

# Canada: The Go-to Country for Brainpower Resources in the Global Digital Economy



Submission to the Government of Canada re:

***Improving Canada's Digital Advantage:  
Strategies for Sustainable Prosperity***  
*Consultation Paper on a  
Digital Economy Strategy for Canada*

Theme focus: *Building Digital Skills*

From the  
**Canadian Coalition for Tomorrow's ICT Skills**

July 12, 2010

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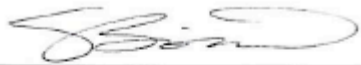
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## Letter of Introduction

July 12, 2010

As the Executive Committee of the Canadian Coalition for Tomorrow's ICT Skills, we are pleased to respectfully submit our response to the Government of Canada's Consultation Paper on a Digital Economy Strategy for Canada.

A majority of CCICT Corporate Members, in addition to ourselves, have carefully reviewed this submission and chosen to provide their specific support. Their executive signatures may be found on the following page.



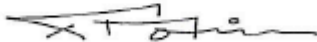
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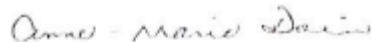
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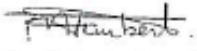
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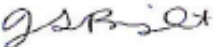
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CCICT Corporate Members specifically in support of this submission include the following:

  
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## Summary

*Improving Canada's Digital Advantage* provides an excellent foundation for addressing the needs of today's digital economy. The Consultation Paper argues that improving productivity and innovation performance requires more and better investments in ICTs. The skills and talents of ICT professionals are essential to this effort, across the economy.

Demand for ICT-related skills is shifting from desk-bound programming jobs to exciting careers that provide leadership and drive innovation:

- **Business professionals** with knowledge, skills and qualities to lead and support effective, competitive use of ICTs
- **Specialized technologists** – both ICT-focused and multidisciplinary – at the leading edge of innovation in every field

The Consultation Paper makes an implicit case that talent and capital are the main sources of available leverage for improving Canada's digital advantage. The CCICT proposes this vision as the centerpiece of the digital economy strategy: **"Canada: The go-to country for brainpower resources in the global digital economy"**.

The CCICT respectfully submits six recommendations and goals for this vision:

1. **Leaders in government and across all sectors should articulate, explain and champion the vision.** The Federal Government should mandate a cabinet champion to lead these initiatives, with the support of the Prime Minister. She or he should form and lead an action-oriented Digital Economy Brainpower Council of stakeholders and thought leaders to finalize a strategy and plan, funding, and set of targets. Implementation should begin in 2011.
2. **Canada should aim to double female enrollments in high value ICT-related post-secondary enrollments by 2017.** The Federal Government should partner with provinces to mobilize resources and campaign for this as a "moon shot" marquee priority. This includes new programs, student seats, and promotional campaigns to career choosers in Canada and abroad.
3. **Government should partner with the private sector to create and sustain a skills data mart** that provides up-to-date aggregated data on supply and demand of increasingly specialized and often changing ICT-related professional skill sets. The marketplace, a driver of labour market innovation and agility, will be a competitive differentiator for Canada's digital economy strategy.
4. **Canadian governments should collaborate to increase investments in education. They should expand seats in next generation ICT-related post-secondary programs at least 20% by 2017.** The cabinet champion,

with the support of the Prime Minister, must create a sense of urgency and allocate funds to prime the pump at a national level.

5. **Make the full range of digital literacy skills a priority in primary, secondary, post-secondary, mid-career and lifelong learning education.**

The Digital Economy Brainpower Council should lead in working with provinces to define learning outcomes, standards, and methodologies for digital literacy, business skills, foundational workplace skills, mid-career education, and practical experience.

6. Governments, educators and the private sector should promote career chooser **awareness** about exciting next generation ICT-related careers; provide **financial assistance, mentoring and other supports**; offer **incentives** to students and educational institutions; and foster **partnerships** to lead change. To support these, the Federal Government should launch a Canada Brainpower Fund under the stewardship of the Digital Economy Brainpower Council.

## About the Canadian Coalition for Tomorrow's ICT Skills

The Canadian Coalition for Tomorrow's ICT Skills (CCICT) is an industry-led coalition of employers, universities and industry organizations, founded by Bell Canada in 2007. As the Government of Canada Consultation Paper, *Improving Canada's Advantage: Strategies for Sustainable Prosperity*, states, the CCICT aims "to ensure that Canadian organizations can hire the ICT professionals they need to meet the changing and diverse needs of the 21<sup>st</sup> century workforce."<sup>1</sup>

CCICT Corporate members include the following organizations:

- Accenture
- Aero Bombardier
- AMEX Canada
- Banque Nationale du Canada
- Bell Canada
- Canadian National Railway
- Canadian Tire Corporation
- CGI Group
- Cisco Systems Canada
- Computer Talk
- Deloitte
- DALSA
- Ericsson Canada
- Government of Ontario
- Hydro-Québec
- IBM Canada
- Loto-Québec
- Manulife Financial
- McCain Foods
- mediaINTELLIGENCE.ca
- Mountain Equipment Co-op
- Open Text Corporation
- Procter & Gamble
- RBC Financial Group
- Research In Motion
- Sapphire Canada
- Standard Life Canada
- Weston Foods
- Workopolis
- Xerox Canada Ltd.

The CCICT seeks to achieve practical solutions to an alarming decline in ICT-related post-secondary enrolments (20-30%)<sup>2</sup>, consistently low female participation (25%), and significant shifts in demand – against the backdrop of a growing need for every industry to embrace the tools and methods of the knowledge economy. We have close to 100 members, including leading employers, educators and organizations across Canada.

Employing over 1 million Canadians, information and communications technology (ICT) activities are the foundation of our knowledge economy. This includes:

- 420,000 incumbents of ICT occupations in the ICT sector (products and services, including consulting and business services)

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<sup>1</sup> Industry Canada, *Improving Canada's Digital Advantage: Strategies for Sustainable Prosperity* (Ottawa, 2010), p. 22.

<sup>2</sup> Information & Communications Technology Council, *IT Enrollments and Retention: Situation Report* (Ottawa, 2008), p. 3.

- 170,000 incumbents of other occupations in the ICT sector (eg., sales & marketing, manufacturing, distribution, HR, administrative personnel)
- 280,000 IT professionals in every other sector (e.g., government, financial services, retail, media, manufacturing, health care, energy)<sup>3</sup>
- Uncounted numbers who combine ICT skills with specialization in another technical field, whether digital media, smart power grids, automotive technology or life science.

