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Developing Tomorrow's Workforce Today

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Outlook for Human Resources in the ICT Labour Market, 2011–2016

Information and Communications Technology Council

REPORT

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Canada

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Executive Summary

Recruitment Conditions: Employers will confront Pervasive Skills Shortages:

1. Between 2011 and 2016, Canadian employers will need to hire approximately 106,000 ICT workers. This is an annual hiring rate of around 17,700 persons. In light of the specialized skills and the mix of technical skills and business understanding that is sought by the majority of employers, these hiring requirements will pose serious and pervasive challenges.

2. In most regions and for most ICT Occupations, employers will encounter systemic shortages when recruiting for ICT jobs that require five or more years of experience. The severity of these shortages will increase when employers are looking for individuals with leading edge skills or with particular combinations of domain experience and ICT expertise. Conversely, most employers will encounter little or no difficulty in recruiting for ICT jobs that require less than five years of experience or for which recent graduates would be qualified.

1. Acute and pervasive skills shortages will affect four occupations in particular:
   - Computer and Information Systems Managers,
   - Telecommunications Carriers Managers,
   - Information Systems Analysts and Consultants, and
   - Broadcast Technicians.

   For Information Systems Analysts and Consultants, the primary driver of shortages is increasing demand counterposed with the limited capacity to train ICT professionals with the mix of ICT and business skills that are required in this occupation. In the other three occupations where shortages will be acute, demographic factors are the major explanation.

3. Conversely, over much of the forecast period, and in many regions, supply will exceed demand for three occupations:
   - Computer Programmers and Interactive Media Developers,
   - Computer Network technicians, and
   - User Support Technicians.

   In general replacement demand for these occupations will be lower, owing to the younger age structure of the labour force. Technology trends—notably the emergence of 'Cloud' computing and 'virtualization'—will weaken the growth in demand for Computer Network Technicians. Demand for Computer Programmers and for User Support Technicians will be undercut by the growth of outsourcing and off-shoring. However, and this is critically important, notwithstanding an overall tendency for supply to exceed demand in these occupations, employers will still have difficulty recruiting individuals with specific skills and experience. For example, employers in some regions will have challenges recruiting computer programmers with experience in java or .Net or with experience in supporting specific types of ERP applications (*e.g.*, PeopleSoft or SAP). Similarly, although there will be more persons seeking user support technician jobs than there will be job openings, many employers will have difficulty recruiting candidates with the appropriate industry certifications, *e.g.*, Cisco, MSCE, Oracle, etc.

Labour Market Conditions for Job-Seekers:

4. In most regions and for most ICT occupations, recent graduates of co-op or internship programs will generally be able to obtain employment that is commensurate with their training. However, graduates from traditional programs that do not have a *practicum* component will experience much longer search periods. In many cases, they will be obliged to take ICT jobs for which they are over-qualified.

5. Recently arrived internationally educated professionals (IEPs), who have no Canadian experience, will have considerable difficulty in securing an ICT job that is commensurate with their qualifications, unless their English or French language skills are strong. Bridging programs that combine language improvement, training in Canadian business practices, and an internship will have their maximum benefit in the ICT labour market conditions that are projected. IEPs without Canadian experience that do not utilise integrative bridging programs will need to consider jobs for which they are over-qualified.

Pervasive Mismatch between Skill Requirements and Skill Supply

6. At the heart of the skills shortage challenge is a pervasive mismatch between the capabilities that employers require and the skills and experience (or lack thereof) of many job-seekers. Over the course of the past decade, employers became increasingly dissatisfied with ICT professionals who had suitable technical skills, but who lacked soft skills or relevant business experience. As a result, a new capabilities profile emerged.

This capabilities profile included technical skills, soft skills (team working ability, communications skills, *etc.*) and context skills, *i.e.*, an understanding of the business needs and business processes to which ICT is applied. By the end of the last decade (if not earlier), this broader capabilities profile had become the new norm for employers seeking to fill ICT jobs. As more employers adopted the broader capabilities profile for ICT jobs, their difficulty in recruiting candidates who met these expanded requirements increased. At the same time, meeting the requirements of the broader capabilities profile also posed increasing problems for recent graduates and for IEPs, as well as for many laid-off ICT professionals seeking re-employment. By the end of the last decade it was apparent that there was a pervasive asymmetry in the ICT labour market between the capabilities profile sought by many employers and the skills and experience of many job-seekers, especially recent graduates and IEPs.

7. For some time it has been evident that occupations that require only ICT skills are growing slowly, if at all, while occupations that require a combination of ICT skills and other domain skills are growing rapidly. Two types of skill profiles are in demand. The first combines ICT skills with an understanding of business processes including an understanding of the specific context in which a business or organization operates. The second combines ICT skills with the technical skills that are important to another field, for example, a particular industry or sector. The post-secondary system is adjusting to this change in skill needs, but has been slow to do so. Too many students still enrol in programs that are focused only on ICT. They inevitably find that the jobs that correspond to that skill profile are growing slowly and may even be declining. Employers, for their part, increasingly rely on experience thresholds to filter out job-seekers who are likely to lack either an understanding of business processes or domain-specific technical skills. So pervasive is this reliance on experience thresholds that experience requirements have now become embedded in the ICT labour market. The result is a large number of job-seekers who cannot meet the experience requirements and an equally large number of employers who have constant challenges in meeting their hiring needs. In the absence of a concerted strategy involving industry, governments and the post-secondary system, these conditions will not change and the skill shortages will grow worse.

1. To change the way the ICT labour market serves both employers and job-seekers will require a strategy that addresses the pervasive mismatch between the capability profile sought by employers and the skills and experience profile of job-seekers. There are four dimensions to this challenge:
   - the design of post-secondary programs,
   - managing the transition from graduation to employment,
   - integrating IEPs into the Canadian labour market, and
   - expanding the re-skilling opportunities available to current ICT professionals.

   A complete strategy needs to address all four dimensions of the mismatch challenge. The relative importance of these four dimensions will differ across regions.

Women in ICT:

8. Although there is anecdotal evidence that some employers and post-secondary institutions are endeavouring to change the current (and significant) gender imbalance in ICT, the overall trends do not appear to have changed. ICT is still approximately 75% male. The gender imbalance compounds the skills shortage problem by limiting the qualified pool from which employers can recruit. This is not a future prospect. It is already happening.

9. While the initiatives of individual employers and post-secondary institutions are encouraging, they are not commensurate with the scale of the problem. Only a broadly-based strategy, founded on an industry and post-secondary partnership, has the potential to alter the current gender imbalance.

Changing our Understanding of ICT Careers:

1. The nature of ICT careers is changing. In the 1990s, ICT occupations were understood predominantly as technical occupations that required an affinity for applied mathematics and, depending on the nature of the job, various degrees of post-secondary training that emphasized pure and applied mathematics. Over the course of the last decade, employers came to view ICT occupations and ICT careers in a different light. Significantly more emphasis was put on the need for an understanding

of the business or organizational context in which ICT was applied. The ICT occupations which grew the fastest in the last decade were those that combined an understanding of ICT with an understanding of business. A consequence of this change was a transformation in the capabilities profile sought by employers and a corresponding change in the nature of ICT careers. Employers re-defined ICT occupations as requiring 'soft skills' and context skills, as well as technical ICT skills. Many of these new ICT occupations still require significant post-secondary training in mathematics and applied mathematics. However, the purely technical focus that defined a great many ICT occupations in the 1990s has been replaced by a new emphasis on soft skills 0and context skills (paragraph 7 above).

10. There is a significant disjuncture between the prevailing perception of ICT careers as quintessentially technical occupations and the way that ICT occupations and ICT careers were re-defined and re-shaped over the last decade. This mismatch between prevailing perceptions and the new reality of what ICT careers are about limits the flow of talent into ICT and thereby perpetuates many of the skills shortages that characterize the ICT labour market. The industry-based Coalition for Tomorrow's ICT Skills is playing an important role in communicating the significance of the changes in the nature of ICT careers to governments, students, and the education system. However, much remains to be done. There is still a significant lag between broader perceptions of ICT careers and the actual nature of those careers and the capabilities they require.

