Labour Supply/Demand Dynamics of Canada's Information and Communications Technology (ICT) Sector

Final Report

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Contents

Executive Summary

The information and communications technology (ICT) sector is a critical and growing contributor to Canada's economy. Accounting for 4.9% of Canada's GDP, the sector generated 9.5% of GDP growth between 2002 and 2010, employs 563,000 Canadians and accounted for 34.1% of all private sector R&D in 2011. A continuous supply of highly qualified talent is a requisite for the sector's success, but it is widely acknowledged that it is becoming increasingly difficult to recruit for a variety of critical ICT occupations – from entry level to seasoned.

Available labour market information (LMI) reveals no clear consensus on the extent and specific shape of talent gaps in Canada's ICT sector and does not provide granular information on the structure, causes, and solutions to recruitment challenges in this tightly-supplied labour market. In light of these issues, Industry Canada engaged Nordicity and its partner, David Ticoll, to undertake a sector consultation encompassing a literature review, one-on-one interviews, online survey, and industry roundtable to develop an assessment and game plan for strengthening Canada's ICT talent resources. The consultation focuses on highly qualified ICT professionals in research and development intensive ICT sector firms.

Literature Review Results

With average unemployment of 2.4% in 2011, Canada's ICT labour force is statistically fully employed. Several recent studies project that the ICT sector is entering a growth phase, which will increase demand for highly qualified professionals.

The question is whether supply can keep pace. Although there is a recovery in ICT enrollments based on data from Ontario, Quebec, Alberta and British Columbia, the fact remains that ICT-related university degrees awarded dropped by 31.4% between 2004 and 2008, while ICT-related college graduations fell 34% between 2001 and 2008. Not surprisingly, current labour market intelligence provides evidence of various ICT-related recruitment difficulties. However, the existing literature does not fully illuminate the causes, the nature and effect of possible talent shortfalls, the issues to be resolved or the highest-impact solutions.

One-on-One Interview Results

All ICT firms interviewed indicated they are currently hiring. They experience challenges recruiting line-of-business related, highly specialized (sometimes multidisciplinary) skills and/or experienced professionals. Beyond technical capabilities, interviewees identified gaps in business and communication skills for certain critical categories of employees – from entry to senior levels. Recruitment challenges increase where seasoned experience is required or a specialized/niche skill set is needed. The most common stated reason is 'lack of available local talent,' which suggests a possible labour shortage.

Firms are playing their part to address these recruitment difficulties. A consistent theme was commitment to internal training to help bridge the gap between school and job skills for new hires, to develop and retain existing employees, and to keep pace with marketplace and technology changes. Most ICT firms hire foreign-trained professionals and desire a reduction in immigration process delays. While ICT firms are generally satisfied with the technical abilities of graduates from Canadian ICT-related post-secondary programs, they are frustrated by new graduates' limited communications, teamwork, personal autonomy, and 'real world' skills.

Online Survey Results

An online survey of more than 110 ICT firms, representing 66,186 full-time and 17,210 part-time or 15% of sector's total employment, confirmed the interview results: Canadian ICT firms face recruitment difficulties, which they attribute to a lack of available talent; and they anticipate future shortages, which they address through internal training, use of staffing consultants, and foreign recruitment.

The survey reveals a distinct preference for experienced ICT professionals over new graduates. The most difficult qualified candidates to find are, in order of importance, bachelors and masters level programmers, bachelors and masters level software engineers, and bachelors and masters level computer engineers. The survey also revealed a three-to-one preference for hiring permanent over temporary foreign workers. Three-quarters of respondents plan to increase use of co-ops and internships and to strengthen collaboration with post-secondary institutions.

ICT Sector Talent Roundtable

An ICT sector talent roundtable, which may have been a first meeting of its kind, bringing together industry, governments and academia, described the current talent situation as "urgent" and identified the following five priorities:

1. **Enrollment and Graduation:** Governments and industry should work together to increase enrolment and graduation in ICT programs as well as to disseminate, through primary and secondary school curricula, a "new narrative" that describes today's ICT-related careers as highly diverse, innovative, multidisciplinary, business oriented, and in demand.

2. **Post-Secondary Curricula:** Post-secondary institutions need to redouble efforts to adapt to a changing mix of specialized and hybrid technical and business skills needs; improve soft skills; strengthen collaboration with industry; and ensure students graduate with real-world experience (e.g. from co-op programs).

3. **Continuous Career Training:** The private sector, particularly small- and medium-sized enterprises, needs to invest in talent to upgrade skills and entrepreneurship to build larger companies with global scale.

4. **Immigration:** Government should address delays and obstacles entailed in bringing top talent into Canada; increase consultations with industry; and strengthen incentives for foreign students to stay in Canada after they graduate.

5. **Labour Market Information:** Improved and ongoing collaborative tracking of ICT LMI at sub-sector/cluster levels needs to be developed and widely disseminated.

ICT sector stakeholders identify an urgency to address talent issues, but also an opportunity for action. The failure to address talent issues will hurt sector growth and productivity, and will result in more Canadian jobs being located in other countries. However, ensuring a robust supply of ICT talent could benefit all sectors of the economy. Participants stated that, just like we can't have too much oil, we can't have too many advanced ICT skills.

Industry and academia recommended a compelling '**Own the Podium**' type campaign – spearheaded by a "chief talent officer" for Canada – to engage all Canadians (youth, parents, teachers, Post Secondary Institutions (PSIs), employers, media, and government) in increasing our ICT talent advantage. Participants agreed on the need for collaboration among all stakeholders – industry, governments and academia – and expressed a willingness to take action.

Conclusions

The results of the consultation were presented to a Federal, Provincial and Territorial Economic Development Ministers' meeting on the Digital Economy in Montreal on March 19, 2012. The Ministers made a commitment to continue working with the ICT industry to seek potential solutions to its skills challenges.

By delving deeply into national opinions skills needs, the causes of recruitment difficulties, priority and potential solutions, the results of this study add much-needed granularity to the LMI on Canada's ICT sector. Given data limitations, this study helps support the already widely held belief that Canada's ICT sector is headed for a labour shortage, and ICT firms are already employing alternatives to increasing their Canadian workforce.

However, the variety of occupations that firms were having difficulty staffing that often required specialized or niche skills, made it difficult to identify broad or consistent gaps with an occupationally-focused methodology. It was also identified through the roundtable that the scope of some existing recruitment challenges – particularly access to foreign workers – has not been fully captured by current LMI data collection methods. Therefore, additional LMI that better captures the reality of today's ICT recruiting practices is needed. As a result, all stakeholders will gain a better understanding of the supply/demand dynamics of Canada's ICT labour market.

1. Introduction – Mandate and Methodology

This section provides the context and mandate for the study and describes the methodology used by the Nordicity team.

1.1   Study Rationale and Mandate

The information and communications technology (ICT) sector is a critical and growing contributor to Canada's economy. While the sector accounted for 4.9% of Canada's GDP in 2010, it generated 9.5% of GDP growth between 2002 and 2010. Similarly, since 2002 GDP per ICT sector employee grew 31%, compared to 2.7% for the rest of the Canadian economy. The result is a significant contribution to the Canadian standard of living. All told, 563,000 Canadians work in the ICT sector.

