaging in more innovation and commercialization activity?



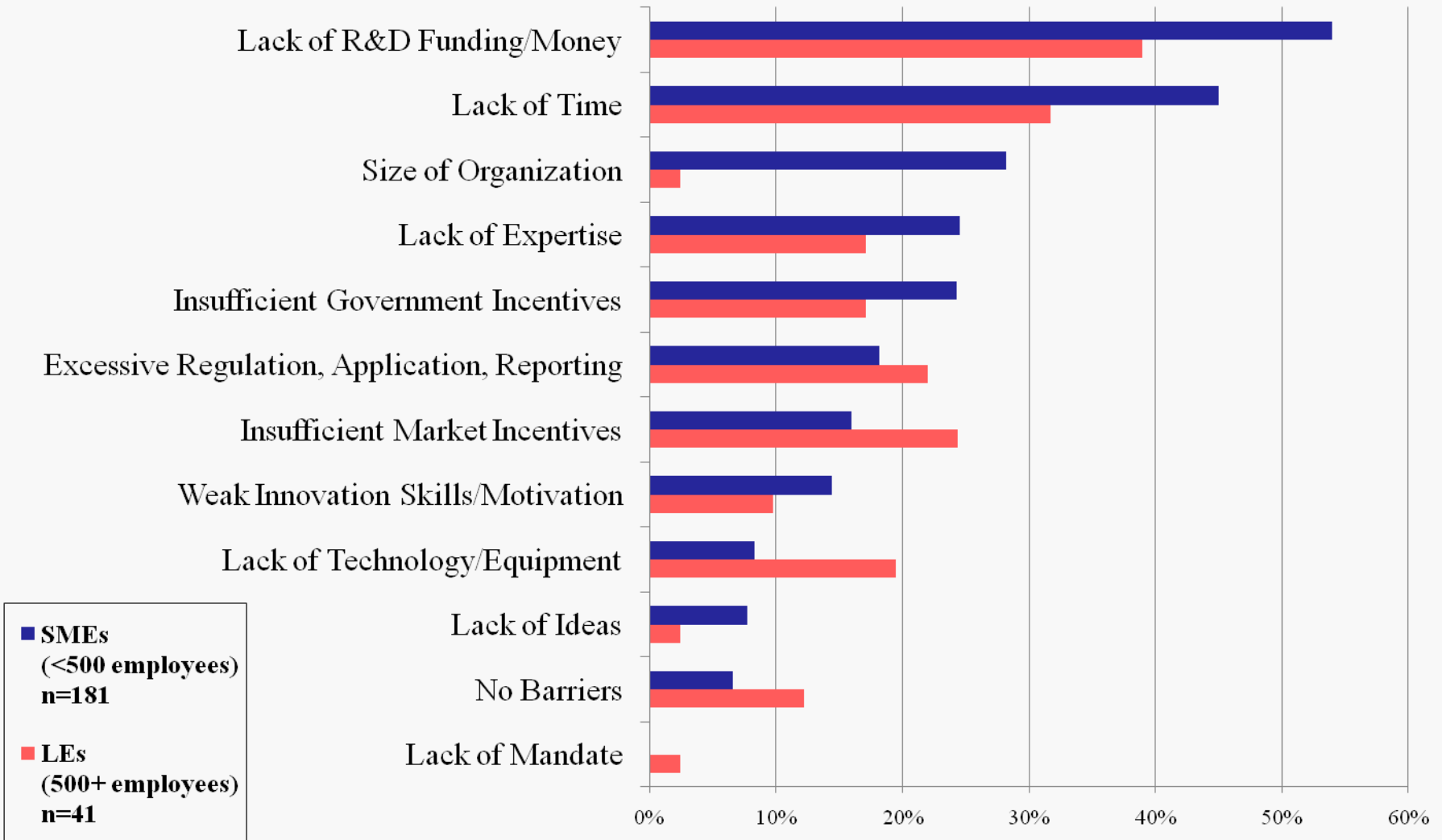
Innovation and Productivity

Gaps and Barriers

- Surveyed 181, interviewed another 41, leaders of public and private-sector organizations of varying sizes and sectors about innovation.
- Nearly *90 per cent* indicated that innovation is somewhat or very important to their organization.
- Despite the *recognized* importance of innovation and a *desire* to do more, respondents identified many barriers to their ability to innovate and spend more on R&D...