Strengthening Our Understanding of the ICT Labour Market:

1. The occupational definitions that are used to track trends in the labour market are increasingly 'out of sync' with the realities of the ICT labour market. There are two dimensions to this problem:
    - First, some occupational definitions are far too broad. For example, 'Information Systems Analysts and Consultants' make up one-quarter of the ICT work force, while 'Computer Programmers and Interactive Media Developers' account for 15%. There is more change happening within these occupational definitions than the aggregated data reveal;
    - Second, one of the most important trends is the emergence of occupations that require both ICT skills and skills from another domain. E-health is an obvious example, but there are scores of others. ICT is re-shaping the skill requirements of a great many occupations. Current statistical measures do not track these changes.

    Effective human resources planning requires labour market information that is timely, accurate, regionally-specific and relevant. Our current statistical resources fall short of meeting that need. It is imperative that industry, governments and statistical agencies address the need for better information.

Continuity of Trends and Changes in Trends: The 2008 and 2011 Outlooks Compared:

2. The *2011 Outlook* builds on and refines previous *Outlooks* that were released in 2004, 2006 and 2008. Frequent revisiting of forecasts is essential to maintain relevance. Every stakeholder in the ICT labour market understands how rapidly changes occur in technology, skill requirements, business structure and human resources management strategies. Most of the key trends identified in the *2008 Outlook* remain important today. However, other trends have also emerged since 2008:
    - The *2011 Outlook* confirms a central conclusion of the *2008 Outlook:* there will be pervasive and serious shortages of Information Systems Analysts and Consultants (Business Analysts). The drivers behind this shortage are changes in how employers understand their skills requirements and a lag in the post-secondary system's response to this change in skills needs.
    - In the *2008 Outlook*, demographic factors were seen as causing serious shortages of persons qualified by training and experience to be Computer and Information Systems Managers. The *2011 Outlook* confirms this projection and also signals that demographically driven shortages will also dominate hiring for Telecommunications Managers and Broadcast Technicians.
    - For Computer Engineers and Software Engineers, the nature of shortages changes somewhat from a generic shortage to one that focuses the *increased* difficulty that employers will confront when seeking to hire 'highly qualified' professionals, especially in R&D roles.

- In the *2008 Outlook*, 'Cloud' computing and 'virtualization' were noted, but their impact was not directly factored into the projections. In the *2011 Outlook*, these technologies are seen as having two effects. The first is to reduce the demand for certain occupations, notably mid-level computer programmers and network support technicians. The second impact is to change skill needs to accommodate the shift to Cloud computing and virtualization.
- In the *2011 Outlook*, more emphasis is also put on the impact of Service-Oriented Architecture (SOA). SOA significantly increases the demand for high-level programmers—'architects' , SOA also changes skill requirements for programmers. In particular, java and .Net skills become more important. In the longer run, however, SOA reduces the marginal cost of developing and supporting a new application or extending an existing application.
- The *2008 Outlook* highlighted the skills shortages related to supporting 'legacy' applications. These skills shortages will continue to be a problem for the major public and private sector employers that rely on those systems and applications.
- For the 2011–2016 forecast period, the *2011 Outlook* interprets the higher Canadian dollar as a 'structural feature' of the Canadian economy rather than cyclical occurrence that will soon be reversed. The higher dollar will encourage more off-shoring of 'commodity' ICT work and will also constrain the growth of 'near-shoring', *i.e.*, the export of ICT services to the U.S. These trends will weaken demand for 'Tier 1' User Support Technicians and for Computer Programmers who do lower-value programming and application support. In the *2011 Outlook*, these trends are more pronounced than in the *2008 Outlook*.
- The *2008 Outlook* described changes in the skills requirements of employers, in particular the 'package of skills' sought by employers—technical skill, 'soft skills' and experience. The *2011 Outlook* interprets these changes as having become embedded in the ICT labour market and fundamentally changing the capabilities profile sought by the majority of employers and the nature of ICT careers.
- In the *2008 Outlook*, the focus was on enrolments in traditional IT, computer science and computer and software engineering programs. In 2008, enrolments in these programs had fallen sharply and were continuing to decline. Enrolments in these traditional programs have now stabilized. Equally importantly, the efforts of the Coalition for Tomorrow's ICT Skills has led many universities to introduce Business Technology Management (BTM) programs that will better align the skills of new graduates with the skills required by employers.
- The *2011 Outlook* takes account of somewhat lower immigration levels of ICT professionals than had occurred in the years prior to 2008. At the same time, the *2011 Outlook* also factors into its supply side estimates the use of Temporary Foreign Workers (TFWs).

11. The central human resources planning issues identified in the *2008 Outlook* will continue to be important in light of the trends identified in the *2011 Outlook*. In the absence of focused, sector-based strategies, employers will face widespread and pervasive skills shortages. These shortages will arise principally from a widespread mismatch between the skills and capabilities that employers need and the skills and experience of many job-seekers. The shortages will continue until new post-secondary programs alter the nature of supply. Graduates of post-secondary programs that do not have a *practicum* component will face an especially lengthy, and often disappointing, search for employment. Accelerating the integration of internationally educated professionals will continue to be important as well as the need for a more structured approach to the graduation-to-employment transition of recent graduates. And finally, there will continue to be a need for well-grounded occupational standards and an expansion of the culture of ICT professionalism with its attendant commitments to ongoing learning and continuing competence.

1. Introduction

This report profiles the labour market outlook for ICT Occupations, that is to say, occupations that specialize in developing or supporting information and communications technology (ICT) products and services. In 2010, approximately 4.0% of employed Canadians worked in an ICT Occupation. Roughly 60% were employed in the ICT industry, *i.e.*, companies that produce ICT products and services. The remaining 40% worked for companies, public sector institutions, or organizations that use ICT products and services as inputs into their business operations.

The purpose of the *2011 Outlook* is to identify the most likely trajectory of labour market conditions over the next five years. The outlook anticipates how the ICT labour market will unfold, in the absence of interventions to change that trajectory. In essence, the *2011 Outlook* describes how the ICT labour market will evolve over the next five years, if we stay on 'automatic pilot'.

As with every forecast, this outlook is based on judgements about likely economic trends and trends in the adoption of new technologies. No forecast can anticipate the introduction of new technologies. Moreover, as recent events have underscored, the overall path of the economy can also diverge sharply and suddenly from previous trends. For this reason, the horizon for the outlook is limited to five years. In ICT, technology changes too rapidly to allow credible forecasts to exceed a five year period. Consequently, ICTC revisits and updates the outlook every two to three years.

The *2011 Outlook* is based on:

- an econometric model of supply and demand trends for ICT occupations developed by Prism Economics and the Centre for Spatial Economics (C_4SE),
- a review of third-party forecasts of ICT spending and employment, including forecasts by IDC Canada, the Conference Board, and the World Information Technology Services Association (WITSA),
- enrolment and graduation trends in relevant post-secondary programs,
- immigration trends, including persons arriving as 'temporary foreign workers',
- telephone interviews with 111 industry informants representing both ICT producers and users,
- eleven focus groups and six webinars with representatives from industry and from the post-secondary education system, involving over 100 persons,
- a web-based survey of 268 employers,
- a review of scholarly, institutional and trade literature on trends in technology and their impact on human resources,
- six validation meetings with industry representatives to confirm and re-calibrate initial findings and conclusions.

Two surveys were used to ground industry assessments of current labour market conditions and expected trends. The first was a web-based survey which attracted responses from 268 employers. Forty-nine percent of the employer respondents employed 25 or fewer persons, 16% employed between 25 and 100 employees, and 35% employed more than 100 employees. In total, the survey respondents reported that they employed just under 170,000 ICT workers. Sixty-five percent of survey respondents considered their companies to be in the ICT industry, *i.e.*, their company's primary line of business was producing an ICT product or service.