The ICT sector's impact goes beyond GDP and job creation. Rather, ICT's most important contribution is to national innovation. ICT spends more on research and development than any sector in Canada, accounting for 34.1% of all private sector R&D in 2011. As such, highly qualified talent is critical for R&D. The ICT sector currently employs 44% of all R&D scientists and engineers working for Canadian businesses. A continuing supply of highly qualified talent is an enduring requisite for future sector success, but it is widely acknowledged that it is becoming increasingly difficult to recruit top ICT talent in Canada.

Existing labour market information (LMI) reveals no clear consensus on the extent and specific shape of talent gaps in Canada's ICT sector. Current data does not provide enough information on the nature and causes of recruitment difficulties that exist in this tightly-supplied labour market, and where potential future shortages may arise.

In light of ICT labour data limitations, Industry Canada engaged Nordicity and its partner David Ticoll to consult with the ICT sector for a factual assessment of unmet demand and recruiting challenges for ICT talent and skills in specific ICT occupations and recommended approaches for addressing these challenges.

1.2   Study Methodology

Based on the mandate issued by Industry Canada, the Nordicity methodology focused on six R&D intensive clusters and six occupations as defined by the National Occupational Codes (NOCs), listed below.

Clusters	Occupations
1. Vancouver;	1. Electrical\Electronics Engineers;
2. Edmonton/Calgary;	2. Computer Engineers;
3. Waterloo;	3. Software Engineers;
4. Greater Toronto Area;	4. Computer Systems Analysts;
5. Ottawa; and	5. Database Administrators and Developer;
6. Montreal	6. Computer Programmers and Media Developers.

The overall methodological process included the following four sequential stages:

1. **Literature Review:** Review of existing and ongoing LMI on Canada's ICT sector.

2. **Interviews:** One-on-one consultations with more than 30 ICT sector stakeholders, including more than 20 ICT firms, as well as government agencies, industry associations, academia and other industry experts. Interviews focused on firms and associations from the six clusters identified above.

3. **Online Consultation:** Fact-based survey of more than 110 ICT firms from across Canada representing 15% of the sector's total employment.

4. **Roundtable:** One-day ICT sector talent roundtable with key stakeholders from industry, governments and academia to discuss the results and develop recommendations (a list of firms and organizations represented at the roundtable is available in the appendix).

The results from each stage of the methodology are presented in this report, beginning with the literature results in the next section below.

2. Literature Review

A significant amount of intelligence is gathered on an ongoing basis with respect to the demand for and supply of highly qualified ICT labour in Canada. This section summarizes a number of recent studies, extracting information that indicates if there will continue to be sufficient supply to meet the growing demand for ICT professionals in Canada.

2.1 Overview of ICT Canadian Employment Trends and Gaps

National picture: With an average unemployment rate of 2.4% in 2011, Canada's ICT labour force is virtually fully employed, from a statistical perspective. After nearly a decade of inconsistent ICT expansion and contraction in Canada – tempered by the 2002 dotcom bust and the 2008 global recession – recent evidence suggests the industry is entering a growth phase, which will increase demand for ICT professionals. For instance, the results of a recent survey conducted by the **Society for Information Management** were very positive about information technology (a segment of ICT) jobs in 2012; CIOs surveyed indicated likely salary increases and fewer jobs being shipped offshore.[1]

Regional picture and specific skills issues: Regional research also indicates significant increases in demand for professionals in technology fields. The **British Columbia Technology Industry Association** (BCTIA)'s recent 'state of the industry' study anticipated 3,000 new jobs in the province's technology sector in 2012. This employment demand includes 1,000 new general management positions and significant demand for software engineers, hardware engineers, and technical and project managers.[2]

With demand increases, the key question is whether supply can keep pace. The inference from the current low unemployment and projected increased labour demand is that there will be shortages within specific ICT occupational or skill categories – if not across the entire sector. Much of the ongoing LMI provides significant empirical evidence suggesting specific ICT labour shortages and recruitment difficulties in Canada. For instance:

> **BCTIA (2012):** "As the industry again nears full employment, there is growing concern about an emerging talent shortage. .. [and] the continued growth will create a new talent crunch."[3]

> **The Stratford Report (2011):** "Today's employers need specialists – whether pure IT (e.g. cyber security gurus) or multidisciplinary (e.g. smart power grid engineers and business/IT hybrids). This new demand profile is here today."[4]

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[1] Source: Ottawa Citizen, *The Outlook's Good For IT Employment in 2012*, October 11, 2011.
[2] Source: BCTIA*, Labour Trends in the British Columbia Technology Sector*, February 2012.
[3] Ibid.

Diversity Institute (2011): "There is general agreement that there is a skills mismatch – that many jobs in the ICT sector are unfilled while many professionals with high levels of skills are under-employed."[5]

Council of Canadian Academies (2009): "[There is] a great deal of anecdotal evidence that technology-based start-ups in Canada (predominantly in the ICT and biotech fields) suffer from deficient business management skills, particularly compared with the United States."[6]

Other regional-specific research has been able to quantify upcoming labour gaps at the cluster level. A February 2012 study from the **Toronto Region Research Alliance** (TRRA) identifies information technology as the only one of six research and innovation intensive sectors in the GTA/Waterloo region to face labour gaps in 2012. The TRRA report predicts that in 2012 new IT jobs in the region will outpace new IT graduates by 5,759. The study also projects a shortage of 1,161 electrical and electronics engineering graduates in 2012. [7]

While not exhaustive, the literature cited above provides some insight into the skill-specific nature of recruitment challenges in the ICT sector. However, where demand for specific skills can be isolated, measures can be taken to address specific needs. For instance, empirical and **Statistics Canada** evidence suggesting a potential labour shortage in the field of computer and information systems security has prompted the **Information and Communications Technology Council** (ICTC) and industry partners to explore a Cyber Security Strategy that identifies the cyber security skills needs of Canada's digital economy.

National forecasts: While regional and occupation- or skill-specific research has identified existing labour gaps, national and industry-wide intelligence is less conclusive. **Industry Canada** has conducted its own 10-year linear supply/demand projections of university-educated ICT professionals based on four different demand growth scenarios[8] and two retirement scenarios.[9] These projections assume maintaining 2008 supply levels of 9,490 Canadian university graduates in ICT fields per year and 4,600 university educated ICT

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[4] Source: Stratford Institute for Digital Media. *The Stratford Report 2011: Canada's Labour Market Needs a Fix*, (David Ticoll) Pg. 22.

[5] Source: Diversity Institute, Ted Rogers School of Management, Ryerson University. *Improving Canada's Digital Advantage: Building the Talent Pool and Skills for Tomorrow*. 2011. Pg. 28.

[6] Source: Council of Canadian Academies, The Expert Panel on Innovation. *Innovation and Business Strategy: Why Canada Falls Short*. 2009. Pg. 63.

[7] Source: TRRA, *Research & Innovation Jobs: Opportunities and challenges in the Toronto Region Labour Market*, February 2012. The TRRA methodology calculates shortages based on new jobs and new graduates, but does not include immigration statistics.