Barriers to Innovation Cited by Business



Innovation and Productivity Gaps and Barriers

- Among both *SMEs* and *LEs* the two most frequently cited barriers are:
 - *a lack of R&D funding/capital*—54% *SMEs*; 39% *LEs*; and
 - *a lack of time*—45% *SMEs*; 32% *LEs*.
- *SMEs* also cited *size of organization* (28%), *a lack of in-house expertise* (25%), and *insufficient government incentives* (24%).
- *LEs* also cited:
 - *insufficient market incentives* (24%), and
 - *excessive regulation and/or onerous application/reporting requirements for government programs* (22%).



Ontario Colleges' Advantage and Potential

What distinctive advantages do colleges have that could help to address barriers to innovation and improve the performance of firms and the economy?



Ontario Colleges' Advantage and Potential

- Interviewees said Ontario colleges have:
 - strong, ongoing, rich *relationships with industry*;
 - *industry-relevant research expertise* (i.e., problem-solving skills that are “grounded”, “practical”, “nimble”, and “responsive”);
 - *facilities and equipment* (that many firms, particularly SMEs, may have difficulty purchasing/accessing);
 - *vast reach and accessibility* (i.e., presence in hundreds of communities in the province);
 - *expertise in applying for and reporting on gov't grants*; and
 - *a general preference that IP be held by clients (to encourage commercialization)*.



Ontario Colleges' Advantage and Potential

Main Innovation Barriers Cited by Business

- Lack of in-house expertise
- Lack of time
- Lack of technology/equipment
- Lack of R&D funding/capital
- Excessive regulation and/or onerous application/reporting requirements
- Insufficient market incentives
- Insufficient government incentives

Ontario College Strengths Cited by Interviewees

- Industry-relevant research expertise
- Strong industry connections
- Accessibility and reach
- Facilities and equipment
- Funding application and reporting expertise/assistance
- Colleges generally prefer that IP is held by clients (to encourage commercialization)



Ontario Colleges' Advantage and Potential

- Ontario colleges have a good *reputation* for applied research *potential*.
- Is that potential actually being *realized* to produce significant benefits for firms, communities, students, and others?



Impact and Benefits for Firms

- **Innovation Catalysts:**

- Ontario colleges' applied research services stimulate *new* R&D activity and spending.
- We asked businesses that have collaborated with Ontario colleges on an applied research project, “if the college’s research expertise and/or funding contribution were *not* available, would you still have pursued the initiative?”
- 9 of 28 projects (32 per cent) would have been *abandoned* had college research services *not* been available.



Impact and Benefits for Firms

- 68 per cent (19 of 28) of initiatives would have proceeded.
- But, nearly all of these firms anticipated at least one major negative consequence had college assistance not been available:
 - more than half would have faced **delays** with their projects (for some this would have resulted in **lower sales/revenues**);
 - half reported that their projects would have entailed **higher costs**, in some cases bordering on being financially unfeasible; and
 - half would have had to locate equipment and/or expertise elsewhere (e.g., at another college, university, consulting firm) with unknown consequences for timelines, costs, and quality.