The second survey consisted of 100 executive interviews administered for ICTC by Ipsos Reid. In the sample, 55 respondents employed 25 or few workers, 22 employed between 25 and 100 workers, and 23 employed more than 100 workers. In total, the respondents employed just over 25,000 ICT workers. Thirty-one firms identified their primary line of business as producing an ICT product or service; 32 firms identified their companies as primarily ICT Users, while the remainder considered themselves to be both Users and Producers.

The forecast that underpins the *2011 Outlook* is necessarily limited by the statistical estimates that are available. This is a significant constraint. Estimates of occupational employment are based on the National Occupational Classification for Statistics (NOC-S) system which classifies persons by the defining characteristics of their work and the skill level for that work. Reliance on the NOC-S system poses two serious problems. First, the NOC-S classifications do not take account of the high degree of granularity in ICT occupations and ICT skills. Programmers working in java or .Net have significantly different skills from programmers who work in COBOL. Programmers who support an Enterprise Resource Planning (ERP) application in a manufacturing environment need significantly different experience from programmers supporting a similar application in a retail environment. The individuals are not interchangeable. However, the NOC-S system treats both individuals as "Computer Programmers and Interactive Media Developers". If one were to rely solely on data driven by the NOC-S system, a surplus of COBOL programmers that was concurrent with shortages of java or .Net programmers could appear as 'balance' in the labour

market despite the obvious fact that there is an acute and systemic mismatch between employers' skill requirements and the skills of job-seekers. For this reason, an important dimension of the *2011 Outlook* is its use of industry insight gathered from surveys, interviews and focus groups to understand the serious skill challenges that are not revealed by aggregated data. We should not, however, view these *ad hoc* research methods as a substitute for the data we actually need to support effective human resources planning in ICT. It is in the interests of all stakeholders—industry, governments, the post-secondary system, ICT professionals and those contemplating an ICT career—that we develop data systems that provide more realistic *current* measures of the complexity and granularity of the ICT labour market. The urgency of addressing this knowledge gap is increasing, not diminishing.

A second, and equally important, constraint arises from the NOC-S system's current inability to identify occupations that require a mix of ICT skills and skills drawn from other domains, such as business administration, health sciences, finance, the natural sciences, *etc.* The OECD refers to these as 'ICT-Intensive Occupations' and estimates that they substantially outnumber 'ICT Specialists'.[1] In some respects, the emergence of 'ICT-Intensive Occupations has overshadowed trends in the supply and demand of 'ICT Specialists'. Yet we have virtually no statistical measures of this important phenomenon and, consequently, relatively little capacity to plan the human capital investments that will be needed. In the *2011 Outlook*, we estimate only the number of "ICT-Related Occupations" that are employed directly by the ICT industry. This, of course, misses the much larger number of such persons who are employed outside the ICT industry, for example in the health sector. This is a glaring gap, but one which current statistical sources do not enable us to address. Again, the urgency of tackling this knowledge gap is increasing, not diminishing.

Notwithstanding the limitations that are inherent in the available statistical sources, by using additional industry insights gathered through interviews, focus groups, surveys, *etc.*, it is feasible to gauge the broad parameters of the ICT labour market and to estimate the most likely five-year trajectories of supply and demand. While some skill gaps will not be identified, many important gaps can be highlighted. This, in turn, provides a basis for strengthening human resources planning and for determining future research and data priorities.

A detailed description of the methodology used in the *2011 Outlook* is set out in Appendix A.

An accompanying publication, *2011 Outlook—Data and Forecast Estimates*, presents the data and the calculations used to formulate the estimates in the forecasting model.

ICTC expresses its appreciation to the more than 500 representatives of industry and the post-secondary system who contributed their time and insights to developing this forecast through their participation in interviews, focus groups, webinars, the surveys and the validation meetings.

ICTC also expresses its appreciation to Human Resources and Skills Development Canada which provided financial support for the *2011 Outlook* through the Sector Council Program.

The *2011 Outlook* was developed for ICTC by Prism Economics and Analysis.

[1] OECD, *OECD Information Technology Outlook, 2010*. The OECD's data for Canada suggest that "ICT—Intensive Occupations" outnumber "ICT Specialists" by approximately 4.6:1. However, these estimates are based on sweeping assumptions about the level of ICT skills required in a range of NOC-defined occupations. The relevant data for Canada accompany Figures 3.1 and 3.12 of the *OECD Information Technology Outlook, 2010*.

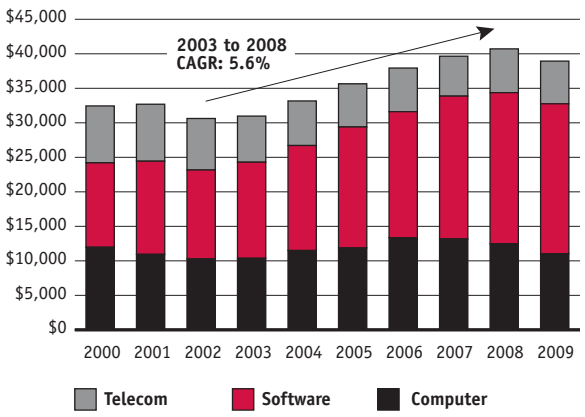
2. Trends in the ICT Labour Market

A. Trends Shaping the Demand for ICT Professionals

1. Investment in ICT in Canada:

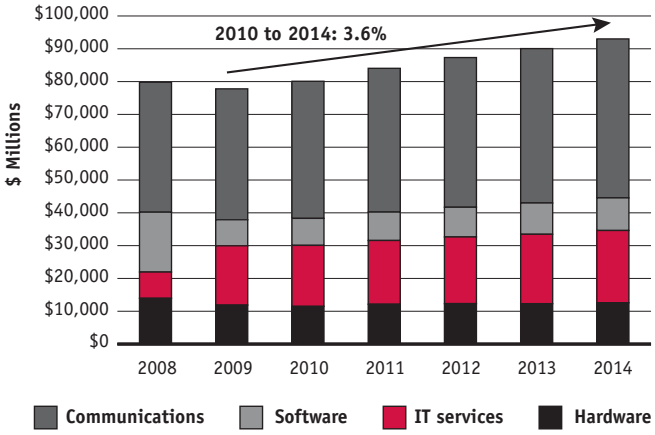
From 2003 to 2008, investment spending in Canada on ICT systems and applications increased by an annual average of 5.6%. In real terms (*i.e.*, after taking out the effect of price reductions), the rate of increase was more than 8.0%. Investment spending at this rate put considerable pressure on ICT human resources and was the leading cause of skills shortages prior to the economic downturn at the end of 2008. In 2009, with the onset of the international financial crisis, investment spending on ICT systems and applications fell by 4.4%.

Figure No. 2-1
Investment in Computer and Other Office Equipment, Software and Telecommunications Equipment
2000 to 2009
Statistics Canada, CANSIM



Two forecasts point to an early recovery in spending on ICT. However, both of these forecasts project that there will be a deceleration in the growth rate of ICT spending compared to the five years prior to the downturn. IDC Canada projects business spending on ICT will increase by 3.6% annually through to 2014.[2]

Figure No. 2-2
Projected Spending on Hardware, IT Services, Software and Communications
2010 to 2014
IDC Canada, *Canadian ICT, 2010–2014 Forecast Summary* (May 2010)



The international forecast published by the Word Information Technology Service Association (WITSA) is prepared by IHS Global Insight. From 2011 to 2103, WITSA anticipates an increase in ICT spending in Canada of only marginally more than 4.0% annually.[3]

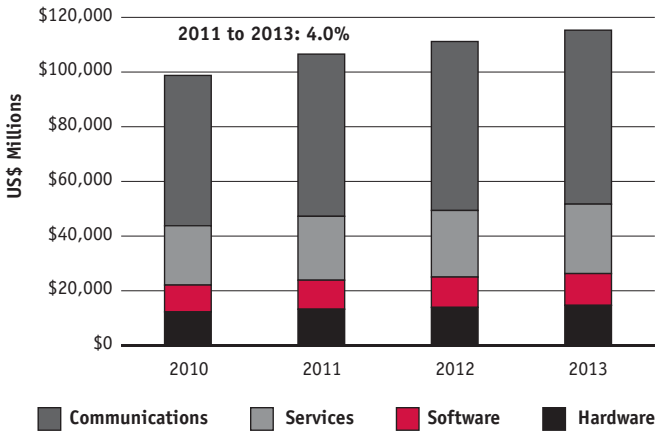
Both of these projections are lower than the 5.6% annual increase in investment spending reported by Statistics Canada for the period prior to the economic downturn.