More Canadians work in ICT than in agriculture, forestry, fishing, mining, oil & gas, utilities, and transportation industry (including auto) manufacturing, *combined*. As demographics and economic changes place increasing focus on a growing gap in knowledge economy skills, ICT-related skills loom front and center.

The nature of demand for ICT-related skills is changing. Numerous ICT professionals are unemployed because their skills do not match the needs of today's labour market. ICT is decreasingly about traditional desk-bound programming and increasingly about exciting 21<sup>st</sup> century careers for professionals who display leadership and drive innovation:

- **Business professionals** who have the knowledge, skills and personal qualities to lead and support the effective, competitive use of information technologies. As the Consultation Paper points out, our lagging productivity has much to do with gaps in these skill sets. Employers across Canada can't find enough people who know how to infuse businesses with technology, and we also face a critical shortage of business-savvy technology entrepreneurs. The Information & Communications Technology Council projects a need for over 65,000 such hires over the next 6 years.<sup>4</sup>
- **Specialized technologists** – both IT-focused and multidisciplinary – who operate at the leading edge of innovation in every field, be it ICT product innovation, digital media, health care and medical research, green infrastructure, or automotive design. This is not just about the ICT sector. Industry-specific ICT-related skills shortages limit the performance of many key sectors (e.g., health informatics, power network informatics, intelligent vehicles & transportation systems, advanced manufacturing, digital media, mobile technologies & applications) and the economy as a whole.

To address these needs, the CCICT has launched the Digital Jobs of Tomorrow Project, in partnership with Human Resources and Skills Development Canada, the governments of Quebec, Ontario, Alberta and other provinces, and leading industry organizations including the Information & Communications Technology Council, TechnoCompétences, the Information Technology Association of Canada, and the Canadian Information Processing Society.

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<sup>3</sup> These figures are our estimates based on Information & Communications Technology Council, *Outlook for Human Resources in the Information and Communications Technology Labour Market, 2008 to 2015* (Ottawa: 2008), p. 16; Industry Canada ICT Sector Employment, 2008 Estimates ([http://www.ic.gc.ca/eic/site/ict-tic.nsf/eng/h\\_it05840.html](http://www.ic.gc.ca/eic/site/ict-tic.nsf/eng/h_it05840.html)); and information provided to CCICT by ICTC.

<sup>4</sup> CCICT analysis of data from ICTC, *Outlook for Human Resources in the Information and Communications Technology Labour Market, 2008 to 2015*

The Digital Jobs of Tomorrow Project includes the following components:

- Business Technology Management (BTM), a new, professional undergraduate university program designed to improve the quality and quantity of business professionals capable of implementing ICTs to improve productivity, innovation, entrepreneurship, and competitive advantage. Several universities across Canada will launch the BTM in 2010.
- A highly interactive, “Web 2.0” style national Digital Jobs of Tomorrow Career Hub for next generation IT-related careers that becomes the go-to site for young career choosers (age 14-26). The Career Hub will provide career information, advice, news, mentoring and community capabilities.
- A high profile “National Digital Careers Week” for young career choosers and influencers to create a “jolt” that changes perceptions about the nature and attractiveness of 21<sup>st</sup> century IT career paths, as well as the educational pathways to these careers.

## Introduction

The Consultation Paper, *Improving Canada's Digital Advantage*, provides an excellent foundation for addressing the central challenges involved in, as Minister Tony Clement says in his opening message, “building a stronger and more competitive Canadian economy.”

This applies particularly to the issue of talent – “digital skills for tomorrow”. Minister Diane Finley points out in her message,

“In the labour market, digital skills are in high demand across all sectors, not just the information and communications technology sector. The ability of Canadian businesses to innovate and position themselves along the global value chain will depend heavily on having access to workers with the appropriate skills.”

We couldn't agree more. But too few Canadians are aware of this fact. As a result, young career choosers, educators, parents, business executives, and government often make poor decisions. Why is this a problem? Because skills and talents are the most critical success factor for Canada's digital economy strategy.

This submission provides the CCICT perspective on how to build on the excellent initial work of the Consultation Paper. We provide our perspective on how to envision and implement, to quote Minister Finley, a “range of integrated and targeted efforts coordinated across government, industry and education partners.”

The Consultation Paper chapter on digital skills frames the issues and strategic options well. In addition, the Paper correctly identifies talent as a key challenge in three of the four other focus areas.

- **Capacity to innovate using digital technologies.** “Canada's underinvestment in digital technologies is part of a broader problem in innovation performance, which is largely due to a lack of business and managerial skills.”<sup>5</sup>
- **Growing the Information and Communications Technology Industry.** “In order for Canadian companies to innovate and grow, they must be able to attract and retain highly qualified professionals. The digital sector is increasingly challenged to seek out and aggressively compete for these professionals. There are some indications of a shrinking talent base due to decreasing university enrolment in the areas of computer and information sciences, applied mathematics and computer software engineering.”<sup>6</sup>

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<sup>5</sup> *Improving Canada's Digital Advantage*, p. 13.

<sup>6</sup> *Improving Canada's Digital Advantage*, p. 22.

- **Digital Media: Creating Canada’s Digital Content Advantage.** “With a near-constant evolution of technologies, and an emerging industry comprised often of small and medium-sized companies, the Government of Canada recognizes that there is a need to develop skills, and share expertise and best practices.”<sup>7</sup>

In our reading, the Consultation Paper makes an implicit case that Canada must address six kinds of challenges in its effort to achieve the goal of a stronger and more competitive digital economy:

1. Talent
2. Capital
3. Tax structures
4. Digital infrastructure
5. Copyright/intellectual property
6. Structural challenges (competition, geography, regionalism, size of domestic market, ICT industry structure).

Our tax structures may not be perfect, but they are competitive, and increasingly so. To maintain this momentum, the Government of Canada should make changes in tax policies in accordance with the digital economy strategy that it announces as the outcome to this consultation. Infrastructure is being tackled through a combination of market forces, regulation/deregulation, and targeted government investment. The government is currently addressing copyright/IP; in any case this issue only affects some sectors of the digital economy. The structural challenges – with the exception of competition, which the government is addressing – are difficult or impossible to overcome. This leaves access to talent and access to capital.

The CCICT focus is talent. We leave it to others to address access to capital.