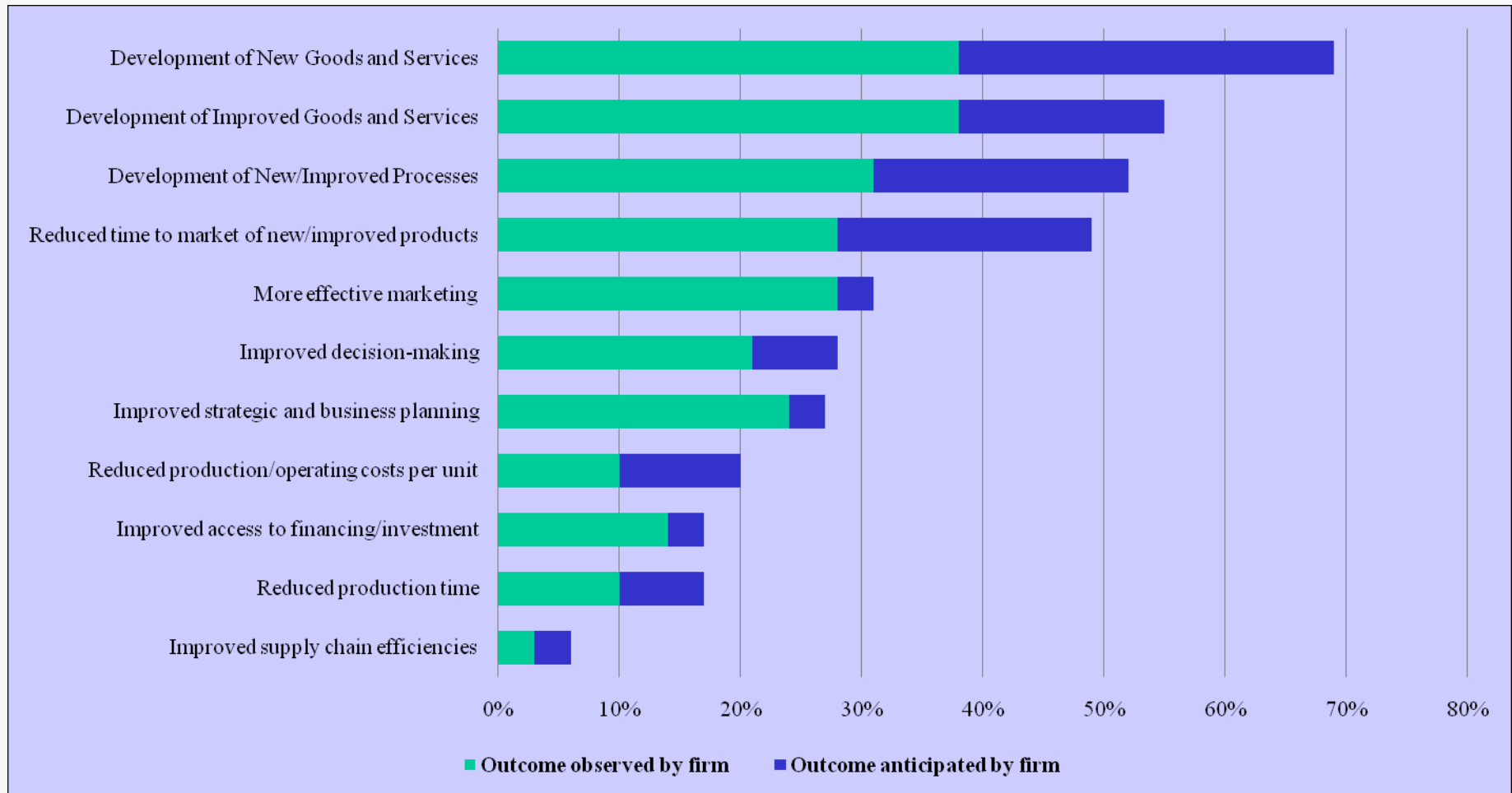


Impact and Benefits for Firms

- Some firms also reported that, without the colleges:
 - their projects (e.g., products, services, or processes) would have been of **lower quality**, with unknown consequences for revenues, customer satisfaction, and other metrics; and
 - they would have **missed out on ideas and opportunities** for future product, service, or process improvements that emerged from the collaborations with the colleges.
- Thus, Ontario colleges' applied research serves as an **innovation catalyst and accelerator**.

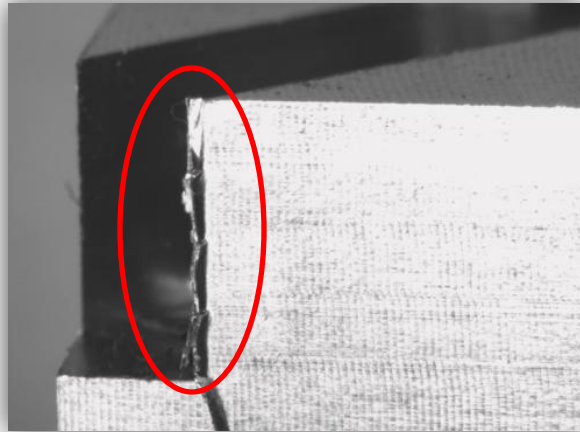


Production and Process Benefits for Firms



COM DEV International and Conestoga College

- COM DEV International—one of the world’s leading producers of advanced space hardware—partnered with researchers at Conestoga College on a process innovation.



Burr at $\approx 20X$ Magnification

Problem:

- After machining, many hardware components have ragged edges called “burrs” that need to be removed—a process currently performed manually.