The *2011 Outlook* expects ICT investment spending to continue to increase in both nominal and real terms, but to do so at a slower pace than prior to the economic downturn. The implication of this projection is that **ICT employment growth over the next five years will be slower than in the five years prior to the downturn in September of 2008**.

[2] IDC's estimates of spending on ICT are not precisely equivalent to Statistics Canada's estimates of ICT investment spending. However, the data series are approximately equivalent.

[3] World Information Technology Services Association (WITSA), *Digital Planet, 2010* (October 2010). The Information Technology Association of Canada (ITAC) is the Canadian affiliate of WITSA.

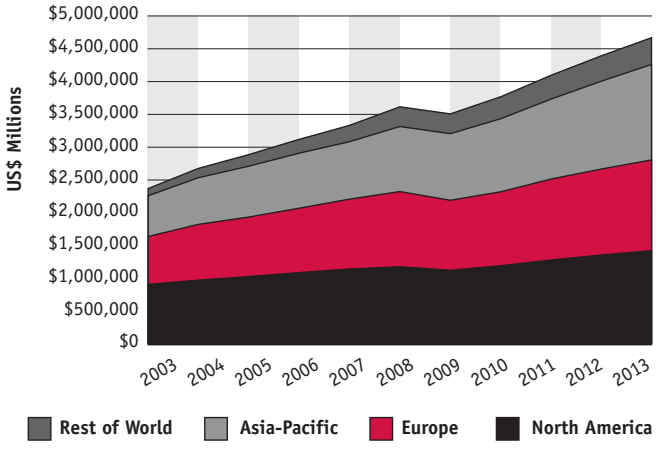
Figure No. 2-3
Projected Spending on Hardware, Software, Services and Communications
2010 to 2013
World Information Services Technology Association (WITSA) Digital Plant, 2010 (October 2010)
(Forecast in US$)



2. Global Spending on ICT

Figure 2-4 shows the projected trend in global spending on ICT, based on the WITSA forecast.

Figure No. 2-4
Estimated Actual and Projected Global Spending on Hardware, Software, Services and Communications
2003 to 2013
World Information Services Technology Association (WITSA) Digital Plant, 2010 (October 2010)
(Forecast in US$)

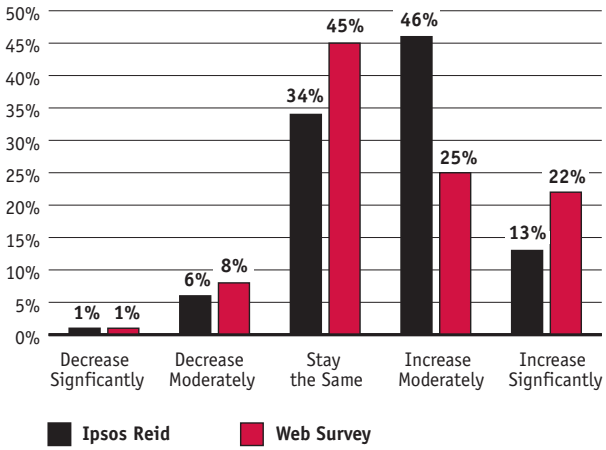


On a global basis, ICT spending is expected to return to growth rates that are comparable to those that preceded the downturn. However, the locus of growth will shift from North America and Europe to the Asia Pacific region, which will account for 43% of the growth over pre-recession levels. For Canadian ICT companies that operate in the global market, this is a positive projection, if they have a presence in the Asia-Pacific market. The U.S. market is projected by WITSA to grow at an annual rate of 5.7% between 2011 and 2013. This is moderately faster than WITSA's projections for the Canadian market, but reflects the much deeper downturn that occurred in the U.S.

3. Outsourcing:

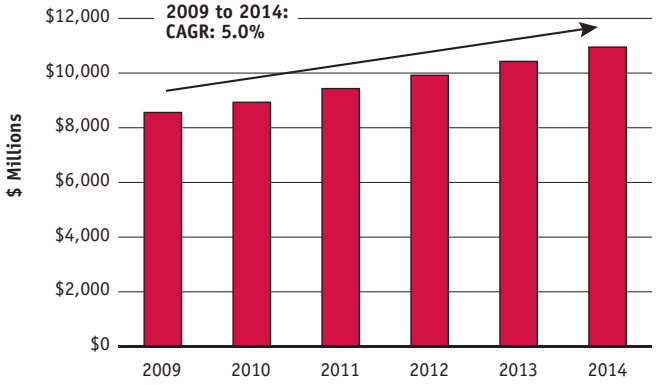
Both the Ipsos Reid interview-based survey and the web-based survey show that there is a widespread expectation among industry leaders that outsourcing will increase over the next five years.

Figure No. 2-5
Expected Change ICT Outsourcing over the Next Five Years
Web Survey and Ipsos Reid Executive Interview Survey
(January 2011)



IDC Canada estimates that, in 2010, outsourcing represented approximately 9.0% of business spending on information and communications technology. IDC Canada anticipates that Canada's outsourcing market will grow by approximately 5.0% per year over the next four years.

Figure No. 2-6
Projected Spending on IT Outsourcing
2009 to 2014
IDC Canada, *Canadian ICT, 2010–2014 Forecast Summary*
(May 2010)



Outsourcing should not be confused with off-shoring, although the two phenomena are related. IDC Canada estimates suggest that off-shore centres currently account for approximately 9.0–10.0% of the Canadian IT outsourcing market, but around 15.0% of outsourced employment. The difference between the off-shore suppliers' share of value and their share of employment arises from the trend to off-shore a greater proportion of lower-value work.[4]

Outsourcing has five effects on the ICT labour market that must be taken into account in formulating an outlook for ICT human resources:

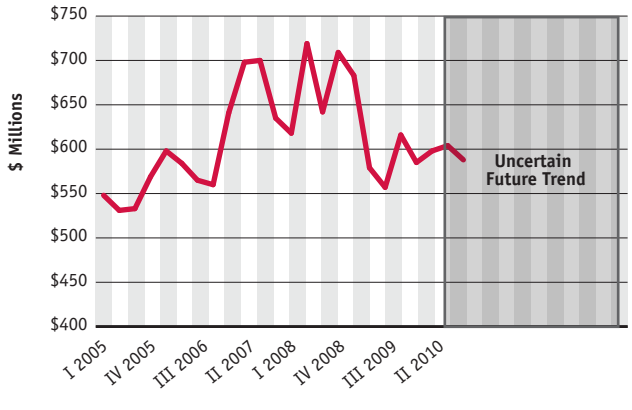
- First, outsourcing alters the regional distribution of ICT employment within Canada by moving work to regions where labour costs are lower or skills are more readily available;
- Second, outsourcing slows down the rate of employment growth by utilizing labour more efficiently, often across more than one client;
- Third, outsourcing breaks down ICT functions into discrete skill-sets and, by doing so, conserves on the requirement for advanced or specialized skills;
- Fourth, outsourcers are the principal vehicle for offshoring Canadian ICT work; and
- Fifth, outsourcers are also important vehicles for exporting ICT services.