We believe that the Consultation Paper chapter, “Building Digital Skills for Tomorrow”, provides an excellent foundation for Canada’s digital talent strategy. The Consultation Paper raises the following key issues about Canada’s digital skills. They provide context and underlying assumptions for this submission:

- “Canada’s underinvestment in digital technologies is part of a broader problem in innovation performance, which is largely due to a lack of business and managerial skills.”<sup>8</sup>
- “The digital sector is increasingly challenged to seek out and aggressively compete for [highly qualified] professionals. There are some indications of a shrinking talent base due to decreasing university enrolment in the areas of computer and information sciences, applied mathematics and computer software engineering. Between 2001 and 2007, information technology

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<sup>7</sup> *Improving Canada’s Digital Advantage*, p. 27.

<sup>8</sup> *Improving Canada’s Digital Advantage*, p. 13.

undergraduate enrolment in Canadian universities dropped by 45 percent, resulting in a 35-percent decline in graduates by 2007. Similarly, enrolment in graduate programs has declined by 21 percent since 2003, leading to a 16-percent drop in graduates by 2007. Moreover there has been a decline in immigrants, as fewer IT professionals in emerging countries seek employment in developed countries such as Canada, due to growing opportunities in their home countries.” Overall, the growth and viability of the ICT sector is at risk, including Canadian and foreign investment in R&D in Canada. It also undermines the entire economy, as 45 percent of all IT professionals work in other sectors.”<sup>9</sup>

- “A significant challenge in determining if Canadians have the skills and competencies required for the digital economy is a lack of a precise understanding of what digital skills are, and how Canada is faring in this regard compared to its competitors.”<sup>10</sup>
- In the ICT sector, “despite a downturn in ICT employment since mid-2008, skills shortages continue in some areas. In many cases, these skill shortages are more related to a workers not possessing the right combination of specific skills and experience required by Canadian employers, rather than a lack of formal qualifications. Solving these ongoing skill shortages will require a range of integrated and targeted efforts coordinated across government, industry and education partners.”
- “A significant gender imbalance also exists in the ICT workforce; women are fewer than one-quarter of workers in ICT occupations. Similarly, Aboriginal Canadians are under-represented...”
- “A digital strategy needs to seek opportunities to increase participation of under-represented groups, particularly through encouraging more post-secondary enrolment in ICT-related programs.”

In this submission, we first provide some refinements and perspectives that we believe are important for framing the discussion. We then address the strategic questions.

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<sup>9</sup> *Improving Canada's Digital Advantage*, p. 22.

<sup>10</sup> This and following 3 citations, *Improving Canada's Digital Advantage*, pp. 30-31.

## CCICT Perspectives

### Digital economy technology skills are changing in exciting ways

The Consultation Paper suggests that there are two kinds of digital skills: (1) deep technology skills of ICT workers, and (2) digital literacy skills required of all workers.<sup>11</sup> We propose five categories of digital capability, at increasing levels of sophistication and complexity.

1. **Digital literacy.** This is a skill set that every citizen needs in order to make effective use of digital media. It is the 21<sup>st</sup> century version of the 19<sup>th</sup> century's 3R's – reading, writing and arithmetic. Digital literacy entails an understanding of the nature and uses of various digital media and technologies, how to communicate effectively via digital media, creativity, etiquette, safety, health, and so on.
2. **Digital business skills.** Beyond literacy, this is the general skill set that every worker uses in a digital economy business setting. It also includes use of specialized tools in every field from scientific research to manufacturing.
3. **ICT technology skills.** This is the traditional skill set of ICT workers; many of these skill sets are now becoming increasingly specialized and demanding. Some ICT workers configure and support pre-built ICT tools to meet business and consumer needs. More advanced ICT workers innovate and create new ICT tools.
4. **Highly specialized and hybrid technology skills** sets are either highly specialized within ICT, or combine ICT worker-class technical skills with an entirely different technical discipline.
5. **Business technology management skills.** This critical skill set combines ICT technical skills – whether ICT-specific or hybrid – with the knowledge and skills of a commerce degree or MBA.

Our research and experience indicate that the last two – hybrid technical skills and business technology management skills – are increasingly in demand. The Consultation Paper chapter on talent mentions the need for these skill sets in a point about post-secondary programs, but we believe it merits greater emphasis.

**Highly specialized and hybrid technologists** focus deeply on an ICT discipline (like analytics, engineering or security) or combine two or more technical disciplines (e.g., bio-informatics, game design, media, smart power, analytics, forensics, actuarial applications).<sup>12</sup> These specialists are at the cutting edge of

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<sup>11</sup> *Improving Canada's Digital Advantage*, p. 30.

<sup>12</sup> The Consultation Paper describes the need for one industry-specific hybrid skill set, namely digital media. It describes a career road map initiative of the Cultural Human Resources Council. We believe most sectors need similar initiatives.

innovation and productivity in every sector of the economy. Technology specialists and hybrids master both technology and technique.

**Business technology managers** design, lead and implement the “complementary investments in labour, organization design, digital skills and other areas [which] are required to realize the full potential of general purpose technologies such as ICT.”<sup>13</sup> They include business analysts, consultants, project managers, IT managers, technical marketers – and vitally important technology entrepreneurs. Absence of such combined business/ICT skills prevents many companies – particularly small ones – from investing effectively in technology for productivity, innovation and growth.

The rise of business technology managers and specialized/hybrid technologists reflects Minister Finley’s point that ICT is now everywhere. As innovations in technology, and in the uses of technology, increase – so does the variety of digital economy occupations. Five years ago, no one talked about clean IT or social network analysis as major career opportunities.

Traditional technology generalist jobs (e.g., programming) have become increasingly commoditized and offshoreable. But many hybrid skill sets are difficult or impossible to globalize, and/or they are objects of a global war for talent. These good jobs are more likely to stay in Canada and provide high value-added, differentiating economic benefits.

No matter what the capability area, digital skills and tools are no longer sufficient – if they ever were. Even in entry-level jobs, employers give preference to employees with two vital sets of attributes:

- **Foundational workplace skills** such as collaboration, problem solving, critical thinking, facilitation, and leadership. These should be integral to the curriculum at all levels, beginning in elementary school.
- Significant, relevant **practical experience** through co-ops, internships, and the like. In areas such as business technology management, the CCICT is working to make practical experience a requirement for professional certification.

**Action implications.** Government policies and programs, including labour market research, post-secondary education and research investments, and public communications should be refocused to support and accelerate the increasing emphasis on specialized/hybrid technologists and business technology managers.