- Manual removal of burrs is labour-intensive and slows down production significantly.

Source: Christopher Martin-Root, Conestoga College.



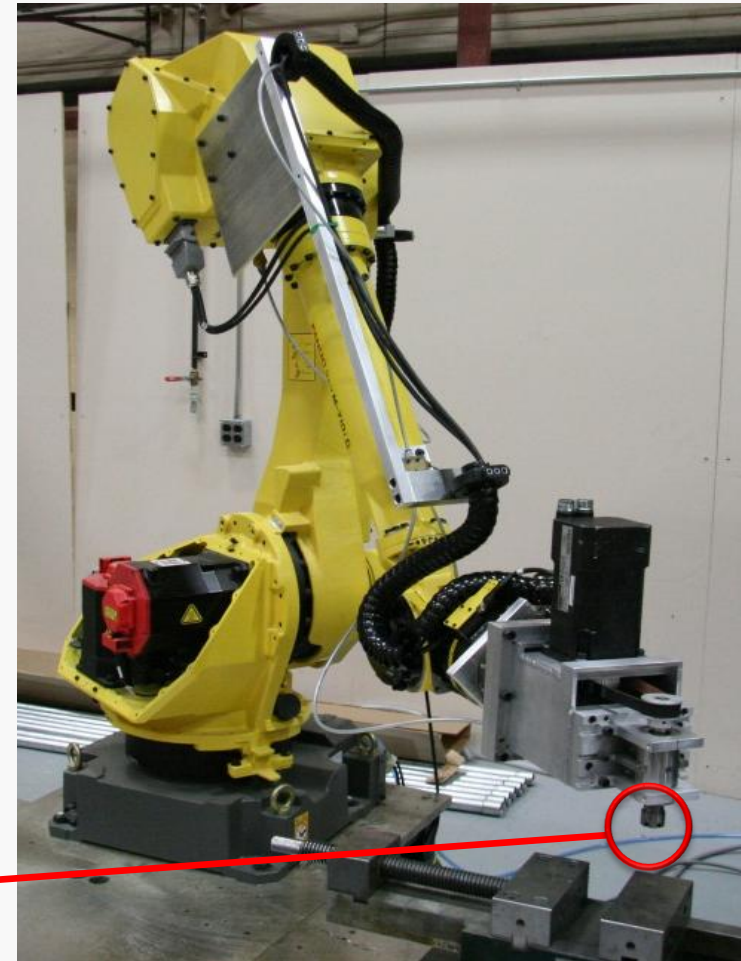
COM DEV International and Conestoga College

Solution:

- An automated, robotic brush deburring system was designed and manufactured.
- Preliminary results show that this process can produce edges that will satisfy COM DEV's deburring standard.