The *2011 Outlook* anticipates that the outsourcing share of ICT will increase by around 5.0% per year, in line with IDC Canada's projections. The growth in ICT outsourcing will lead to a moderate shift of employment in some occupations to Quebec and to the Atlantic region.

4. Off-shoring:

Data on imports of 'computer and information services' track expenditure by Canadian businesses and organizations on the off-shore supply of design and support services, technical consulting, and data processing. Figure 2-7 shows that after growing at a rate of 2.0% *per quarter*, the import of 'computer and information services' appears to have peaked in 2008 and then declined.

Figure No. 2-7
Imports (Payments): Computer and Information Services
2005(i) to 2010 (iii)
Statistics Canada, CANSIM



Industry surveys, on the other hand , show that there has been an increase in the number of companies using off-shore resources. The paradox revolves around the distinction between the 'incidence' of off-shoring and its 'intensity'. The 'incidence' of off-shoring measures the number of companies or organizations that use off-shore resources. The 'intensity' of off-shoring measures the value of work which is moved off-shore. The Sapphire/IBM *Canadian IT Staffing Outlook 2010*, reported that, comparing 2010 to 2009, there was a moderate increase in the *incidence* of

[4] Centre for Outsourcing Research and Education in partnership with IDC Canada, Outsourcing Monitor, webcast Presentation, January 19, 2010.

companies using off-shore suppliers.[5] At the same time, our executive interviews and focus groups suggested that many companies have repatriated some types of ICT work that they previously had off-shored. Others have declined to use off-shore resources for new projects. What appears to have happened is that from roughly 2003 to 2007, many companies experimented with off-shore resources. Often these experiments succeeded. As a result, the incidence off-shoring increased and off-shore centres consolidated their role as suppliers of 'commodity' ICT work. Commodity work encompassed mainly data processing, routine support for business applications, low-level programming, and 'tier one' help desk work. Today, off-shore options are routinely offered as part of an outsourcing contract for work of this sort. However, the experience of using off-shore resources for higher level programming and application support was much more mixed. This appears to have led to a reduction, or at least a deceleration, in the use of off-shore resources for these types of ICT work. The result was the decline in the *intensity* of off-shoring that is shown in Figure No. 2-7.

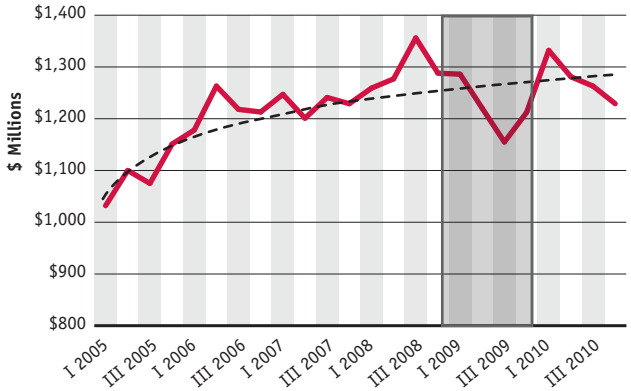
What does this imply for the future? In the first place, the demand for lower value ICT work will continue to be met, at least in part,—and probably to an increasing degree—by off-shore resources.[6] The outlook for mid-value ICT work is uncertain. Off-shore suppliers may address the quality concerns and more of this work may move off-shore. Alternatively, Canadian companies may continue to be highly cautious about off-shoring mid-value ICT work.

The *2011 Outlook* anticipates that low-value ICT work will continue to move off-shore. This will affect primarily 'user support technicians' who provide Tier 1 help desk services, some types of computer programmers and some types of data administrators. The *2011 Outlook* anticipates some movement of mid-value ICT work to off-shore centres, but does not anticipate that this will be a major feature of the off-shoring phenomenon, at least at this stage in the industry's development.

5. Near-Shoring:

Canada is both an importer of 'computer and information services' and an exporter. Firms such as CGI have secured a strong position in the international IT outsourcing market, performing much of that work from Canadian locations. A number of U.S.-based outsourcing firms have also located in Canada with a view to supplying U.S.-based customers with IT support from a 'near-shore' location that avoids many of the complications associated with off-shore supply. Figure 2-8 shows the trend in exported 'computer and information services'.

Figure No. 2-8
Exports of Computer and Information Services
2005(i) to 2010 (iii)
Statistics Canada, CANSIM



In 2005 and 2006, the industry grew by 2.5% *per quarter*. In 2007 and 2008, the higher Canadian dollar cut this growth rate approximately in half. Nevertheless, it is important to note that the industry continued to grow in the face of a significantly higher dollar. In the last quarter of 2008, with the onset of the economic downturn, exports of 'computer and information services' turned down. This decline continued through most of 2009, by which time, exports were roughly 15% below the pre-recession level. In 2010, the 'near-shore' industry recouped virtually all of

[5] The Sapphire/IBM survey reported in *Canadian IT Staffing Outlook, 2010* that 34% of responding companies used 'low cost global resourcing'. This was an increase from 31% in the prior year.

[6] Data from the web survey found that 45% of Producers in the survey and 39% of Users expect the use of off-shore resources to increase moderately or significantly. This result is consistent with the interpretation that the amount of 'commodity' ICT work that is sent off-shore will continue to increase.

this loss, but then declined again as U.S. companies repatriated some of the work they had previously assigned to 'near-shore' operations. In the weaker international conditions that currently prevail, the competitive disadvantage of the higher Canadian dollar appears to be having a greater impact than in the period prior to the downturn that occurred at the end of 2008.

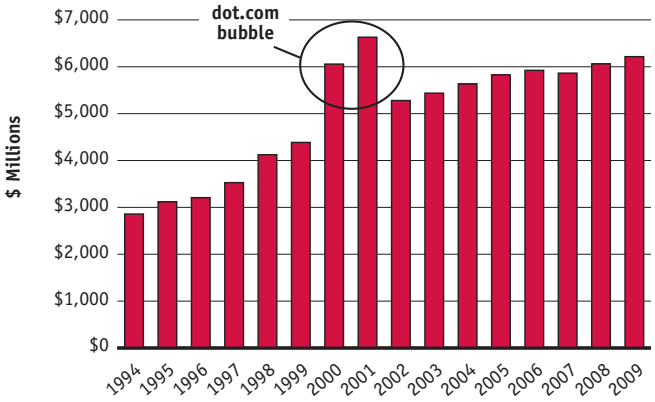
The *2011 Outlook* anticipates that the use of near-shore services by U.S. companies and public sector bodies will increase as part of their general strategy to reduce operating costs.[7] However, the higher Canadian dollar will dampen some of this increase in demand. It is anticipated that exports of 'computer and information services' will stabilize in 2011 and increase moderately over the forecast period by around 2.0% to 3.0% per year.

6. R&D:

ICT accounts for around 40% of total R&D spending by Canada's business sector. From 1994 to 2005, R&D spending by the ICT sector increased by 6.8% per year. A similar pattern of growth (excluding the dot.com bubble) was evident outside of ICT. This growth trend in R&D spending reflected increased returns to technology development and Canada's favourable position as a cost-effective jurisdiction in which to undertake R&D. Our cost competitiveness was rooted in the low Canadian dollar which averaged between US$0.637 and US$0.825 during this period.

After 2005, as the Canadian dollar appreciated, there was a marked deceleration in R&D spending. Between 2006 and 2009, the rate of growth in R&D spending fell to 1.6%. To a significant degree, this deceleration in R&D spending reflects the relocation of some R&D to lower cost regions, notably Eastern Europe and India. **On a go forward basis, the *2011 Outlook* anticipates that the Canadian dollar will remain in approximate parity with the U.S. dollar and that R&D spending in Canada will continue to grow at a rate between 1.0% and 2.0%, but not higher.**

Figure No. 2-9
Spending on R&D by ICT Businesses
1994 to 2009
Statistics Canada, CANSIM



7. Technology Trends—User Industries:

There is broad consensus that for ICT User industries, the key technology trends over the next five years will pertain to (1) virtualization, (2) the 'Cloud' and, (3) Service-oriented Architecture (SOA). Adoption rates for each of these technologies are being driven by the potential for significant cost savings and an increase in flexibility.