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<sup>13</sup> *Improving Canada’s Digital Advantage*, p. 13.

## Lack of awareness leads to skills shortages

Here is the situation:

- Canadian employers must fill 65,000 business technology management jobs by 2015. But in every region of the country, employers across all sectors have difficulties finding people with the requisite skills.<sup>14</sup> Meanwhile, most university programs that teach these skills, such as Commerce MIS honours, cut student seats early in the last decade due to a drop in enrollments.
- There is a big risk that labour and skill shortages will limit the ability of federal and provincial governments across Canada to implement their e-health strategies.<sup>15</sup>
- Canada's provincial governments are investing billions to build smart power grids, which entail fundamental technology and business model changes for their power distribution companies. Yet Canada has few if any post-secondary programs that teach the skills and knowledge required to lead these changes.

Whether it's educators who need to make better choices about their offerings, or young career choosers who need to understand the potential of high value ICT-related careers, there is a serious lack of awareness about the exciting opportunities that exist right now. The CCICT 2009 survey of 1,000 grade 9 & 10 students across Canada found that:<sup>16</sup>

- Students see computing jobs in traditional ways – programmer, technician, Web design, and so on. The only hybrid job that comes to their minds is game design.
- Only 9 percent of boys, and 4 percent of girls, view an ICT-related career as very appealing.
- Students generally believe that ICT-related careers are easy to find, secure, pay well, and offer good promotion opportunities. But they don't care. These factors have no correlation with their interest – or lack of interest – in pursuing an ICT-related career.
- Those who do find ICT appealing tend to believe (in order of prominence) that the field is interesting, fun, cool, creative and social. The problem is, most respondents don't believe – or aren't sure – the field has these attributes.

The fact is, today's specialized/hybrid technology and business technology management careers are extremely interesting, fun, cool, creative and social. But career choosers don't know this, and neither do key influencers like parents (who

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<sup>14</sup> ICTC, *Outlook for Human Resources in the Information and Communications Labour Market, 2008 to 2015* (Ottawa: October 2008). The study projects a combined need for 65,000 ( $\pm 15\%$ ) computer and information systems managers, telecommunication carriers managers, and information systems analysts & consultants. It also describes the issue of declining enrollments in ICT-related post-secondary programs.

<sup>15</sup> ICTC, *Health Informatics and Health Information Management Human Resources Report*, November 2009.

<sup>16</sup> Conference Board of Canada, *Connecting Students to Tomorrow's ICT Jobs and Careers*, May 2009.

harbour false fears about ICT job security), guidance counselors, and many in the media.

**Action implications.** Government must work with the private sector and educators to aggressively inform – and alter the choices of – career choosers and influencers about the exciting new ICT-related careers in the digital economy.

### **Stakeholders need a visible digital economy labour market**

At the root of the awareness problem is absence of information. Employers, educators, career choosers and policy makers simply don't know what is going in the ICT labour market – the engine of the digital economy. The result? Bad decisions are routine.

Supply, demand, and employment data on ICT-related occupations is inadequate. The Information & Communications Technology Council does yeoman work producing data updates and special studies. But the funding and data resources available are insufficient. Government departments have in recent years reduced their resourcing of the ICT sector and its information needs. As a result, the best current data available reports on but a handful of ICT occupations. Published data typically provides only aggregate national growth rates in percentage terms, not even numbers employed – let alone by industry sector or region.

Compounding the problem, the categories (“national occupation code”) that government uses to quantify ICT sector employment are outdated and incomplete. The categories need significant, and ongoing, updating. For example:

- The code agglomerates a massive category of “information systems analysts and consultants” (138,375 in 2006, the last year for which this data was published) into a single group.
- It pinpoints the number of broadcast technicians (2,640).
- A seemingly arbitrary list of multidisciplinary “ICT-related occupations” counts only those employed inside the ICT industry. We'd bet that other sectors have more hybrid technologists than are found in the ICT sector.

Consider what is missing. Using health and life science as an example, the market needs annual supply and demand data on health informatics analysts and consultants; computer-based medical equipment technicians; bio-informatics researchers; health application designers/developers; and so on. Digital media gets a code for Web designers and developers, but what about game designers and developers, mobile applications designers and developers, entertainment and arts creators, etc.?

We also lack other key pieces of the information puzzle, for example:

- Occupation distribution by industry/sector
- Gender distribution by occupation and sector
- Internationally Educated Professional participation by occupation and sector
- Supply-demand gaps by occupation and sector
- Available ICT-related college, polytechnic, university, and private programs, including hybrid programs and number of seats per program
- Enrolments and graduations in ICT-related college, polytechnic, university, and private programs, by program type and by gender
- Metrics for immigrants, aboriginals, international students, and other special groups
- Geo-mapping to illuminate clusters of skills, jobs, and investments

Having such data, regularly and reliably, is vitally important. It sends supply and demand signals that drive critical choices, to career choosers and influencers, educators, government policy makers, employers and inbound investors. The ICT labour market, like every market, thrives on information – the signals that facilitate liquidity and alignment between supply and demand. Today’s signals are faint and fuzzy.

There is another dimension to this problem. Where good labour market data exists, it is often delivered in technical language and reports that are inaccessible to ordinary people. Though the materials are in the public domain, invaluable data is poorly publicized. Labour market information must be delivered to the people who need it, in formats they can use.

**Action implications.** Canada needs consistent, current, reliable – and accessible – supply/demand data to ensure that the digital economy labour market meets the needs of employers and potential inbound investors, and is globally competitive.

### **Every sector faces digital economy skill shortages**

The talent chapter in the Consultation Paper makes the important point that skills shortages affect both the ICT sector and workplaces across the digital economy. It makes many good points about what must be done to address the needs of the ICT sector – for example more hybrid skills – but fewer points about non-sector ICT employers.

However, as Minister Finley suggests in her introductory message, many of these points apply equally to workplaces across the digital economy, and in some cases more so. The consultation devotes a chapter to the needs of the digital media sector. Canada’s digital economy strategy should pay comparable attention to many other sectors. Innovative technology skills and investments are needed in life science and

health care, police and national security, power generation and distribution, auto and aerospace, media, and financial services – to name a few. Canada has scores of college and university programs in game design, but few if any in green grid informatics.