[8] 3.6%/year (employment growth of university educated ICT professionals during 2002-2010); 5.0%/year (increased hiring in ICT industry and increase in ICT adoption); 7.0%/year (increased hiring in ICT industry and increase in ICT adoption, e-health, etc.).

[9] 0.1% cumulative increases/year; 0.05% cumulative increases/year.

professionals added per year through immigration. Industry Canada generated scenario projections that range from a **surplus of 40 to 870 HQP** to a **shortage of 8,000 to 9,000** ICT professionals per year between 2011 and 2020.

On average, Industry Canada's analysis forecasts a very tight labour market with a high probability of labour shortages, but not a conclusive, widespread labour gap. However, average industry figures can mask shortages in specific occupations, and surpluses in others. Demand forecasts are also difficult to project, particularly over a 10-year period. Historically, supply and demand dynamics of the industry are heavily driven by global events (like the dotcom crash) and, more importantly, by structural and technological innovations.

ICTC has also undertaken labour demand projections for specific occupational categories. The sector council's five-year outlook projects skills shortages for three relevant occupations: **computer and information systems managers**; **telecommunications carriers' managers**; and **information systems analysts and consultants**. ICTC forecasts surpluses for three other occupations: **computer programmers and interactive media developers**; **computer network technicians**; and **user support technicians**.[10]

College/university entry rates: Canada's ability to meet growing demands depends on, in part, the ICT graduate output of our post-secondary institutions. Following the dotcom bust Canadian ICT graduation rates declined significantly. ICT-related degrees awarded dropped by 31.4% between 2004 and 2008, and college graduates in ICT programs fell 34% between 2001 and 2008. Recent research indicates enrollments are improving. Recent provincial data from Ontario, Quebec, Alberta and BC indicates enrollments are improving.

2.2   Conclusions from the Literature Review

The significant LMI on Canada's ICT sector – both empirical and quantitative – continues to shed light on the labour supply/demand dynamics of Canada's ICT sector. The available intelligence appears to show that the ICT sector is growing and increased labour demands could cause subsector, regional and skill-specific labour shortages. However, drawn from the existing literature, the causes, issues to be resolved and highest-impact solutions are not entirely clear. The consultation results presented throughout the remainder of this report, therefore, provide more intelligence on this complex issue.

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[10] Source: ICTC, *Outlook for Human Resources in the ICT Labour Market 2011-2016*. The ICTC forecast is based on industry growth that is below recent historical averages.

3. Summary of the One-on-One Interviews

Throughout more than 30 one-on-one interviews with Canadian ICT sector stakeholders – including more than 20 ICT firms – consistent themes emerged within the following topics discussed in the interviews: current hiring preferences and practices; recruitment difficulties; skills needs; future recruitment; addressing recruitment difficulties; and academia. The themes identified in the interviews for each topic are presented below.

3.1 Current hiring preferences and practices

Consistent with the literature review findings, virtually all ICT firms interviewed are hiring ICT professionals. Beyond that, there was little consistency in terms of the types of ICT professionals that firms are hiring. The majority of firms look for candidates with a bachelor's degree as a minimum educational requirement, but experience and skills preferences vary greatly.

As a rule, current hiring preferences are highly line-of-business specific. While some employers are looking for new graduates that can be indoctrinated into their overall business processes, others require highly specialized or niche skills specific to their product or service. Such specialized requirements often call for professionals with a combination of skills in more than one technical area. Often, the required complementary technical skills are outside ICT – for example in security, usability, or life science. The same employers often additionally require hybrid business/technical skill sets – for example, business analysis, project and team management, or technical sales/marketing.

Another theme regarding hiring preferences was a broad need for project managers, often with five years or more of experience, which is consistent with the BCTIA report findings that indicated roughly one-third of the labour demand in BC's technology industry will be for project managers. This finding further suggests that as ICT firms have increased sales emerging from the recession, the need for project managers to oversee design, production and service delivery has increased as well.

Concerning hiring practices, at least half of all firms use six different methods to locate and identify new hires. Employee referrals and post-secondary institution recruiting are the preferred recruitment methods, each being used by roughly 90% of companies. These practices are followed by online recruiting (65%), job fairs (58%), and informal networking and the use of employment agencies (50% each). The multi-pronged approach to finding talent suggests a competitive industry.

3.2 Recruitment difficulties

The themes that emerged from the discussions of recruitment difficulties closely follow those from the discussion of hiring practices. Just as all firms indicated they are currently hiring, all firms also indicated they are experiencing difficulties filling at least one strategic

position. Similarly, recruitment difficulties are more often linked to the need for line-of-business related, highly specialized skills or experienced professionals. In particular, recruitment difficulties increase where more experience is required or a more specialized or niche skill set is needed.

There is very little consistency in terms of the specific skills needed where combined skill sets are preferred, with the exception of computer services firms demonstrating increased need for – and difficulty finding – professionals with a combination of business and technical skills. Employers need professionals with skills in specific business markets. This explosion of technical skill specialties parallels the continually changing proliferation of information technologies into every domain of the economy and life.

Industry needs change quickly with industry developments and often create additional demand for niche skill sets. Medium-sized firms also struggle to find professionals with the appropriate skill set to conceive the next wave of products and take them to the global market. If this need was addressed more effectively, the result would be more global innovative players in Canada.

Over three quarters of interviewees perceived a 'lack of available local talent' as the leading cause of recruitment difficulties. This reaction suggests a labour shortage. Almost as many interviewees identified the corresponding high price of talent as a leading recruitment barrier, which further indicates a highly-competitive marketplace. Interviewees involved in specialized ICT sub-sectors also suggested that recruitment difficulties are caused by a lack of cluster strength to create a significant pool of labour within their specific niche.

The lack of consistency in recruitment difficulties across the industry – particularly in terms of identifying consistent need within one or two highly specialized skill sets – makes it difficult to identify causes and potential solutions to labour shortages. However, trends emerge at the subsector levels that help identify and contain the issues.

Consider the videogame industry. Videogame firms currently are having difficulty finding game developers with specialized experience in online game design. The need is caused by the market trend away from console games towards online games, which is driven largely by development initiatives in the Bay Area of California. The further result of the trend is that experienced designers from Canada are attracted to high-paying opportunities in California. Consequently, Canadian firms need to recruit foreign talent, thereby needing to navigate the slow and complex immigration process. So, specialized talent needs arising from rapidly changing industry trends and a lack of ICT cluster strength in some important categories of innovation can be specifically isolated, which helps to identify problem points and potential solution areas.

3.3   Skills needs

A consensus emerged from the interview process that Canadian ICT firms greatly value communications and team work skills, and yet such 'soft skills' are in short supply. The

overwhelming opinion is that new graduates, while technically proficient, enter the workforce without the preferred communications and team work skills. The significant amount of foreign students –who inherently lack communications skills – graduating from Canadian PSIs has exacerbated the problem.

When asked to rate various employee qualities on a scale of 1 to 5, interviewees rated willingness to learn (4.8), ability to work with others (4.7), positive attitude (4.4) and communications skills (4.3) ahead of possession of technical knowledge (4.2). Of these skills, however, it was apparent that team work and communications skills were the hardest to find.