Virtualization: In its 2010 survey of its members, the Society of Information Management, whose membership comprises senior ICT managers in Canada and the United States, identified virtualizaton, for the first time, as one of the five leading technology investments.[8] Virtualization refers to software applications that create a virtual (rather than an actual) version of hardware platforms, operating systems, storage devices or network resources. Virtualization holds out the promise of significant savings on ICT capital budgets. As well, virtualization creates new flexibility in where and when companies and organizations can deploy their human resources.

[7] IDC's Worldwide Service Contract Database suggests that private businesses accelerate their use of outsourced services as part of their response to economic downturns. The effect is sometimes lagged, in that outsourcing decisions made during the downturn may not be implemented until somewhat later.

[8] Society for Information Management, *2010 SIM IT Trends Survey*.

The human resources impact of virtualization cuts two ways. In the first place, the accelerated implementation of virtualization is creating new skill needs among computer engineers, software engineers, computer programmers, and network support technicians.[9] Associated with these new skill needs are new categories of skill certification.[10] Virtualization is also re-casting security needs and the related skill requirements. At the same time, by virtue of its consolidation effect, virtualization technology is also reducing the need for traditional network and storage support technicians.

The Cloud: The *OECD Information Technology Outlook*, 2010 defines 'cloud computing' as "the provision of scalable ICT services over the Internet, typically based on consolidated hardware and software in large-scale data centres.[11] Companies providing Cloud services operate in one or more of three markets: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS). As with virtualization, the Cloud offers ICT Users the potential for substantial savings on capital budgets. However, the Cloud also offers potentially significant savings on operating costs, as well. The OECD estimates that if a company with 15,000 employees were to move its email from in-house to a Cloud supplier, cost per employee would be reduced by roughly 66% and ICT staffing expenditures on email would decline by almost 90%.[12] As with virtualization, the human resources impact of Cloud computing cuts two ways. Companies that offer Cloud services will generate new jobs that require new skills. U.S. data show that these companies have been expanding at exponential rates.[13] At the same time, the Cloud will also reduce the need for in-house infrastructure and application support. Moreover, there is no assurance that the jobs generated by Cloud service providers will be located in Canada.

Security concerns and dependability are potentially important constraints on the adoption of Cloud computing. In Canada, the emergence of domestic suppliers of Cloud services is removing concerns about data being housed on servers outside Canada.[14] Cloud service suppliers will need to address the concerns about security and compliance with privacy legislation, as well as dependability. The view taken by the *2011 Outlook* is that the cost advantages of Cloud computing will be powerful incentives supporting its adoption and that the suppliers will be able to adequately address security and privacy concerns as well as reliability.

Service-Oriented Architecture (SOA): Service-oriented architecture is an approach to high-level design in which self-standing components provide discrete 'services' but can be flexibly associated with one another through 'orchestration'. Data must be structured in a way that it is usable across components. SOA enables blocs of services to be strung together to create *ad hoc* applications. The advantage of SOA is that after a sufficient library of self-standing components have been developed, the marginal cost of creating new applications is exceedingly low, as most (or all) of the software required already exists as self-standing components. For large ICT Users, SOA holds out the promise of being able to meet future application needs economically and quickly. SOA substantially eliminates the risk of being locked into a particular software solution that may no longer meet an organization's needs.

ICT Users also have continuing needs that are driven by technology considerations. Foremost among these is **security**. Our survey of employers identified security as the leading technology concern. Regulatory compliance, liability concerns, and the serious damage to reputation arising from a publicized security breach are all factors that increase the importance of security. As noted, virtualization and Cloud computing have changed the context for security and will recast the skill requirements for security specialists.

Supporting **legacy applications** continues to be a challenge for some ICT users, though interviews with industry executives suggest that the many companies and organizations have replaced some of their legacy applications. Nevertheless, many large companies and public sector organizations have substantial investments in legacy applications which they are reluctant to write off. The skill pool to support these applications is diminishing as older programmers retire.

[9] D. Dubie, "No Virtualization Skills? Better Get Started," *Network World*, 18 June 2009.

[10] The leading suppliers of virtualization applications, at this time, are: VMware, Citrix, and Microsoft. All three vendors offer certification.

[11] OECD, *OECD Information Technology Outlook*, 2010 p 157.

[12] *ibid.* p 150.

[13] VMWare, which is widely seen as the current market leader in providing virtualized servers, employed approximately 3,000 employees in 2006. Today, the company reports more than 8,200.

[14] IDC Canada, *Canadian Technology Innovation Watch* (August 2009). The report identified 10 Canadian companies offering Cloud services.

8. Technology Trends—Producer Industries:

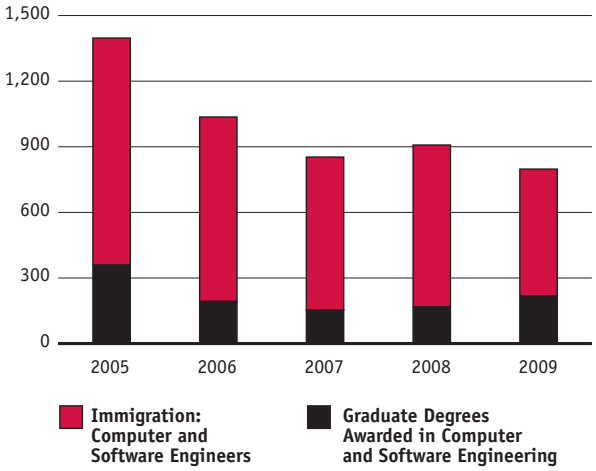
For ICT Producers, technology drives skill requirements through R&D activity and the need to support new technologies that are being brought to market. Skill needs related to R&D have three characteristics. First, R&D skill requirements are highly granular, that is to say, they pertain to highly specialized fields. Second, R&D requires advanced levels of skill, often, but not exclusively skills that require advanced degrees. And third, companies seek highly qualified professionals who have had prior R&D experience, preferably, though not necessarily, in a private sector context.

For companies with major commitments to R&D, finding the right people is their number one human resources challenge. There is a global shortage of qualified R&D professionals with experience and training in highly specialized fields. Canada is not exempt from this shortage. It is possible to estimate the number of persons with advanced degrees in fields related to information and communications technology. It is not practical, however, to estimate the number of persons with both advanced qualifications and the R&D experience that is so prized by ICT companies. Nevertheless, there are indications that employers may have *more* difficulty meeting their R&D talent over the next several years.

In the first half of the previous decade, there was a significant increase in the number of students pursuing graduate studies in mathematics, computer science and engineering. However, the trend levelled off later in the decade. Immigration data, on the other hand, indicate a tapering off of the number of computer and software engineers coming to Canada—roughly half of whom have graduate degrees. Figure 2-10 suggests that there may have been a moderate deterioration in the supply of highly qualified ICT professionals (using the sum of graduate degrees awarded in computer and software engineering and the number of new IEPs in these fields as a proxy indicator of supply.) These data suggest that the shortage of highly qualified R&D specialists that was pervasive in the last decade will likely continue to be a central human resources planning challenge over the course of the forecast period.

The second technology-driven skill need in the Producer Industries arises from the need to support and further develop products and services that are already in the market. New skill requirements are generated by the need to support new types of products and services. At any time, there are a range of new products and services being introduced. The trends which our industry consultations currently identify as generating skill requirements that are difficult to meet are: **gaming**, **3-D animation**, the development of mobile applications (**'apps'**), and **social networking** applications.