According to the Consultation Paper, 45% of ICT professionals are outside the ICT sector - a huge proportion. The non-sector portion may be even higher, because many uncounted hybrids are in non-sector workplaces. Also, the lines that demarcate the ICT sector are debatable. Are Amazon and eBay – not to mention Apple – in ICT or retail? Does RIM “play” in the mail and package distribution industry? What about RBC, which runs on ICTs and has 10% of its workforce in the IT department? Could one say that General Motors and Toyota design and manufacture complex computing environments that just happen to provide transportation?

Distinctions evidently remain across the two sides of this fence, but they are increasingly fuzzy.

**Action implications.** We need to provide all sectors of the digital economy – and particularly high value-adding participants – with access to the advanced and evolving talent sets that traditionally gravitated to the technology sector.

### **For diversity and growth, focus on women, targeted immigration and international students**

The Consultation Paper identifies potential sources of ICT labour supply from some under-represented and special groups: women, Aboriginal Canadians, temporary foreign workers, and internationally educated professionals. We have some comments about the two that appear to offer the greatest numerical impact: women and internationally educated professionals (IEPs). We also propose a third source of supply, namely international students.

Before getting into these details, we want to make a broader point about diversity, a major strength of Canadian society and a crucial value for its digital economy talent strategy. ICT has a mixed bag of performance in this regard. The good news is that members of visible minorities occupy over one quarter of ICT occupations, compared with 15% of the national labour force. Immigrants (internationally educated professionals) fill nearly a quarter of ICT-related engineering jobs in Canada (vs. 20% of all jobs). On the other hand, aboriginals and women are severely under-represented. Addressing these and other diversity issues, done right, will strengthen the quality and size of our ICT workforce. A main point in the following is that diversity strategies and priorities should be carefully designed to achieve meaningful results.

**Women in ICT.** Low female participation in ICT-related occupations has been hovering around 25% for decades. This unacceptably low participation rate is worse than for other scientific and technical fields such as life science and mathematics.

If we could improve the gender balance while keeping male participation at current levels, the overall problem of talent shortages would go a long way towards being solved. Even better, young women are arguably more likely to select the hybrid and business/ICT careers we describe elsewhere in this paper. In one stroke we could address the numbers issue and increase availability of high value 21<sup>st</sup> century skills.

Many young women decide early that an ICT-related career is not for them. Young women tend to be more interested in careers that are social and communicative, where they can “make a difference.” But parents, peers, teachers and the media often portray technology as an isolated, antisocial, gimmicky male endeavour. There is more than a kernel of truth to this. But times are changing. Today’s hybrid technology and business technology management careers require precisely the skills of communication, collaboration and contribution that young women tend to value. But this message isn’t getting out.

It should be a top priority to inform and convince young female career choosers, and the people who influence them, about the nature, excitement and viability of today’s cutting edge ICT-related careers. This effort should pay attention to the diverse segments of Canada’s youth including daughters of immigrants, young female Aboriginal Canadians, and those in families that have been hit by the economic downturn.

**Internationally Educated Professionals.** Canada should be clear about where internationally educated professionals are most likely to succeed, and it should act accordingly. To understand this issue we must unpack the 14% of workers in ICT occupations cited in the Consultation Paper as occupied by IEPs.

According to Census data provided to the Information & Communications Technology Council (Figure 1, next page), in 2006 IEPs were 20-24% of those employed in engineering occupations.<sup>17</sup> This is better than the 20% overall participation of immigrants in Canada’s labour market. ICT engineers, some 65,000 at the time, are crucial to Canada’s innovation agenda, and we need to recognize and enhance the vitally important role of IEPs in this segment.

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<sup>17</sup> IEPs were 23.9% of electrical and electronics engineers (C033), 22.3% of software engineers and designers (C073), and 20.4% of computer engineers and designers (except software engineers) (C047), per a special tabulation of the 2006 Census.

Share of Internationally Educated Professionals in Core ICT Occupations, 2006  
(2006 Census – Special Tabulation)

Occupation	IEP Share of Total Employed
A122 Computer and information systems managers	10.1%
A311 Telecommunication carriers managers	5.5%
C033 Electrical and electronics engineers	23.9%
C047 Computer engineers (except software engineers)	20.4%
C071 Information systems analysts and consultants	12.9%
C072 Database analysts and data administrators	18.1%
C073 Software engineers and designers	22.3%
C074 Computer programmers and interactive media developers	18.2%
C075 Web designers and developers	7.3%
C141 Electrical and electronics engineering technologists and technicians	9.9%
C181 Computer network technicians	9.1%
C182 User support technicians	8.0%
C183 Systems testing technicians	15.1%
F124 Broadcast technicians	7.8%
All Core ICT Occupations	13.8%

Figure 1: Internationally Educated Professionals in ICT occupations

On the other hand, IEPs are only 10-12% of the critical, in high demand managers, analysts and consultants (those with business technology management skills).<sup>18</sup> In 2006, Canada employed some 182,000 people in these roles. The ICTC found that this is the most critical of ICT-related labour shortages – and the fastest-growing occupation set – in every region of the country. ICT managers, analysts and consultants are vital. Whether as entrepreneurs or in-house change leaders, they have the expertise to turn technology dreams into economically and socially useful reality.

It should be no surprise that IEPs are only 10-12% of those employed as ICT managers, analysts and consultants. These occupations typically require fluent command of at least one official language, excellent communication skills, ready knowledge of Canada’s business context, and a variety of tacit understandings about how things work. Only some potential immigrants have the required technology skills in combination with this “package” of business competencies and communication skills. People with such skills are in short supply and high demand everywhere in the world, including their home countries. Many create their own opportunities; they don’t necessarily need to migrate.

<sup>18</sup> 10.1% of managers (A122), 12.9% of IS analysts and consultants (C071) per Figure 1.

Canada may well be an increasingly preferred destination for international immigration. But in the context of a global war for talent, it is becoming ever harder to attract top talent from one country to another.

One last point: IEPs are fewer than 10% of technicians. This is not a “highly qualified” role, but it does cover a third of the ICT workforce.<sup>19</sup> There is not much to be gained in seeking out immigrants to install and repair networks and personal computers or provide tech support at call centers. We have many displaced manufacturing workers, tech track high school graduates, and college students who can fill these jobs. ICTC research does not forecast significant shortages in technician occupations.

In sum, it’s fair to say that Canada does relatively well at attracting and placing IEPs into the jobs that fit them best. We can always improve, of course.