Beyond the issues related to communications and team work skills, Canadian ICT firms also experience gaps in terms of niche and combined technical skills specific to each company's line of business, as indicated in the section on recruitment difficulties. This suggests that additional research is required to explore the significance of soft skills and core technical skills.

3.4   Future recruitment

Canadian ICT firms anticipate a variety of future recruitment difficulties, but – due to rapidly changing competitive and technology dynamics – they are unable to predict in what areas such difficulties will emerge. Industry associations consulted further noted that shortages will be exacerbated by a lack of timely, granular data on skills needs, which will hinder the associations' attempts to head off shortages.

In addition, future labour supply emboldened with the right entrepreneurial and business skills will generate new business and increase demand for skilled professionals.

Concerning the leading causes of future recruitment difficulties, 55% of interviewees identified a reduced availability of graduates, increased competition and the pace of change in the needed skill sets. An additional 46% of respondents identified the increased need for business and/or technical hybrid skill sets as a likely cause of anticipated future recruitment woes. The quantitative results further support the concerns that future recruitment difficulties are hard to predict due to the changing need for specialised and hybrid skills, and that increased competition and reduced availability of graduates could exacerbate potential shortages.

3.5   Addressing recruitment difficulties

ICT firms indicated during the interviews that internal training, foreign recruitment and offshoring are the main steps that have been taken to address recruitment difficulties. Key takeaways from the discussions of all three are summarized as follows.

Internal training: Virtually all ICT firms provide internal training program, whether formal or informal. The consistent theme throughout the interview process was a renewed commitment to internal training. With the recession likely behind us, ICT firms are once

again investing in internal training to either formalize informal processes, or increase existing training programs. Internal training was seen to have the following benefits: it helps bridge the gap between school and job skills for new hires; it allows employers to retain existing employees whose skills have become obsolete; it helps keep pace with technological change; and it prepares for future needs due to redundancy across multiple skill sets.

Foreign recruitment: Most Canadian ICT firms hire foreign-trained professionals, although not all use the same techniques. Two thirds of them use foreign recruitment for a significant number of hires (5-30% of new hires), while the remainder use foreign recruitment to address specific gaps (1-2 hires per year). However, about half of the firms interviewed generally only hire landed immigrants to avoid the challenges and perceived delays in the immigration process. Overall, the interviews did not reveal any significant issues with the immigration process. Rather, the majority of respondents indicated they would welcome a reduction in immigration process delays, but this was not a critical issue in general.

However there is a critical exception. The immigration process was identified to cause problems in cases where a single critical foreign employee would have a significant impact on a Canadian business, its capabilities, growth, and workforce development. Interviewees believe the immigration system is better geared towards areas where significant numbers of hires were needed in traditional fields – such as agriculture – rather than towards targeted, high-impact hires.

Offshoring: Offshoring of Canadian ICT work to other countries is seen to be limited among interviewees as a means to address recruitment difficulties. Some companies are unable to offshore because of manufacturing standards required from their clients. Others already have an international presence and send work to the location that has the best and most cost-effective skill sets. The Canadian-based divisions of global countries do not face offshoring. Instead, they face skills-based internal competition for product mandates with divisions in other countries.

Similarly, for the companies that do offshore work, access to labour – not cost savings – is the leading motivation. In particular, companies with significant time-to-market constraints are more likely to offshore work when the necessary talent is not available in Canada or cannot be brought into Canada immediately. The economic downturn has also created a pool of skilled talent in Europe that allows more companies to offshore design work. This increased talent pool helps offshore capabilities move up the value chain from manufacturing, and challenges Canada's ICT talent advantage.

3.6 Academia

Canada's post-secondary institutions (colleges, universities and polytechnics) generally receive top marks from the ICT firms that were interviewed. Several interviewees referred to Canada's PSIs as 'the best in the world.' Overall, firms are satisfied with the technical

capabilities of new graduates and the willingness of PSIs to respond to new industry needs. The industry also acknowledges that a certain amount of on-the-job training is always necessary.

That said, ICT firms did note some areas of potential improvement for PSIs. Most importantly, the industry believes that more should be done to prepare new graduates for the "real world," which could be largely accomplished through co-op programs. As well, more emphasis should be put on key soft skills like communications and teamwork. Some respondents commented that today's young graduates lack personal autonomy and self-direction, compared with those of even a few years ago.

ICT firms are concerned about low enrolments in, and graduations from, ICT-related programs, and the increasing trend of foreign students returning home immediately after graduating from Canadian PSIs. The former could be rectified through increased promotion of ICT-related careers to high school students, while the latter reflects the increased global competition within the ICT sector and may be more difficult to address.

4. Summary of the Online Survey Results

The consultation process included an online survey administered with the assistance of several national, provincial, and regional organizations. This section summarizes responses to the survey.

4.1 Profile of firms responding to survey

More than 110 Canadian ICT firms employing 66,186 full-time and 17,210 part-time employees, representing 15% of the sector's total employment, completed all or part of the online survey.[11] The survey addressed topics similar to those in the one-on-one interviews, and similar themes emerged. Therefore, this summary addresses topics similar to those in the previous section.

While the majority of survey results discussed pertain to the entire respondent base, some results are grouped into four product-based subsector segments to provide more depth.

Digital Media	Computer Services	Software Development	ICT Manufacturing
Game or interactive media development; Mobile application development; Content services	Technology advisory services; Systems integration and implementation services; Technology services outsourcing; Systems administration	Middleware or enabling software development; PC/Mac/Linux application development; Technical/business software development	ICT component manufacturing; Hardware device manufacturing

4.2 Current hiring preferences

As with the literature review and interviews, the survey confirms that Canadian ICT firms are hiring a wide variety of ICT professionals. Roughly 70 respondents indicated they were in the process of hiring 1,114 ICT professionals – nearly 16 new hires per firm. The occupations most frequently sought are:

- programmers (27% of new hires);

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[11] While more than 110 companies began the online survey, a total of 62 companies answered all the questions. Therefore, the number of responses to any individual question varies.

- game developers (21%)[12];
- computer engineers and technicians (20%); and
- software engineers and technicians (12%).

The survey ranks the education and experience preferences of the respondents for new hires. The table below shows hiring preferences in response to questions asking respondents to rank each experience/education level on a 1 (least preferred) to 5 (most preferred) scale.

Figure 1: Overall hiring preferences in terms of preferred candidates (N=64)
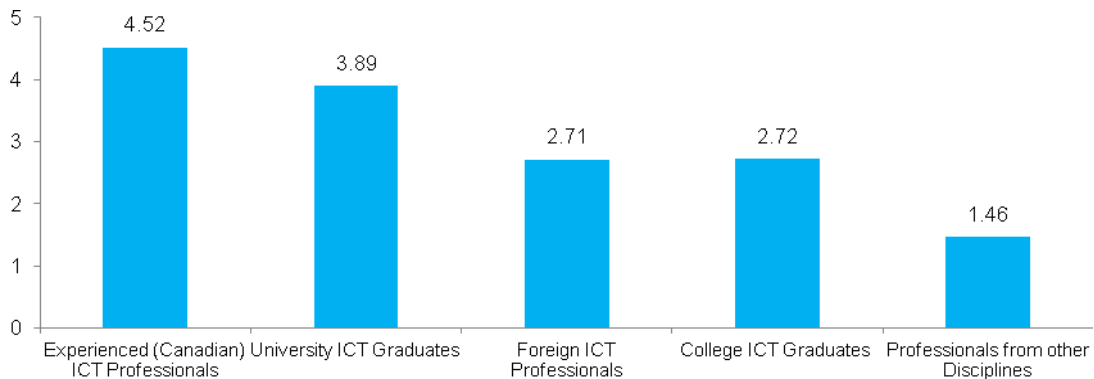
As the figure demonstrates, Canadian ICT firms prefer to hire experienced Canadian professionals ahead of university ICT graduates, by nearly a 2-to-1 margin over foreign ICT professionals and college graduates.