Figure No. 2-10
Approximate Annual New Supply of Computer and Software Engineers with Advanced Qualifications 2005 to 2009
Graduate Degrees Awarded: Engineers Canada, *Canadian Engineers for Tomorrow*
Immigration: Citizenship and Immigration Canada (Special Tabulation)*



* Total immigration counts reduced by 50%, based on 2006 Census which indicates that approximately half of immigrants in these occupations had graduate degrees.

B. Trends Shaping the Supply of ICT Professionals

1. Enrolment and Graduation Trends:

Full-time undergraduate and college enrolments in mathematics and computer science peaked in the first half of the previous decade and declined thereafter, following the bursting of the dot.com bubble. The enrolment decline appears to have bottomed out in 2007–08. (See Figure 2-11). Some colleges and universities are reporting moderate increases in 2010–11 enrolments.

Enrolments in graduate programs increased in the latter half of the previous decade, though they now appear to have plateaued.

Figure No. 2-11
Full-Time Enrolment in Mathematics and Computer and Information Sciences
1992/93 to 2008/09
Statistics Canada, CANSIM

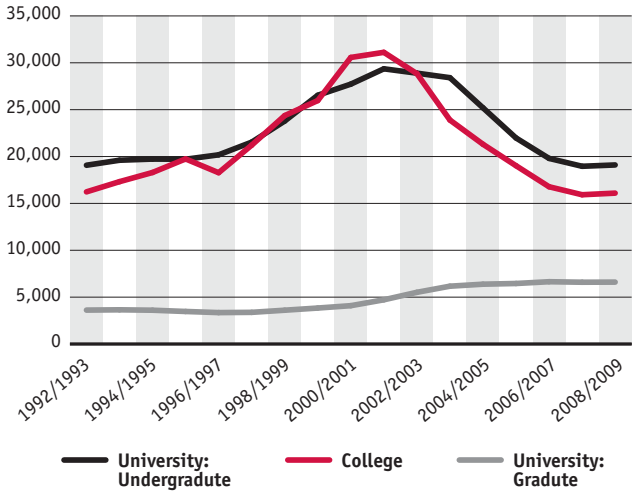
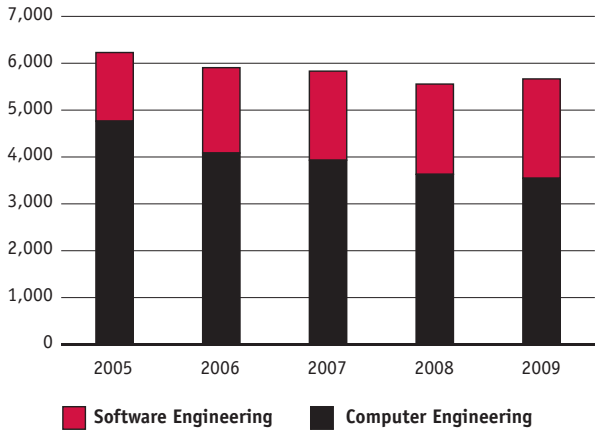


Figure 2-12 shows a similar, though less marked decline in undergraduate enrolments in software and computer engineering. Enrolment in software engineering increased by 45% compared to 2005. However, this increase was more than offset by a 26% decline in computer engineering enrolments.

Figure No. 2-12
Enrolment in Undergraduate Software and Computer
2005 to 2009
Engineers Canada, *Canadian Engineers for Tomorrow*



For the *2011 Outlook*, we are assuming that enrolment trends have stabilized. We therefore anticipate that recent enrolment levels will continue over the forecast period and that graduation rates can be estimated as a function of enrolment trends.

2. Business Technology Management:

The introduction of **Business Technology Management (BTM)** programs is a notable change in undergraduate program offerings in the university system. Students build their knowledge and skills on two foundations. First, they study the core business disciplines—marketing, operations management, accounting and finance, human resources management, and law. Second, students receive training in a range of ICT subjects—systems analysis and design, Internet and web-based applications, ICT architecture and infrastructure, and privacy and security. In their senior years, students integrate their learning from these two foundations to the strategic application of ICT across a range of business processes, including supply chain management, sales and customer relations. As well, students learn about project management and change management.

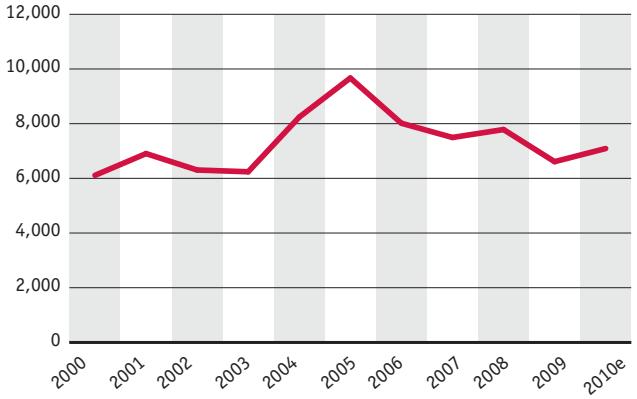
BTM programs address a major gap, namely the need for ICT professionals who understand both ICT and the business processes to which ICT is applied. The BTM program is an initiative of the industry-based Coalition for Tomorrow's ICT Skills (**www.ccict.ca**). The Coalition has also partnered with the Canadian Information Processing Society (CIPS) to offer an industry-recognized certification to program graduates. BTM programs are now offered, or about to be offered, by 12 universities. As these programs mature, they will graduate upwards of a 1,000 students annually. As more universities adopt the BTM model, the number of graduates who combine ICT training with business qualifications will increase. Towards the latter end of the forecast period, BTM graduates will account for 6–10% of new entrants into the ICT labour market. This will have a significant impact on the long-run capacity of Canadian employers to meet their skill needs.

The BTM program is an important advance. The BTM program addresses a central challenge, namely the need to construct post-secondary programs that are aligned with the capabilities profile that now dominates hiring requirements. Similar strategies are needed in other domains, including the health sector, the education system, the arts, and various sub-segments of business, such as manufacturing, finance, transportation, distribution, *etc.*

3. Immigration:

Internationally educated professionals account for approximately 14% of the ICT labour force, based on 2006 Census estimates. Immigration of ICT professionals peaked in 2005 with 9,670 persons immigrating to Canada and identifying an ICT occupation as their intended field of work.

Figure No. 2-13
Immigration Arrivals—Persons Identifying ICT Occupations as their Intended Occupation
2000 to 2010
Citizenship and Immigration Canada (Special Tabulation)



2010 estimated based on January to June data

It is difficult to gauge what proportion of internationally educated professionals have sufficient English or French language skills to effectively integrate into the ICT labour force and are willing to locate where relevant employment is offered. However, if 50% meet this test, then, on average, immigration supplies approximately 30% of the new supply of ICT professionals each year. In some regions, this proportion will be higher, while in others, it will be lower.

In addition to persons who immigrate to Canada as permanent residents, companies were also able to hire ICT professionals under the Temporary Foreign Worker program. Companies are also able to recruit candidates off-shore and fast-track their application for permanent resident status if they can demonstrate an inability to find the required skills in Canada. In a survey of 100 employers undertaken for this study with Ipsos Reid, roughly one-third of respondents indicated that they had used the Temporary Foreign Worker program at some point in the past.

In the *2011 Outlook*, we anticipate a stable immigration trend.

4. Women in ICT:

The ICT work force is approximately 75% men and 25% women.[15] There has been virtually no change in the share of women in ICT employment over the decade. Our consultations with industry confirm that many companies find this an unsettling trend because it narrows the size of the labour pool from which they must meet their skill needs.[16] Some companies have taken steps to address the imbalance, though the impact of these measures has not altered the overall trends.

In a survey of 90 employers undertaken for this study, in collaboration with Ipsos-Reid, 38% reported an increase in the number of women applying for ICT jobs, while 13% reported a decline. If these findings are representative, a modest increase in the share of women in ICT jobs may occur over the next five years.