**International students.** Canada should do more to attract international students – including female students – into a variety of digital economy career preparation programs. It also should make a special effort to incent international student graduates to remain in Canada and join its digital economy workforce. The Ontario government announced one such initiative in its April 2010 budget: a plan to add 20,000 university seats and target 50% growth in the number of foreign students. Such a multipronged strategy has significant potential. It increases the number of university seats – critically needed if we are to expand our digital economy workforce. It draws on foreign students – who pay higher fees – to help pay for these new seats. And many of these international students will decide to stay, improving the quality of the province’s workforce.

Programs like that of Ontario should offer additional incentives to international students for remaining in Canada. One idea: a partial rebate on university fees to those who remain here and achieve continuous employment in relevant occupations. The government could invest the rebate in a segregated RRSP account on the date of graduation and build up returns, the whole to be transferred to the graduate at a defined date.

**Action implications.** To meet future demand for digital economy skills, the top priority should be to increase participation by Canadian-based career entrants. This means a primary focus on high school students and young women, with an emphasis on the new, exciting, cutting edge hybrid careers of the 21<sup>st</sup> century. A second priority should be to attract and integrate immigrants with specifically needed knowledge, skills and abilities, into suitable jobs, in a focused and disciplined way. Third, we should increase the number of post-secondary program seats, in part filled by international students whom we incent to remain in Canada.

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<sup>19</sup> Figure 1: C141, C181, C182, F124. Not in this calculation are Systems Testing Technicians (C183), who often require more advanced qualifications, but accounted for only 7,540 employed professionals.

## Embed digital literacy and skills in all education programs and beyond

The Consultation Paper raises the important issue of digital skills for all Canadians. We strongly agree that this is an essential requirement. We also agree with the particular need to close various digital skills divides. In the 21<sup>st</sup> century, digital literacy is an essential component of general literacy, and the definitions of general literacy must be significantly rethought. As described earlier in this submission, we propose five categories of digital capability, at increasing levels of sophistication and complexity.

1. **Digital literacy.** This is a skill set that every citizen needs in order to make effective use of digital media. It is the 21<sup>st</sup> century version of the 19<sup>th</sup> century's 3R's – reading, writing and arithmetic. Digital literacy entails an understanding of the nature and uses of various digital media, tools and technologies; how to communicate and collaborate effectively via digital media; critical thinking about the role and uses of digital media; creativity, etiquette, safety, health; and so on.
2. **Digital business skills.** Beyond literacy, this is the general tool and practices skill set that every worker uses in a digital economy business setting. It also includes specialized tools and practices in every field from scientific research to manufacturing production.
3. **ICT technology skills.** This is the traditional skill set of ICT workers; many of these skill sets are now becoming increasingly specialized and demanding. Some ICT workers configure and support pre-built ICT tools to meet business and consumer needs. More advanced ICT workers innovate and create new ICT tools.
4. **Highly specialized and hybrid technology skills** sets are either highly specialized within ICT, or combine ICT worker-class technical skills with an entirely different technical discipline.
5. **Business technology management skills.** This critical skill set combines ICT technical skills – whether ICT-specific or hybrid – with the knowledge and skills of a commerce degree or MBA.

These five categories overlap in various ways, and perhaps ought to be seen as a continuum.

Each of these has a distinctive place in the educational system. **Digital literacy** should be learned, relearned, and become increasingly sophisticated at every level, from preschool to graduate school. A key challenge is that many teachers lack sufficient mastery of digital media; this has contributed to the notion that teachers should learn digital media from students, rather than the other way around. Though this idea has some merit, it will not solve the problem. The educational system must take up the challenge of developing and implementing learning outcomes, methods

and teacher training for this ever expanding, still immature field. The principles and practices of digital literacy should be integrated into school curricula at every level.

**Digital business skills** should be an essential component of the high school curriculum. The curriculum should include effective business communications and collaboration using various digital media; basics of information and communications technologies; ICTs in business organizations, the economy and society; and ICT-related careers. All high school, college and university programs should include training in the business functions and productive uses of domain-specific ICTs.

The other three digital capability categories – ICT technology, specialized/hybrid technology, and business technology management – will typically be the subjects of dedicated college and university programs.

All these literacy and skill sets should be subjects of lifelong learning and skill upgrading, inside and outside the workplace. Governments and employers have an important role.

## **Vision & strategy for digital economy talent and skills**

Human skills, talent and ingenuity are the raw materials for digital economy industries and activities. They are as important as farm products to the food industry, or oil & gas for the transportation industry. Canada has learned that its natural resources are a source of prosperity in the industrial economy. The CCICT believes a similar approach – investing in and drawing on reservoirs of brainpower resources – will ensure Canada’s prosperity in the digital economy.

### **Canada’s digital economy strengths**

- Canada has a healthy ICT sector and a dynamic, multi-sector digital economy.
- It continues to produce and sustain global ICT “champion” firms.
- Canada has digitized huge swaths of its knowledge, activities and social interactions.
- Many organizations across the economy invest effectively in ICTs.
- Global ICT companies select Canada as a place to operate because of the quality and value of its workforce and its geopolitical advantages.
- Canada is at the crossroads of the 21<sup>st</sup> century global digital economy. Its largest trading partner is the US, yet Canada has distinctive and growing relationships with Asia and Europe.
- Canada celebrates the diversity of its people and workforce.
- It has an excellent education system, with several leading ICT-related teaching institutions, programs and researchers.
- It provides competitive economics for technology employers and the most robust, reliable economy in the G8.

### **Challenges**

- Canada has domestic-based global ICT sector successes, but not enough.
- Its ICT sector includes many foreign-owned subsidiaries.
- Canadian organizations lag in the adoption and effective use of ICTs.
- Career choosers and influencers (parents, teachers, guidance counselors, government, media) are generally unaware of the exciting nature of today’s ICT-related careers
- National talent-creation strategies must abide by federal-provincial constitutional rules, particularly regarding education.
- A chronic lack of supply-demand information hampers ICT labour market adaptiveness.
- Public spending on education has stagnated since the mid-1990s. Seats in key ICT-related post-secondary programs don’t meet demand.
- This is compounded by slow recovery in enrollments and low female participation.

A good vision will build on our strengths, adapt to our structural challenges, and help fix the challenges that are fixable.

Following is the vision that we propose:

**Canada: The go-to country for brainpower resources  
in the global digital economy**

***We propose this brainpower vision as the centerpiece of Canada's entire digital economy strategy.*** This entails a focus on the two cutting edge talent sets we identified earlier in this paper.

