



Learning from living laboratories: Canada's universities contribute to the digital economy

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Executive summary

In every era, universities have played a vital role in helping people and nations adapt to societal, economic, political and cultural change. In this submission, the Association of Universities and Colleges of Canada has identified three key functions universities perform in contributing to and preparing Canada for the digital economy: developing talent, conducting research and creating new and maintaining existing research infrastructure. These three functions come together in the form of “living labs” through which Canadian universities are singularly placed to explore the design, development and deployment of new applications in information communications technology (ICT), widely regarded as the foundation of the digital economy.

- Canadian universities are developing the talented, innovative, creative and digitally-savvy individuals with vision, skills and knowledge who seek out better, safer, more efficient ways and means of living, working and playing.
- Research conducted by Canadian universities has and will continue to lead to a wide array of new discoveries that improve the daily lives of Canadians. There are literally thousands of such examples. From the discovery of insulin, and the introduction of the first internet search engine, to the invention of Plexiglas and creation of canola, to name just a few. In collaboration with key stakeholders from other sectors, universities work together to transfer this new knowledge throughout the economy.
- Canadian universities both contribute to the development of and are major users of high performance computing platforms in Canada. Digital infrastructure also includes the technical staff who maintain these platforms and who possess the technical and analytical skills that are necessary for their maintenance and deployment. These systems are the backbone of Canada’s digital infrastructure.

In the next decade, Canada will face many challenges: an aging population, addressing lagging productivity, and increasingly intense global competition, especially within the new digital economy. Much of this will occur during a period of fiscal restraint, as we emerge from the greatest recession in 70 years.

The early stages of the digital economy have demonstrated that Canada is facing more than the introduction of new technologies. We are transitioning into a new society, a digital society which has its roots in ICT. Canada has long been a leader in ICT. Universities are major contributors to Canada’s ability to effectively design, develop and deploy ICT throughout our economy. Universities, with people, ideas and infrastructure, are contributing to the solutions that will ensure our country succeeds in this new digital society.

Introduction

In 1964, Marshall McLuhan coined the phrase the medium is the message. The argument, explored more fully in his 1967 pictorial and textual collage, co-created with Quentin Fiore, called *The Medium is the Message*, is based upon the concept that technology changes how we think and how we interact. Technologies massage the senses in different ways. McLuhan used the Gutenberg press, created in the middle of the fifteenth century, to illustrate his point. The printing press put knowledge in the hands of a wide group of people and changed established power structures in the process. Today there are many examples that illustrate this concept, such as the radio, the telephone, the automobile, and the internet, the latter of which has had the greatest impact on our behaviour and which continues to drive a transformation in how we work, how we study and how we live.

The wide array of new technologies and techniques to effectively deploy information are collectively transforming our behaviour. As McLuhan predicted in his later works, we are witnessing the emergence of an electronic culture. Through the digital economy, and the digital society, we are becoming more connected within Canada and around the

world. Information and knowledge are shared more quickly, and our degree of awareness increases in time with the information we receive, sometimes to the degree of information overload and fractured attention.

The developing digital economy, and digital society, is an evolutionary process that is changing the way we operate in our professional environment, our academic environment, and our personal environment. Embracing the opportunities provided by this evolution and managing the risks – while ensuring access for all Canadians – will require a long-term, strategic approach that involves representatives from many sectors across Canada coming together and building new working relationships and networks.

Canada's university sector has a critical role to play in contributing to and preparing us for all facets of the digital economy, and by extension, our digital and rapidly globalizing society.

Strengthening Canada's capacity in ICT will be an important component of a successful digital economy. ICT is broad and pervasive, and has an impact in every sector of our economy. It touches every aspect of our lives. Universities are singularly placed to act as "living laboratories" to explore the different, innovative uses for ICT in every field, to understand our behaviours and reactions to new digital media and content, and to identify and address the digital challenges facing Canada. To use the set of concerns about an aging population as one of many examples of a looming national challenge, a university environment – the combination of innovative people and ideas with smart infrastructure clustered in one place – provides a "living lab" in which to grow potential solutions. By extension, this environment can also explore and provide solutions for the kinds of challenges that will arise from the digital economy. For example: adopting a national digital health information system in Canada, promoting digital literacy, developing a green computing system, preserving digital records, improving digital security, and promoting the use of digital technologies by small- and medium-sized enterprises (SMEs) and our international collaborators.

Growing talent and producing innovative people

One of the greatest services that universities provide is equipping graduates with the necessary creative, analytical and innovative skills to succeed both at work and in life. University graduates attain the necessary skills to adapt in new environments and to integrate knowledge from new and different sources. They also possess the ability to challenge previously held beliefs with new information, develop and adopt new theories, and find solutions to challenges. Together, these skills combined with technical and social skills, as well as discipline-specific knowledge, create a cohort of lifelong learners who are intellectually agile and flexible and can easily adjust to shifts in Canada's employment market.