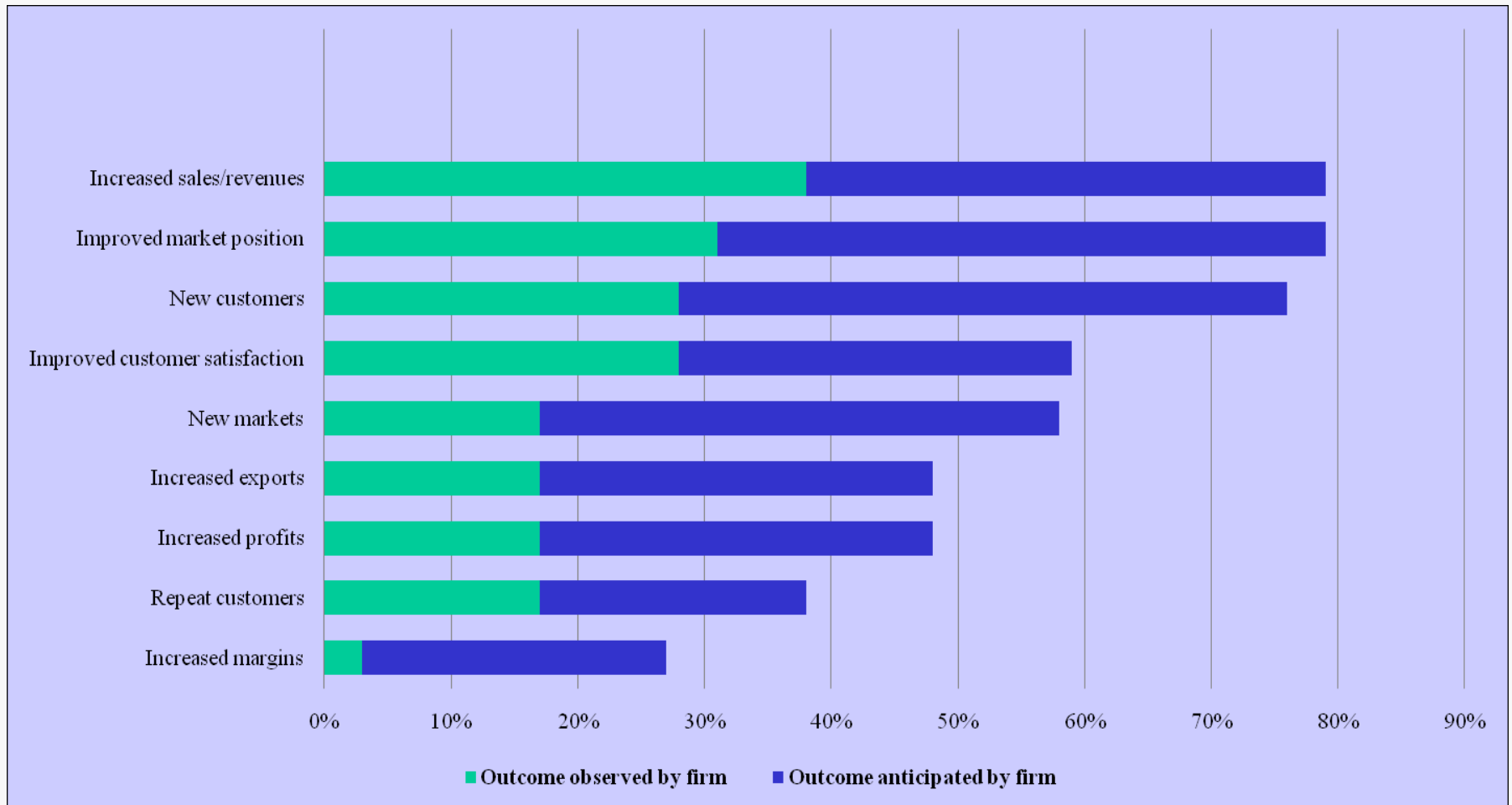
Significance:

- In 2009, burrs cost the global economy approximately \$27-50B USD.
- Automating the process at COM DEV can reduce labour costs, and improve quality, time-to-market, and competitiveness.



Source: Christopher Martin-Root, Conestoga College.

Sales, Markets, Customer Benefits for Firms



HousAll Systems and Algonquin College



- Civil and mechanical engineering professors and students at Algonquin College worked with HousAll Systems to test prototypes of temporary shelters.
- HousAll credits Algonquin with getting the prototypes to market at least a *year early* and at *half the cost*.
- **Project Cost:** \$60-70,000, including cash and in-kind contributions from HousAll, and funding from the Ontario Centres of Excellence.
- **Results:**
 - improved shelters used in post-earthquake relief efforts in Haiti;
 - generated \$2 million in sales over six-month period for HousAll;
 - received recognition from former U.S. President, Bill Clinton;
 - 2 Algonquin students hired by HousAll after completion of the project.



Workforce Impacts for Firms

- Some firms that collaborated with Ontario colleges report that their employees and managers now exhibit:
 - an *improved capacity to solve problems* (45%);
 - an *increased belief that innovation leads to competitiveness* (38%);
 - *improved teamwork and communications* (34%).
- These are some of the skills and attitudes that make up the Conference Board's *Innovation Skills Profile*—an account of the skills that employees and managers need to contribute to an organization's innovation performance.

<http://www.conferenceboard.ca/topics/education/learning-tools/isp.aspx>



Schlegel Seniors Villages and Sheridan College

- Ontario colleges are also contributing to **social innovation**—i.e., improvements in products, services, or processes that produce *social* value.
- **Schlegel Seniors Villages**—an organization providing continuing and long-term care for Ontario seniors—has partnered with the Sheridan Elder Research Centre for Creative Aging to find ways to improve residents' quality of life.
- Building on research which reveals that memory loss can be slowed with a combination of physical activity, and mental and social stimulation, Schlegel and Sheridan have been exploring activities that combine all three and that would be appropriate for seniors.