4.3 Recruitment difficulties

Across the industry, ICT firms have had the most difficulty recruiting programmers, software engineers and computer engineers, in that order, over the past two years. These recruitment difficulties vary at the subsector level. The table below indicates the two ICT occupations that have been most difficult to fill within each of the product line subsectors over the past two years. Beyond programmers, recruitment difficulties correlate to lines of business.

Figure 2: Most difficulty locating one or more suitable candidates (N=48)

| Product Line Grouping	Most Difficult to Fill	Second Most Difficult to Fill
Digital Media	Programmers	Game Developers

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[12] A large percentage of the game developers are being hired by one specific company. Therefore this result may be more indicative of our respondent based, rather than average industry trends.

Computer Services	Programmers	Computer & Software Engineers
Software Development	Programmers	Software Engineers
ICT Manufacturing	Programmers	Electrical & Software Engineers

The survey responses provide more detail on the nature of recruitment difficulties. The figure below identifies recruitment difficulties at various education levels across the various occupations.

- Canadian ICT firms indicate most recruitment difficulties in terms of locating suitable candidates at the bachelors and masters levels, especially in the programmer, software engineer and computer engineer, in that order.

- Firms also indicate little difficulty locating suitable candidates at the college level, which indicates a preference for engineers over technicians.

Figure 3: Difficulty locating suitable candidates at the college, bachelors and masters level (N=68)
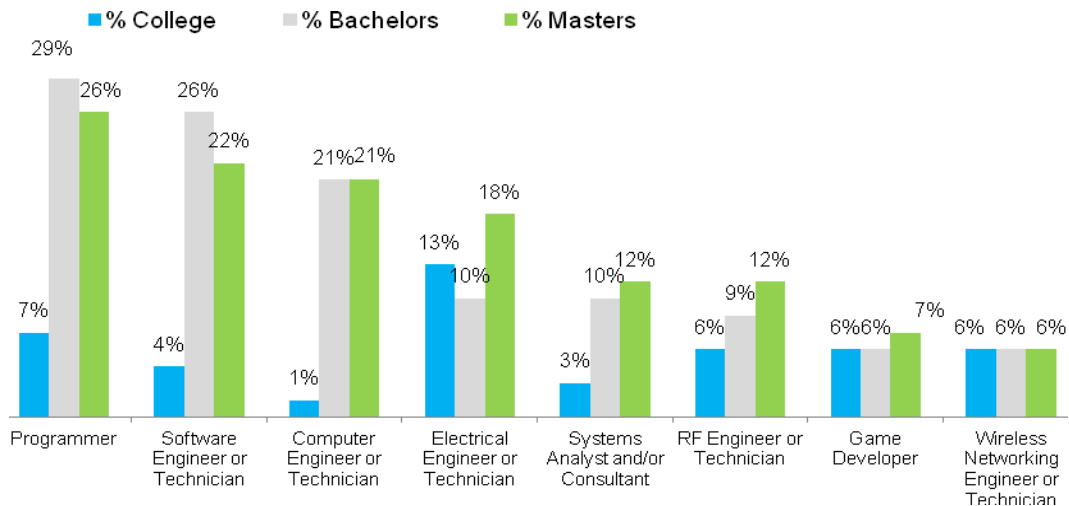

The figure verifies the earlier finding of preference for university graduates over college graduates. It also highlights the differences in difficulty locating suitable candidates at the bachelors and masters level. Suitable bachelors level candidates are the toughest to find among two of the three occupations that are most difficult to fill. However, masters level candidates prove the most difficult to locate among all other occupations, especially masters level electrical and electronics engineers.

Figure 4 provides insight into perceived causes of recruitment difficulties. As with the interviews, the survey results indicate "lack of available talent" as the leading cause of recruitment difficulties, further suggesting talent shortages. Survey respondents also

identified "high price of talent" as the second-leading cause of recruitment difficulties. This result suggests that firms are experiencing an overall shortage of ICT talent. Competition for talent pushes up the price of employee compensation. Most survey respondents (and interviewees) identified poaching talent from competitors as a response to recruitment difficulties – another contributor to higher wages.
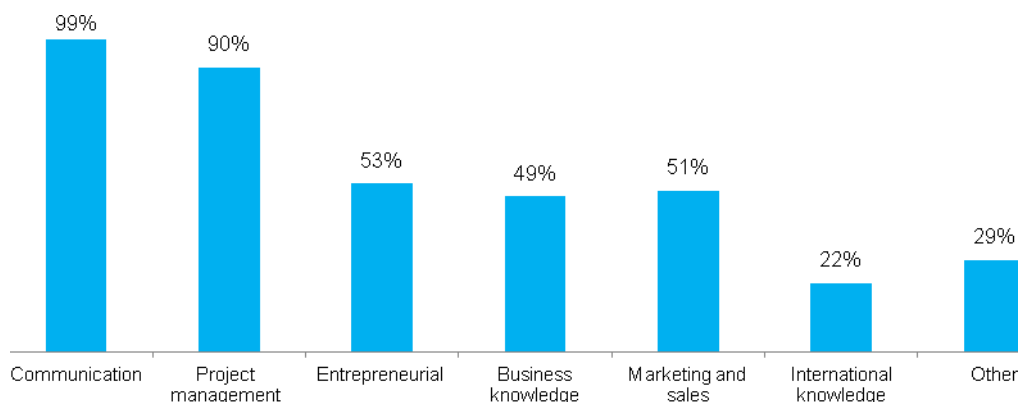
Figure 4: Causes to recruitment difficulties (N=60)
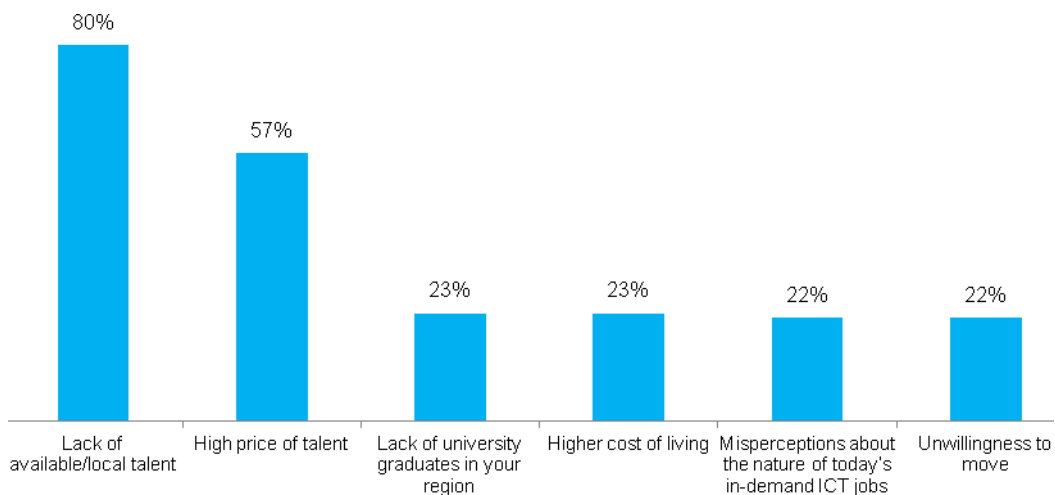
4.4   Skills needs

The survey results overwhelmingly support the interview findings that Canadian ICT firms greatly value communications skills. Fully 99% of all respondents identified communications skills as essential.