For example, the 2006 Census revealed that there were some 120,000 people with bachelor's degrees employed as computer and information systems professionals -- but just 36 percent had majored in computer science. The remaining 64 percent were spread across an array of disciplines, demonstrating that universities produce graduates whose content and digital expertise can be used in applications from financial services, to medical diagnostics, to forest management, to video gaming and advertising.

The digital economy extends far beyond simply creating new technologies. To be successful, new technologies must be designed, developed and deployed in ways that promote widespread application and utilization. That will require a high level of education throughout the economy. Universities are developing services and resources to assist academic staff in providing the kind of innovative teaching methods that their students increasingly expect and need to be effective learners and users. Teaching and learning centres are creating the digital tools and content that facilitate learning for different types of students – from the most digitally-savvy to those with far less digital expertise.

Universities employ ICT as a way to engage and interact with students, and as a means to enhance the learning experience. Used in this way,

technology provides a means to access higher education and promote lifelong learning.

Nevertheless, in recent years, the proportion of youth in Canada who enrol in and complete university programs has fallen behind many other nations. According to the latest data from the OECD, Canada ranks 20th among OECD nations, behind emerging economies such as Korea, Hungary and Poland, for the proportion of youth who have access to full-time university programs soon after completing secondary school.

Promoting the excellence of ICT programs in Canadian universities abroad would attract greater numbers of top international students to these programs to help meet the sector's needs. Women and Aboriginal students also remain underrepresented in two disciplines which are prevalent in ICT: computer science and engineering. Creating awareness of the vast array of careers in the area of ICT to these groups, and the associated intrinsic benefits is another way to increase the talent pool for ICT-related careers, because there are not enough talented workers. While many Canadian industries within the ICT sector are now clamouring for graduates, enrolment has been declining in computer science and engineering in universities. This is due in large part due to fluctuations in labour market demand for these graduates. Enrolment trends in Canada highlight that students are sensitive to signals in the labour market and respond to those signals. As ICT continues to evolve as an applications-enabler – in areas from healthcare to the environment and business – it should help create greater awareness of the potential career opportunities, and attract more top foreign students and underrepresented groups in Canada to this sector. Programs that encourage Aboriginal learners will also be of critical importance in building economic capacity in Aboriginal communities as well as helping to grow Canada's labour force.

To appeal to underrepresented groups over the longer term, emphasis also needs to be placed on the many and varied opportunities for employment in ICT and related occupations while students are

enrolled in primary and secondary school. This requires a concerted effort on the part of provincial governments, alongside universities and the private sector. Creating a national open source portal to promote ICT and related disciplines, employment opportunities and the development of ICT-related skills at the primary and secondary education levels will help to ensure that all Canadians have access to the types of early learning tools needed to bridge the digital divide.

Promoting the development of a digital economy will also mean enhancing the skills of today's workforce. Universities also provide continuing education courses, especially in ICT, web-design and related areas. Moreover, university education faculties are leaders in the development of learning approaches, technology applications and strategies for inclusion that will address the growing digital divide across primary, secondary and postsecondary levels of education.

Our recommendation:

As Canada moves to address both demographic challenges and those resulting from the emergence of a digital economy, the demand for highly qualified personnel will continue to increase. Active recruitment of top-tier international students, and those currently underrepresented in Canada will be essential to meet this demand because a high quality undergraduate education is the first step in ensuring that all students may contribute to a strong digital economy, and help drive Canada's productivity. Programs that support collaborative research and learning opportunities – such as internships, international learning experiences and co-ops – and promote the transfer and integration of knowledge from the learning environment to the workplace are also essential to the development of critical thinking, analytical and digital skills that will drive Canada's digital economy.

Research and knowledge transfer

Universities are major contributors to Canada's ability to effectively design, develop and deploy ICT throughout our economy.

Research conducted by Canadian universities has and will continue to lead to a wide array of new discoveries that have major impacts on the development, design and use of digital technologies and infrastructure. University research and researchers contribute in every facet of the innovation process, from basic to applied research, and contractually-driven research with private sector partners to pan-Canadian, collaborative research networks, to networks with international scope. Collaborative networks draw from basic and applied research practices and recognize the need to bring together multidisciplinary knowledge as well as public and private interests to address compelling challenges and opportunities beyond the capacity of one institution.

Students who graduate from the university learning environment are our country's greatest asset. Programs which connect these highly qualified individuals with the private sector help drive innovation with large companies and in particular, with SMEs. The knowledge they bring with them from university fuels Canada's ability to collaborate and compete in the global digital economy.