*Specialized/hybrid technology professionals* focus deeply on an ICT discipline (like analytics, engineering or security) or combine two or more technology disciplines (e.g., bio-informatics, game design, media, smart power, analytics, forensics, actuarial applications). They are at the cutting edge of innovation and productivity in every sector of the economy. Technology specialists and hybrids master technology and technique in one, two or several domains.

*Business technology managers* combine ICT with the knowledge and skills of a commerce degree or MBA. These professionals design, lead and implement the “complementary investments in labour, organization design, digital skills and other areas [which] are required to realize the full potential of general purpose technologies such as ICT.”<sup>20</sup> They include business analysts, consultants, project managers, IT managers, technical marketers – and last but not least – technology entrepreneurs. The CCICT Business Technology Management initiative targets this critical skill set.<sup>21</sup>

Why should brainpower be the centerpiece of Canada's digital economy strategy? Here are some positions already taken by other countries, and which are inappropriate for Canada:

- The United States is the world leader in ICT industries – at the top of the global ICT supply chain.
- Finland (Nokia) and Germany (Siemens, SAP) are known primarily for their global champion companies.
- China (manufacturing) and India (offshoreable, specifiable services) are positioned largely at some part of the “back end” of global ICT supply chains, with aspirations and potential to leapfrog into “front end” roles.

The 21<sup>st</sup> century cutting-edge digital economy brainpower niche we propose for Canada is different, distinctive, has huge potential, and is a natural extension of

<sup>20</sup> *Improving Canada's Digital Advantage*, p. 13.

<sup>21</sup> See page 31 of this report.

successes that illustrate the performance of Canada's ICT talent engines. For example:

- During the past decade, many foreign-owned ICT companies have selected Canada as a place to expand operations, whether through acquisition or greenfield investment. This builds on Canada-based global mandates that several international technology companies continue to sustain. In most cases, the sought-after employees are advanced specialists and hybrids who combine ICT with other specialized technologies.
- Canada also attracts global digital technology investments for multidisciplinary innovations in green energy, life science, transportation, and other sectors.
- Our provinces have done well at supporting the development of a variety of clusters – in the ICT sector and in other sectors – where digital economy talent is a foundational strength that has produced Canadian-based global champions.
- Despite lacking the economics of emerging economy, Canada has a robust IT services sector that is part of the “global sourcing model” for many international companies.
- Several Canadian colleges and universities are top talent scouting destinations for international companies – to the point that local employers worry about the brain drain.
- The pace of digital economy entrepreneurship – across many sectors – is stronger than ever, in all parts of the country.

Canada's stewardship of abundant natural resources that meet the needs of the industrial economy has led the world to beat a path to its door. We should learn from this experience to beneficially apply comparable – though suitably adapted – thinking to talent, the quintessential digital economy resource.

Areas of improvement to look for as a result of bringing this vision to life:

- Investments in high value-adding digital economy initiatives both domestic and inbound
- Digital innovation and productivity in many sectors
- Quantity and quality of adoption of ICTs by Canadian businesses, including SMEs
- Performance of Canadian entrepreneurs
- Enrollments in next generation technology-related post-secondary programs
- Numbers of digital economy professionals in high value occupations, and substantial increase in female participation
- Alignment of talent supply and demand, for both overall occupations and discrete skills

Recognizing the role of the federal government in the Canadian system, we recommend it take six steps to lead in bringing this vision to life.

## **1) Articulate, explain and champion the vision**

Government leaders at political and institutional levels should articulate this message strongly. To maximize support and practical engagement in related activities, we recommend the formation of collaborative mechanisms to engage stakeholders such as provincial governments, employers, career choosers and educators.

The Federal Government should mandate a cabinet champion to lead this entire set of initiatives, with the explicit support of the Prime Minister. She or he should form and lead a Digital Economy Brainpower Council of key stakeholders and thought leaders to finalize and steward an action plan, funding plan, and set of targets. This plan should begin implementation in 2011.

## **2) Double female enrollments, while growing male enrollments, in high value programs by 2017**

To drive change, Canada needs a “moon shot” goal and must invest in achieving it. A “moon shot” goal is easily understood, a stretch, and entails complementary (sometimes invisible but important) investments and benefits.

We propose the following: *double female enrollments, while growing male enrollments, in high value ICT-related college and university programs by 2017* (the 150<sup>th</sup> anniversary of Confederation).

Young women are more likely to be interested – and offer needed aptitudes – in the high value careers we have described. Doubled female participation should be incremental (more seats) rather than a replacement of male enrollments. So in one swoop we would increase the numbers of qualified graduates ready to pursue digital economy careers, and increase female participation. Awareness campaigns and innovative college and university programs should expand male enrollments as well. These increased enrollments should encompass both Canadian residents and international students.

Governments and other stakeholders should invest in these additional seats, new education programs, promotion campaigns, and the like.

The Federal Government should lead in the formation of a partnership with provinces to mobilize resources and campaign for the achievement of this “moon shot” priority. This includes the creation of new programs, student seats, and attention-getting promotional campaigns to career choosers in Canada and abroad.

The Government should present this as a high priority imperative for the viability of the Canadian economy in the 21<sup>st</sup> century.

### **3) Create a skills data mart to drive labour market agility & innovation**

This is critical to Canada's differentiated vision as the world's leading 21<sup>st</sup> century advanced digital economy talent hub. In all markets – be they for commodities, securities, consumer goods or business services – data about supply and demand facilitate investment and innovation decisions. But digital economy labour markets lack this essential ingredient: accurate, timely information about supply and demand.

In the past, when the number of occupations and specialties were few, and changed slowly, the need was less acute. Today, the pace of change in technologies and their uses is driving an explosion of new skills, occupations and job definitions. Occasional surveys and traditional, rarely revised occupational codes no longer meet the need. Canada's digital economy needs a transparent skill and talent marketplace that sets a new standard for the world.

To meet the need, it would be necessary to provide information to a high level of granularity with respect to the kinds of jobs that need to be filled, in what sectors, and in what specific geographies. It is especially important to focus on specialized high value-adding occupations that are critical to innovation, productivity, and competitiveness. (Note: the talent marketplace is not a job board. It will provide aggregated, anonymized data about supply and demand of ICT-related specialized occupations across all sectors.)