Figure 5: Critical skills for ICT professionals hired by your company (N=70)

Project management skills were identified as critical by 90% of respondents, and roughly half identified entrepreneurial skills, business knowledge and marketing and sales abilities.

At the product line level, all segments identified communications and project management as the top two critical skills. Beyond that commonality, 62% of the ICT manufacturing respondents identified business knowledge, while 71% of computer services respondents identified entrepreneurial skills as crucial.

4.5   Future recruitment

While interviewees projected a wide range of future recruitment difficulties, survey respondents identified specific occupations they anticipate will be difficult to find suitable candidates for over the next two years. The graph below compares responses on recruitment difficulties over the past two years with those for anticipated recruitment difficulties.

Respondents were asked to rank the three occupations they have anticipated having the most difficulty recruiting suitable candidates. The numbers in the figure below reflect a cumulative score of the rankings, whereby a 3 is accorded to the occupation that is most difficult to recruit for, a 2 for second most difficult and a 1 for third most difficult.

**Figure 6: Ranking of past and future recruitment difficulties by occupation (N=68)**
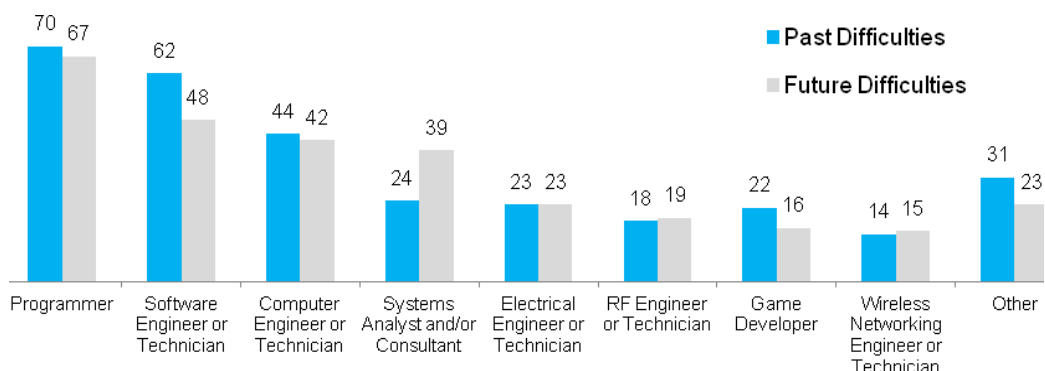
Consistent with other findings, programmers, software engineers and computer engineers ranked as the most difficult positions to fill, over the past and future two years. Comparing the past and projected findings demonstrates that ICT firms score those three occupations as being slightly less difficult to staff with suitable candidates in the future than they have been in the past. For instance, 26 companies out of 68 identified software engineers as being one of the top-three most difficult occupations to staff over the past two years, but only 20 companies believe it will be in the top three in the coming two years.

Systems analysts and/or consultant positions, on the other hand, are projected to be much more difficult to fill in the next two years than in the past – although there were fewer mentions for these than for the top three most difficult occupational categories.

4.6   Addressing recruitment difficulties

Canadian ICT firms take a variety of steps to address recruitment difficulties. Six different options were identified as having been used by at least 33% of all firms. Training current employees was the primary option. Internal training was followed closely by using consultants or staffing agencies (52%), hiring from competitors or poaching (47%) and recruiting foreign talent (40%).

Figure 7: Steps being taken to address labour shortages (N=60)
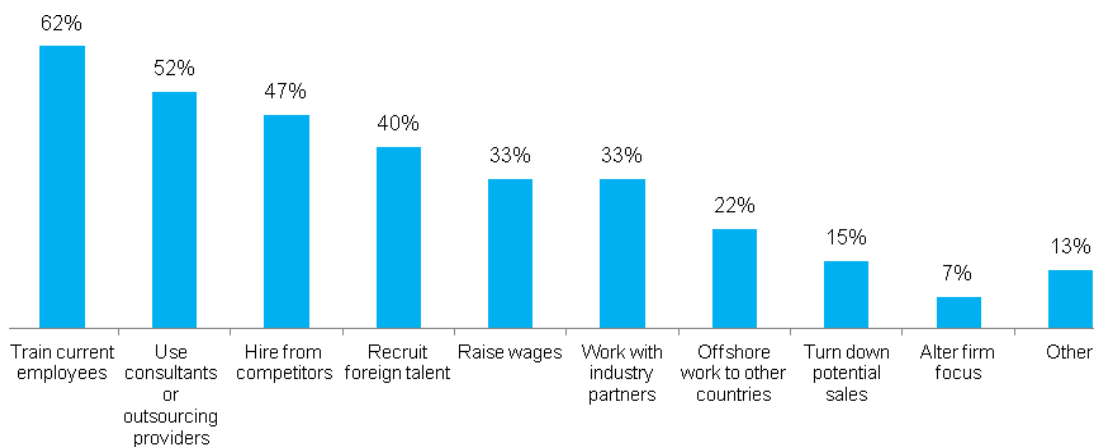
As noted above, the costs of talent was identified as a key recruitment barrier. Not surprisingly, 33% of respondents indicate they have increased wages to attract talent, which further validates the existence of a highly competitive labour market.

Additional information was gathered on the hiring of temporary and permanent foreign professionals. Almost half (42%) of respondents indicated that they hire foreign professionals. Of those who hire foreign workers, 27% said they hire temporary workers and 72% hire permanent workers. This practice shows a clear preference for maintaining foreign hires for long-term.

**Figure 8: Hiring foreign professionals (N=62; 26; 25)**
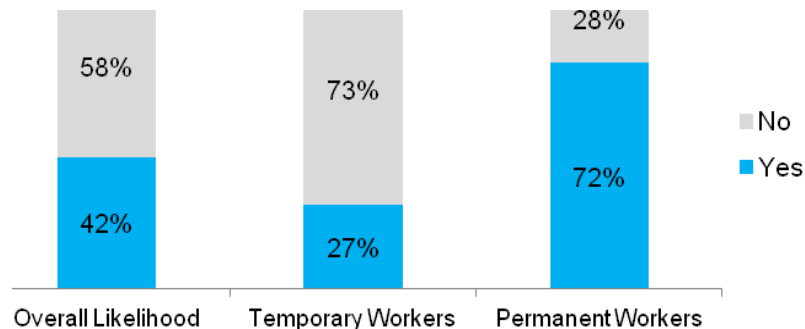
Fewer respondents indicated the countries they hire from, but patterns emerged among the 26 responses to that question. The leading country for foreign hires was the United States, which was followed by Western Europe in a close second. About half as popular as the leading two locations were Eastern Europe, India and Southeast Asia. China was indicated as being about half as popular a source as the latter set of countries.