Research also produces ideas, policies, products and services. Universities are increasingly using web-based tools to provide greater access to the research discoveries of their faculty, in plain language to supplement the more technical research material. Through this information sharing, the private sector has access to information that enables them to drive the creation of these new products, policies and services. Many Canadian universities are exploring new ways to collaborate with various levels of government and the broader public service to share these results more widely, for example, creating national open source repositories of research publications and data that support the transfer of knowledge by graduates to the private and public sectors. Through the open source repositories, public and private sector stakeholders

can benefit from the firsthand knowledge generated in universities. In this way, the public and private sectors can actively integrate new knowledge and research into their existing and future practices and strategic plans.

One hallmark of the digital economy is the prevalence of innovative new methodologies often spawned by comparatively small companies, which then grow very quickly. Canada's relatively conservative venture capital community makes rapid, high-risk development difficult to pursue, and more difficult to secure. Consequently, the scope of many Canadian SMEs is necessarily limited by the need to secure sustainable funding before they can focus on more long-term, strategic planning.

Our recommendation:

Enhancing support for programs and policies that promote cross-sectoral collaboration will mitigate the cost of research and the associated risks for the private sector, support the creation of a research culture, and build natural research strengths in both the academic and private sectors. Long-term, sustainable support for student and graduate internships, applied solutions to business-defined market challenges and opportunities and university incubators such as research parks, business mentors, early stage financing, interdisciplinary linkages between federal and provincial labs, regional clusters, national and international collaborative research networks is necessary to provide the environment in which both students and the private sector can help drive Canada's innovation, productivity and competitiveness.

Integrated infrastructure

Universities have both contributed to the development of and are major users of high performance computing platforms in Canada. These systems are the backbone of Canada's digital infrastructure. Canada's Advanced Research and Innovation Network (CANARIE) together with Compute Canada and its regional partner consortia provide the ultra high-speed network and integrated

high performance computing platform needed to facilitate leading-edge research, major science support, as well as support for growing competitive fields such as digital media. This infrastructure supports collaborations between researchers and ICT companies across Canada, North America, particularly California, and around the world.

But infrastructure is not just about hardware. Infrastructure has evolved in recent years, and has come to include the technical staff and their analytical and modeling skills which play an integral role in the research process, as well as the data housed in these computing platforms.

Our recommendation:

Canada has invested heavily in digital infrastructure for many years, and we now possess a solid foundation. However, the international shift towards shared data and collaborative working models suggests increasing demands on data and repositories by new and growing audiences, such as the private sector, and for more extensive purposes, such as emergency preparedness planning. The increasing breadth and depth of demand will require ongoing, sustainable investments to ensure that Canada can provide expanded access to high speed broadband infrastructure at prices that will help to eliminate the digital divide. Just as we were early pioneers in wireless, with similar support, we can build and maintain global competitiveness in digital access.

An evolving Canadian culture: The way forward

Emerging from the deepest recession in 70 years, Canada's economy has shown remarkable resilience. Canadians recognize the need to confront global challenges, adapt to the new economy, and do so within a context of fiscal restraint. At the same time, we are cognizant of a demographic shift that will constrain growth in the workforce over the next forty years. Canadians are now undergoing another significant change: the emergence of the digital

economy, and the challenges of adapting to a digital society.

The new digital society is an opportunity to take an integrated approach to designing and effectively deploying new technologies and processes that will offset the demographic and fiscal challenges Canadians are facing. We must embrace the digital society as an opportunity to drive growth and create an advantage for Canada. Canadian universities have a role to play in the creation of a digital society, which includes working collaboratively with governments and the private sector for the benefit of all Canadians.

Universities, the private sector and the public sector must come together more frequently in problem-focused interdisciplinary clusters, multi-sector national and international research networks, partnerships or hubs to address the challenges we face. We must find better ways to connect our skilled and talented students in multi-sectoral collaborations, and enhance their ability to transfer and translate knowledge into the products and services that will drive our economy. This will help Canada address its collective innovation challenge. We must focus on local strengths to realize global digital success.

The results will be astounding: better access to information, healthier Canadians, more vibrant culture and entertainment, more efficient organizations.

Our recommendation:

The foundation of a prosperous digital economy in Canada requires an intensely integrated, collaborative approach to research, infrastructure and talent. Leveraging the strengths of the highly qualified people in our academic, private and public sectors, we will employ the findings of our investments in research from all sectors, our infrastructure and talent to build the way forward for Canada and Canadians.

About AUCC

The Association of Universities and Colleges of Canada is the voice of Canada's universities. We represent 95 Canadian public and private not-for-profit universities and university-degree level colleges.

Since 1911, we have provided strong and effective representation for our members, in Canada and abroad. Our mandate is to facilitate the development of public policy on higher education and to encourage cooperation among universities and governments, industry, communities, and institutions in other countries.

We provide services to member universities in three main areas:

- public policy and advocacy
- communications, research and information-sharing
- scholarships and international programs

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