Schlegel Seniors Villages and Sheridan College

- With funding from the Canadian Institutes of Health Research, Sheridan researchers have been examining the benefits of participation in a twice-weekly dance program for adults over the age of 55.
- Josie D'Avernas (VP Program Development and Innovation, Schlegel Seniors Villages) reports that participating residents have already experienced benefits and the research team is planning an expanded study.



Other Impacts for Firms

- One-third of projects led to firms **increasing their R&D spending**.
 - Another 10 per cent *anticipate* more R&D spending in the future as a consequence of collaborating with an Ontario college.
- Some firms reported that the collaboration has led to an **expansion of business networks** which, in some cases, has led to **new business opportunities**.
- 27 of 29 firms were so impressed with the results that they are planning **repeat collaborations** with Ontario colleges.
 - 14 are already involved in new research projects with an Ontario college.



Impact and Benefits for Students

- Assessments of 29 applied research collaborations revealed that 13 students were hired after working on a project, while other firms anticipate hiring collaborating students in the future.
- Practical, industry-relevant experience
- Reference letters from industry collaborators
- Expanded career and employment networks
- Students' *innovation* and *employability skills* improve:
 - communication skills
 - problem-solving skills
 - ability to work with others
 - adaptability
- These improvements to **innovation literacy** and **entrepreneurial ambition** contribute to the development of an *innovation-ready workforce*—a key component of an innovative society.



Impact and Benefits for Students

“Applied research doesn’t *mimic* the real world,
applied research *is* the real world.”

- Algonquin College Student



Impact and Benefits for Students

“Applied research is the best way for students to put their existing skills to use, and the best way for them to refine and develop new skills.”

- Mark Hoddenbagh

Director of Applied Research and Innovation, Algonquin College



Future Research

- Evidence for impact on students' innovation and employability skills is *indirect*—i.e., relies on interviews with college faculty, officials and industry partners, rather than direct measurement.
- To fill the gap, we are partnering with 15 colleges and polytechnics from across the country—led by Dr. Robert Luke of George Brown College—and other stakeholders, to conduct a *longitudinal (6 year) study of the impact of applied research participation on college students' innovation skills, attitudes, and behaviours*.
- Results should assist colleges in refining curriculum and collaboration parameters to maximize the contribution of AR to the development of a highly-skilled innovation-ready workforce.
- Research proposal is now in the hands of SSHRC.



Foundations of Success

- Achieving benefits for firms and students—and thereby improving innovation and productivity—depends on:
 1. Funding environment
 2. Human, physical, and administrative capacity at colleges
 3. Effective collaborations



1. Funding Environment

- While improvements are being made, the funding environment for Ontario colleges' applied research is characterized by:
 - *low levels* of funding, especially compared to what is available for university-based research;
 - formal and informal barriers to the *accessibility* of the funds;
 - guidelines on the appropriate *use of funds* that are restrictive in key areas (e.g., faculty release);
 - *performance measures and reporting requirements* that are not sensitive to the nature of AR and the college context.
- These barriers make it difficult for SMEs and colleges to secure resources to assist with research and applied innovation.



2. College Capacity

- Design and execution of successful AR projects depends on the state of college capacity, including
 - Human capital and HR policies;
 - Facilities and equipment; and
 - Research policies and administrative structures.
- Many of the capacity challenges faced by Ontario colleges are developmental in nature and can be solved by adopting strategies used by colleges that are further along the developmental path.
- Other challenges, however, can only be solved through government policy and/or funding reform.



College Capacity: HR

- The most stubborn challenge is in funding and coordinating **teaching release** for faculty pursuing applied research.
 - Operating grants and most research funding programs are not designed to fund release time for college faculty;
 - Legislation and collective agreements provide little room to solve release issues;
 - The uncertainty of research funding streams and funding agency timelines make release funding and planning very difficult.



College Capacity: Facilities and Equipment

- While some colleges have **facilities and equipment** to conduct applied research projects and collaborations, maintaining functioning, up-to-date equipment is difficult to secure/maintain.
- Until very recently, colleges had difficulty accessing resources from the Canada Foundation for Innovation—the agency focused on PSE research infrastructure funding.
- New funding from CFI should help colleges enhance their facilities/equipment and thereby become more attractive to SME collaborators—but the scale is still relatively small.