4.7   Academia

The survey results confirm the industry's general satisfaction with graduates being produced by Canada's PSIs. Based on the figure below, Canadian PSIs earn an 'A' for the quality of the programmers, software engineers and electrical engineers they produce, and a B+ for computer engineers.

Figure 9: Ranking of satisfaction with graduates hired directly from post-secondary institutions from 1(least satisfied) to 5(most satisfied) (N=40)
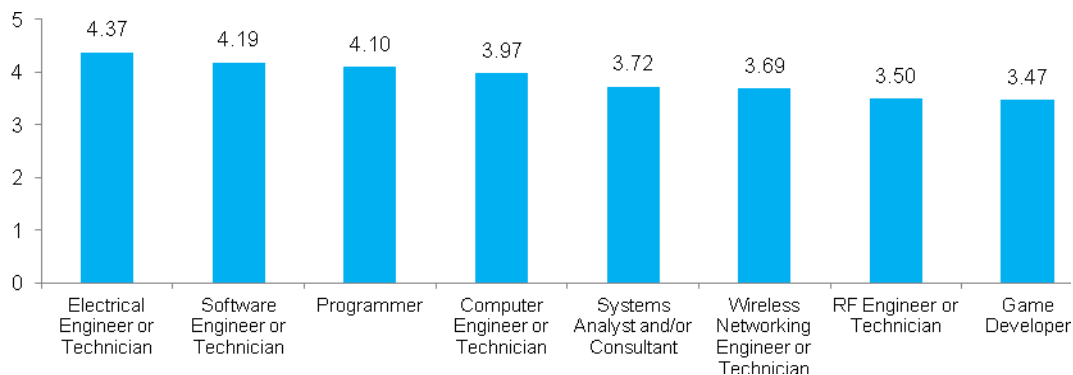

ICT firms see a role for Canadian PSIs in addressing future ICT labour shortages. When asked about addressing long-term ICT labour needs, 75% of respondents identified internal

training as a strategy option, but 75% also identified increased use of co-ops and internships. In addition, 69% of respondents identified increased collaboration with post-secondary institutions. From the results presented below, it is clear that ICT firms value Canadian PSIs and see them as key partners for addressing their talent needs.

Only half of respondents identified a corporate HR strategic plan as a measure to address long-term hiring needs. This response suggests that many companies lack the resources for HR planning, believe it is impossible to plan for the long term in their respective parts of the dynamic technology marketplace, or both.

Figure 10: Measures being taken to address long-term hiring needs (N=67)
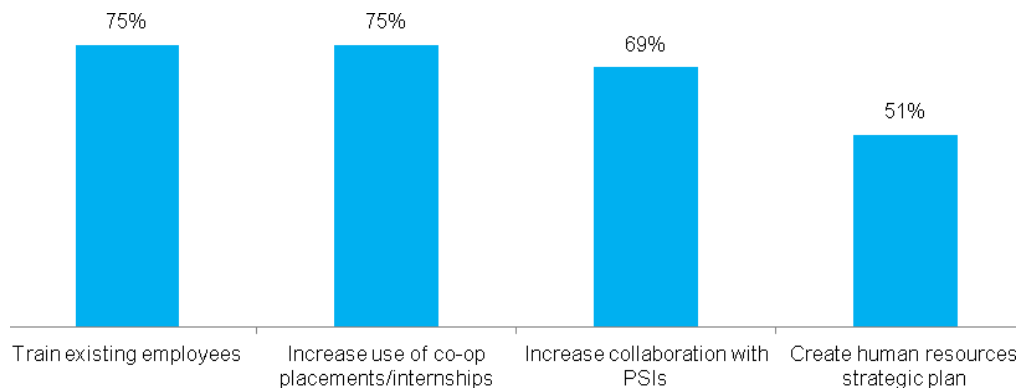
5. Results of the Industry Roundtable

The ICT sector talent roundtable, held in Ottawa on March 7, 2012 may have been the first meeting of its kind. More than 21 ICT sector stakeholder organizations attended, including leading employers, industry associations and clusters, academic associations and Government officials. Following a presentation of the research results by the research team, the roundtable engaged in a day of discussions to validate the research findings and identify potential solutions. The following key issues were identified for improving access to the right talent for the ICT sector:

- Enrollments and Graduations;
- Post-secondary Curricula;
- Continuous Career Training;
- Immigration; and
- Labour Market Information.

While the majority of the priority areas identified relate directly to, and validate, the research results, the roundtable discussion also identified how some ICT labour issues have not been identified through traditional consultative methods. A summary of the roundtable findings, and the particular nuances of how these findings differ from the research results, is provided below.

5.1 Enrollment and graduation

The roundtable participants discussed known issues regarding relative enrollment in and graduation from PSI ICT programs. The issue was effectively broken into two categories: K-12 and PSIs. The issues specific to these categories are described below.

K-12: The roundtable participants believe that elementary and secondary school students, their teachers and parents do not receive accurate information on the nature of today's ICT-related careers. They argued that the traditional view that ICT jobs are boring, geeky, limited to programming, and at risk of being offshored deters many students from choosing the field. However, participants said (and the other components of this consultation confirm), this message is inaccurate. Stakeholders proposed that all provinces work together to encourage ministries of education and industry to propagate a "new narrative" on ICT-related careers to students, educators, and parents. Such a narrative would describe today's ICT-related careers as highly diverse, innovative, multidisciplinary, business oriented, and in demand.

Also, because the most technical post-secondary ICT programs require a strong background in mathematics, many believe students become ineligible for an ICT career if they do not select these courses by grade 10. Participants argued that mathematics education should be

made more interesting and approachable, and students should be made aware of ICT-related career pathways that are less mathematically intensive.

PSIs: Although increased enrolments in ICT-related programs can supply Canada's growing ICT industry, the PSI representatives at the roundtable noted that many ICT programs are fully subscribed and more seats cannot be added due to the structure of PSI funding in most provinces. Resolving these capacity issues could take years to accomplish. In the interim, it was suggested that PSIs work to focus on improving graduation rates by reducing drop-outs from ICT-related programs, like engineering. Industry representatives suggested that the current 'boot camp' approach to engineering education is not relevant to today's ICT careers and discourages talented students from graduating and moving into the workforce.

5.2   Post-secondary curricula

While the interview and survey results indicate nearly unanimous satisfaction with the ICT graduates being produced by Canada's PSIs, the roundtable discussion identified some industry dissatisfaction with the PSI 'product.' Roundtable participants from the industry strongly reiterated the research findings that new graduates lack communication skills, and more importantly, "real-world experience."