This will require many changes in the way things are done. But consider the benefits. Healthy markets – whether for equities, coffee, health services or fine art – depend on readily available, reliable information. In the presence of such information, market dynamics of liquidity, innovation and responsiveness improve productivity and needs matching. Students will choose in-demand careers that they might not otherwise even know about. Educators will launch programs in areas of growing demand. Immigrants and immigration officers will use the data to assess the marketability of their skills in Canada. The demand side (employers, inbound investors) will identify the scale and locations of Canada's talent resources that meet their needs, and invest accordingly.

For all the key variables, stakeholders need current employment information, as well as information from employers regarding their future needs and/or gaps that they are having trouble filling. With the pace of innovation, new occupation definitions should be identified every year. Planners should think about how close they can get to the immediacy, relevance and quality standards of stock and commodities exchanges.

To accomplish this, the Digital Economy Brainpower Council should convene the Information & Communications Technology Council, Statistics Canada and other

information providers and stakeholders to frame requirements and deliverables, and design a funding and business model. A collaborative business model with industry and educators for the talent marketplace could entail an economically sustainable public-private partnership.

The skills data mart will be a global first and a competitive differentiator for Canada.

#### **4) Increase digital economy college and university seats 20% by 2017**

Since the mid-1990s, United States public spending per capita on health and education each grew from about \$2500 to over \$3000. Canadian spending growth on health was comparable. But Canada's education spending has remained nearly stagnant.<sup>22</sup> If health care is about the present, and education about the future, Canada has arguably made a risky choice. Clearly, if this country is to become the world's go-to country for digital economy talent, we must rethink these investment decisions.

As the Consultation Paper points out, the topic of education spending raises the thorny issue of federal vs. provincial jurisdiction. But despite all the same jurisdictional issues in the health arena, governments have repeatedly found ways to get together, sort out the issues, and take giant steps. A sense of crisis, precipitated by strong leaders, had a lot to do with it. We must create the an effective sense of urgency in the education domain.

The goal should be a minimum 20% increase in high value ICT-related post-secondary program seats, in every province and territory, by 2017.

Federal and provincial governments must make difficult choices in these tight economic times to fund this initiative. The cabinet champion, with the full support of the Prime Minister, must obtain the funds to prime the pump at a national level.

#### **5) Make the full range of digital literacy skills a priority in primary, secondary, post-secondary, mid-career and lifelong learning education**

The Digital Economy Brainpower Council should take the lead with provinces to define a set of learning outcomes, standards, and methodologies - particularly in the following areas:

1. **Digital literacy.** This is a skill set that every citizen needs in order to make effective use of digital media. It is the 21<sup>st</sup> century version of the 19<sup>th</sup> century's 3R's – reading, writing and arithmetic. Digital literacy entails an understanding of the nature and uses of various digital media, tools and

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<sup>22</sup> Institute for Competitiveness & Prosperity, *Beyond the Recovery: Report on Canada 2010* (Toronto, 2010), p. 33.

- technologies; how to communicate and collaborate effectively via digital media; critical thinking about the role and uses of digital media; creativity, etiquette, safety, health; and so on.
2. **Digital business skills.** Beyond literacy, this is the general tool and practices skill set that every worker uses in a digital economy business setting. It also includes specialized tools and practices in every field from scientific research to manufacturing production.
  3. **Foundational workplace skills** such as collaboration and teamwork, problem solving, critical thinking, facilitation, and leadership. These should be integral to the curriculum in every program, beginning in elementary school.
  4. Significant, relevant **practical experience** through co-ops, internships, and the like.
  5. **Mid-career education** to ensure that the skills of ICT-related professionals remain relevant to evolving labour markets and technologies.

## 6) Build awareness, supports, incentives and partnerships to drive change

The skills data mart will provide evidence of changing employer demand for high value ICT-related careers. But we need more than data to change the behaviour of career choosers and educators.

- Government and other stakeholders must invest in continuous, highly engaging **awareness** programs targeting high school students, other career choosers, key influencers, and educators – to ensure that the supply side gains awareness of the need for, and benefits of, these career paths.
- Awareness should be complemented by **supports**. Students need mentoring, learning aids, financial assistance and other supports to overcome the challenges of a technology education. Educators would benefit from the development of reference 21<sup>st</sup> century programs like the CCICT Business Technology Management initiative (see next page). Such initiatives are needed in many different fields.
- **Incentives**, in the form of student scholarships and subsidies or awards to educators for educational innovation are needed in order to send a strong message and help drive behaviour change.
- The CCICT “Digital Jobs of Tomorrow” project is a **national partnership** of employers, national and provincial governments, and educators that intends to address these needs. To achieve these objectives, it requires significant, ongoing support and engagement from Federal and provincial governments.
- To provide for awareness, support and incentives the Federal Government should create a **Canada Brainpower Fund**. The fund should operate under the stewardship of the Digital Economy Brainpower Council.

**Canada will be a world leader if it chooses its terrain wisely. With a clearheaded, logical strategy, committed leadership and targeted investments, Canada will become the go-to country for the brainpower resources of the digital economy.**

## **Profile: CCICT Business Technology Management initiative**

Business Technology Management (BTM) is a new, professional undergraduate university program that CCICT corporate and academic members have designed to improve the quality and quantity of business professionals capable of implementing ICTs to achieve productivity, innovation, entrepreneurship, and competitive advantage. It is a digital economy version of MIS and similar programs offered by some university business faculties. Typical roles of business technology managers including business analyst, project manager, change management, consultant, entrepreneur, and IT manager.

Canadian organizations employ over 200,000 people with this profile. This is the fastest growing segment of ICT occupational growth, and the one that is experiencing the worst skills shortages in every region of Canada. On top of the labour shortage, employers are not satisfied with the quality of skills available in the marketplace for these strategically critical occupations. In 2009, employment for business technology management jobs experienced 33% growth according to Statistics Canada.

CCICT launched a consultation process to design the BTM, including employers and educators from across Canada, in February 2009. A working group designed a set of learning outcomes for the program, drawing heavily on relevant international standards. Each accredited university program is encourage to carve its own path in terms of curriculum, administrative arrangements, and areas of specialization, all while delivering the minimum set of learning outcomes. Meaningful, relevant practical experience is a requirement for individual graduate designation as a Certified Business Technology Manager (CBTM). We are partnering with the Canadian Information Processing Society for program accreditation and graduate certification.

This initiative has strong and growing support, and it is being adopted by many university business faculties including Ryerson University, UBC, Simon Fraser, University of Calgary, Wilfred Laurier, University of Waterloo, University of Western Ontario, York University, UQAM, Concordia, Laval, and St. Mary's.