College Capacity: Administration

- Colleges have experienced and will continue to experience challenges related to developing **administrative and organizational capacity** to support AR.
- Having an office of applied research, research policies and structures, and financial and project management policies and structures in place all contribute to success in winning funding and completing projects.
- But colleges face challenges in *securing resources* and designing/developing *effective policies and structures*.



3. Effective College-Business Collaboration

- Ontario colleges and businesses face challenges in developing and managing their AR relationships, including issues with:
 - **time pressures/schedules;**
 - preparedness of, and expectations about, **student researchers;**
 - ambiguity around **roles, responsibilities, deliverables;**
 - **limited awareness** of college AR services in private sector.
- Business interviewees observe that most (but not all) colleges lack *professional industry liaison capacity* and need a fuller understanding of *business drivers and constraints*.



The Mood in Government

- What is the government ‘mood’ with respect to college AR?
- There is a great deal of “**positive inertia**” in government:
 - Increasing recognition of the college AR contribution to student training/employment, firm performance, and overall innovation and competitiveness;
 - Desire to harness and support that contribution;
 - New initiatives have been announced in the past 12 months (including one from CFI which *in the past* has been viewed as not especially college-friendly);
 - Many appear to want to improve conversations and programs related to college AR.



The Mood in Government

- But...
 - Still trying to determine how exactly to design programs to support college role (with the exception of NSERC's CCI);
 - Wait-and-see attitude: Colleges need to further demonstrate positive outcomes with existing resources;
 - Some ambiguity about respective roles of *Ministry of Research and Innovation* and the *Ministry of Training, Colleges, and Universities* relative to Ontario colleges' AR;
 - At both levels, an emphatic concern that college AR should directly *support* student education, training, and employment and not compete with, or siphon resources from, that goal;
 - At both levels, ongoing concern about economic climate and constraints on new spending.



Improving Innovation Performance

- Our weak innovation performance demands improvement.
- Ontario companies—especially SMEs—can get help with their innovation and R&D activities through Ontario colleges' AR services.
- But while the college AR lever has produced excellent firm-level results in the pilot phase, it is operating on a very small scale with limited resources.
- To maximize the contribution that Ontario colleges are poised to make, action by government, colleges, and business is required...



Recommendations for Government

1. Federal and provincial agencies should continue to strengthen and build on college applied research funding programs.
2. Revise the criteria used to evaluate applied research applications and outcomes to better reflect innovation performance and economic development aims.
3. Create a *College Applied Research Leaders* program.
4. Provide base funding for colleges to redeploy employees to participate in industry-led applied research as required.
5. Ensure significant opportunities for college students.



Recommendations for Colleges

1. Ensure that AR serves to strengthen economic growth and contributes to the development of highly skilled, innovation-ready graduates.
2. Improve relationships with business collaborators and clients.
3. Expand AR capacity and activities gradually and learn from colleges further along the development path.
4. Increase college-to-college mentoring and sharing through the Colleges Ontario Network for Industry Innovation (CONII).
5. Take steps to create and/or improve AR-supporting offices and officers, especially research champions, mentors, and a Director of Research (if not done so already).



Recommendations for Business

1. To improve awareness and to extend the reach of colleges' AR services, industry associations, chambers of commerce, and business advocacy groups should increase efforts to spread the message about and direct their clients to the Colleges Ontario Network for Industry Innovation.
2. Recognize that Ontario colleges' applied research services depend critically on the participation of students and may require more guidance than would normally be the case in collaborations with professional consultants and experts.



Conclusion

- Through applied research activities, Ontario colleges are emerging as critical innovation *catalysts* and *accelerators*, especially for SMEs.
- Ontario colleges are poised to make *further* contributions to the country's innovation performance through applied research, but need more time and a gradual introduction of key resources to reach full potential.



Questions?



Questions for You

1. Thinking about your own innovation and productivity challenges, do you see a potential role for college AR?
 - Does AR strike you as a *promising lever* for stimulating innovation?
2. What *challenges* do you anticipate for firms/orgs, colleges, students, and/or government with respect to AR collaborations?
3. What *skills/attitudes/behaviours* should graduates have?
 - What recommendations would you make to colleges about how to develop AR activities to enhance those skills/attitudes/behaviours?



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