The message that too few graduates are ready to 'hit the ground running' resonated more at the roundtable than in the interviews. The path to address this issue is clear. PSIs, participants said, need to better adapt to changing needs, focus on so-called soft skills, increase industry-academia collaboration and increase real-world experience opportunities through co-op programs, internships and mentoring.

5.3   Continuous career training

PSIs alone are not responsible for ensuring a talented ICT workforce. Employers also play a role in upgrading the skills and talent of their workforce. The interviews identified strong industry commitment to internal training, a promising finding.

The roundtable participants pointed out that support for additional training is needed to increase the business and sales capabilities of high potential small and medium-sized ICT firms. Growing Canada's ICT SMEs to become global players would strengthen the sector and improve the capacity and subsector diversity of its clusters.

5.4   Immigration

Based on the roundtable discussion, one ICT labour market issue that the interviews and surveys failed to capture was the precise nature of immigration challenges. Interview respondents said they would welcome a more streamlined immigration process, but this was not identified as a critical issue. Typically, interviewees have learned to deal with it. The roundtable discussion, however, revealed that the way companies were 'dealing' with immigration delays is a major issue for Canada's ICT sector and the Canadian economy.

The roundtable participants representing some of Canada's largest and most dynamic ICT firms emphasized that due to delays in obtaining a Labour Market Opinion issued by Human Resources and Skills Development Canada (HRSDC), they, simply hired new foreign employees into one of their international offices. Often, such positions are extremely time-sensitive for competitive reasons.

At present, there is no way to track these 'lost jobs'. Such foreign recruits often fill managerial roles and hire large teams, even divisions of several hundred people. When a high-level foreign recruit is hired in another country due to immigration delays, Canada can lose hundreds of high-value ICT jobs. Neither the 'demand' for the initial hire, nor the 'offshored' jobs that person creates, are captured in Canada's employment statistics.

Because these types of lost jobs are not tracked, there is no relevant immigration information to be disseminated to Citizenship and Immigration Canada (CIC). Canadian firms do not contact CIC to report an abandoned immigration attempt.

Industry representatives at the roundtable strongly advocated for faster immigration procedures and increased consultations with industry by CIC and HRSDC to assure sector market needs are better heard at CIC. Given the weakness in LMI, industry needs to be more directly consulted by CIC in identifying labour market shortages. The need for liaising with the sector to supply CIC with its demand requirements to be reflected in the next LMI occupation list was also emphasized by the industry and Industry Canada committed to provide liaising between industry, CIC and HRSDC. The roundtable also noted that the current challenged US economic climate provides an opportunity to attract talent from the US, including the repatriation of Canadian expatriates.

5.5   Labour Market Information

The quality of LMI has been an issue in Canada's ICT sector for years. Information on the supply and demand for ICT skills is limited and subject to a number of constraints. For instance, Industry Canada's forecast cited earlier in this paper, and many other studies, rely on Statistics Canada data, which in turn is based on a limited set of somewhat dated and insufficiently granular National Occupational Classification codes. While core employment data is gathered monthly, other information is collected only during the 5-year census, if at all. Given the rapid pace of change in the ICT sector, survey and roundtable participants called for an updating and broadening of the NOCs to encompass the growing diversity of ICT-related occupations.

The consultation, including the roundtable, identified other data issues. The challenge with tracking diverted immigration attempts described above is one. Another is the significant number of ICT labour studies that concluded or were ongoing during this very consultative process. In addition to the BCTIA and TRRA studies published in February, industry studies were being conducted in Alberta ICT and Quebec. All these studies were conducted

independently of one another using different methodologies, limiting opportunities for aggregation and comparability.

Improved, collaborative ongoing tracking of ICT labour market information at sub-sector and cluster levels is needed, including a much expanded, more current baseline set of occupational definitions.

5.6 Roundtable conclusions

The overall outcome from the roundtable was the identification of an urgency to address the talent issues in the industry and also an opportunity for action.

Talent Issues: Talent is the "natural resource" of the ICT sector, yet there are current and projected challenges locating qualified talent across all levels – from new graduates to senior leaders. There is a strongly held view, both from employers and cluster associations that limited talent supply is a major concern, and that strong action is needed. Talent is the number one employer challenge in the sector. The failure to address unmet demand would hurt sector growth and productivity, and could result in more Canadian jobs being located in other countries.

Opportunity for Action: Making talent a priority could ensure Canada's global leadership in ICT in all sectors. Given 2.4% unemployment rate for ICT professionals in 2011 and the aging workforce, participants felt that there is a limited chance of negative repercussion from oversupplying ICT talent. Participants stated that, just like you can't have too much oil, you can't have too many advanced ICT skills.

A compelling 'Own the Podium' type approach that engages all Canadians (youth, parents, teachers, PSIs, employers, media, and government) spearheaded by a "chief talent officer" for Canada was recommended by industry and academia. It was argued that just like we mobilized the country to win Olympic medals and solicited significant private investment in the process, we should use a galvanizing vision to make Canada a global ICT leader. Participants agreed on the need for collaboration among all stakeholders – industry, governments and academia – and expressed a willingness to take action.

6. Conclusions

This section describes the overall conclusions from the study process, including some of the next steps that have already been initiated.

6.1 FPT Ministers meeting

Steps were taken on conclusions of this consultation even before it was finalized. On March 19, Nordicity presented results to a Federal, Provincial and Territorial Economic Development Ministers' meeting on the Digital Economy in Montreal.

The presentation focused on the five priority areas identified at the roundtable and called on Ministers to move forward with addressing Canada's ICT skills challenges. The Ministers made a commitment to continue working with the ICT industry to seek potential solutions to its skills challenges.

6.2 Research conclusions

The results of this study support the need for more granularity to the LMI on Canada's ICT sector and overall contributes to the significant amount of intelligence that is constantly being gathered on ICT labour issues. In particular, this study delved deeper into national skills needs, the causes of recruitment difficulties, priority and potential solutions and roles through the interviews, survey and the roundtable. In general, this study helps identify that Canada's ICT sector is headed for a possible labour shortage, and ICT firms are already employing alternatives to increasing Canadian ICT workforce.

However, research limitations constrain the extent of the final results. The variety of occupations that firms were having difficulty staffing often required specialized or niche skills. This made it difficult to identify broad or consistent gaps with an occupationally-focused methodology. It was also identified through the roundtable that there are issues relating to labour supply – particularly access to foreign workers – that cannot be sourced via traditional LMI data collection methods. Therefore, while this study provides insight into unmet demand for ICT talent in Canada, LMI data capture and dissemination issues merit additional research. In that way, all stakeholders will be able to develop a better understanding of the supply/demand dynamics of Canada's ICT labour market and to formulate effective solutions.

A.1 Roundtable Attendees

Industry	Government	Academia
Communitech	Citizenship and Immigration Canada	Association of Canadian Community Colleges
Ericsson	Department of Canadian Heritage	Association of Universities and Colleges Canada
IBM	Government of Ontario	Polytechnics Canada
Information Technology Association of Canada	Human Resources and Skills Development Canada	
Invest Ottawa	Industry Canada	
OpenText	Information and Communications Technology Council	
Research in Motion	Natural Sciences and Engineering Research Council	
Ubisoft	Social Sciences and Humanities Research Council	
Wavefront		
Wesley Clover		