For all employers, a major constraint on hiring more women into ICT jobs is the limited number of women who enter the labour pool in the first place. Figure No. 2-14 shows that there has been no increase in the share of women in university enrolments in mathematics and computer and information sciences. Indeed, at the graduate level, the share of women appears to have declined.

Reports from focus groups and interviews conducted for this study suggest that the share of women is higher in programs that combine ICT training with other skills, *e.g.*, business studies or the health sciences. Nevertheless, the overarching fact is that ICT employment is strongly skewed to men and that, in the main, the gender distribution of new entrants is reproducing the existing employment pattern. For employers who are seeking scarce skills (and,

[15] The trend in Canada is similar to the pattern throughout the OECD region. See European Commission, *Women and ICT: Status Report 2009* (March 2010). See also, Thomas J. Misa, ed. *Gender Codes: Why Women Are Leaving Computing* (Wiley/IEEE Computer Society Press, 2010).

[16] Information Technology Association in Canada, *ICT and Women* (December 2009)
Information and Communications Technology Council, *Taking Action on Women in ICT: Women in ICT National Forums Action Report* (March 2008)
CATA*Alliance* sponsors Canadian Women in Technolgy (CanWIT).

Figure No. 2-14
Share of Women in University Enrolments in Mathematics and Computer and Information Sciences
1992/1993 to 2008/2009
Statistics Canada, CANSIM

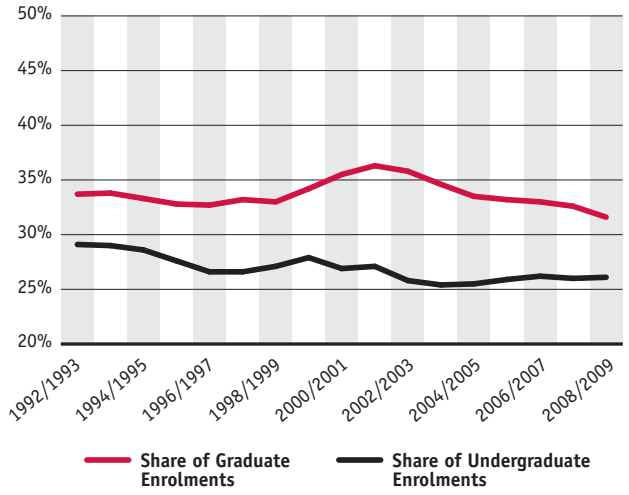
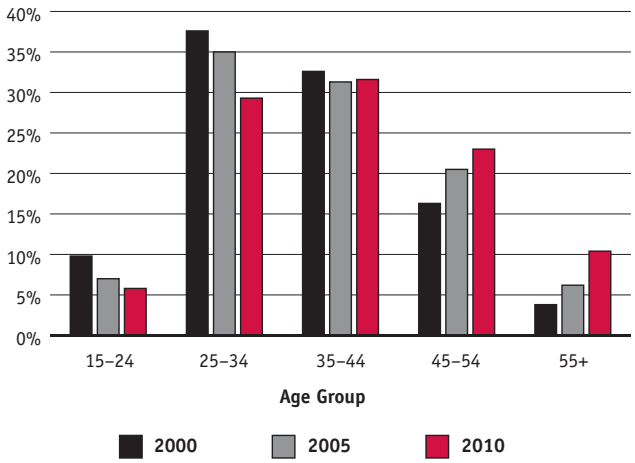


Figure No. 2-15
Approximate Age Distribution of ICT Labour Force
Base on January to March Averages, 2000, 2005 and 2010
Statistics Canada, *Labour Force Survey* (Special Tabulation)



more particularly, scarce *combinations* of skills) it is clearly important to invest more resources into broadening the labour pool. While there are steps that individual companies can undertake, this task is chiefly one that must be tackled at the sectoral level.

5. Demographics:

Two demographic facts are central to the ICT labour market. The first is that the ICT work force, on average, is younger than the overall labour force. In ICT, approximately 33% of the labour force is age 45 or older. In the labour force, as a whole, the proportion is 39%.

The second demographic fact is that the ICT labour force is aging. Over the course of the next ten years, demographically driven replacement demand will be more important than it has thus far been. Figure 2-15 shows that the proportion of the ICT workforce that is age 55 or older has increased from around 4% at the beginning of the last decade to somewhat more than 10% in 2010. The *2011 Outlook* factors increased replacement demand into the human resources needs forecast.

6. Adjustment Lags:

The ICT labour market adjusts with a lag to changes in demand. In the first pace, it takes time to train new ICT professionals. Depending on the occupation, training can range from one to two years for technician-level occupations to several years for occupations that require an advanced degree. Immigration and career changing also responds to demand trends, but only when those trends have been established for more than a year. A result of these adjustment lags, an increase in demand can encounter a temporary supply constraint until the supply adjusts to the new demand conditions.

Adjustment lags also operate when there is a cyclical or long-term decline in demand. Students who entered ICT programs when demand conditions were strong may graduate when the cycle has turned down. Individuals whose skills have been made redundant by technological change may not fully appreciate the scope of the change in the labour market. It may take a few years for them to acquire new skills or pursue a different career path.

C. Occupation Trends

1. Rapidly Growing Occupations:

The most rapidly growing ICT Occupations are those which combine ICT skills with an understanding of business needs. For most employers, the combination of ICT skills with an understanding of business needs is the most difficult skill profile for which to recruit. Figure No. 2-16 highlights the rapid employment growth, especially since 2005, of three categories of ICT occupations which reflect the combination of ICT skills and an understanding of business processes:

a) Information Systems Analysts and Consultants (*i.e.*, Business Analysts),

b) Database Analysts and Data Administrators, and

c) Computer and Information Systems Managers

Figure No. 2-16
Employment Trend for
Information Systems Analysts and Consultants (NOC C071)
Database Analysts and Data Administrators (NOC C072)
Computer and Information Systems Managers (NOC A122)
Index: 2000=100
Statistics Canada, *Labour Force Survey* (Special Tabulation)

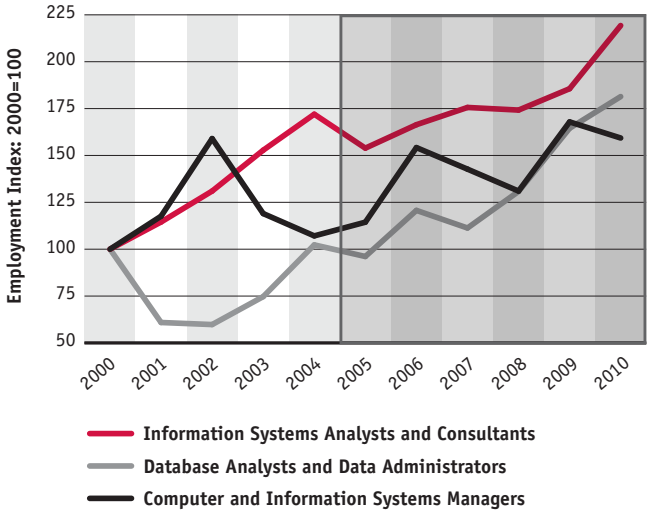


Figure 2-16 does not capture the granularity or specificity of employers' skill and experience requirements. The skills of a business analyst with experience in the oil and gas industry are not readily transferable to the health care sector.

With few exceptions, a database analyst with experience in inventory systems and supply chain management in the retail or wholesale sector cannot transfer that experience to the financial sector. Similarly, experience and expertise in one ERP application is not easily transferred to companies that utilize a different application. **The specificity or granularity of skill and experience requirements is absolutely central to the way in which the ICT labour market operates**.

Occupation	Estimated Employment 2010
Information Systems Analysts and Consultants (NOC C071)	145,200
Database Analysts and Data Administrators (NOC C072)	13,900
Computer and Information Systems Managers (NOC A122)	45,700

2. Engineers

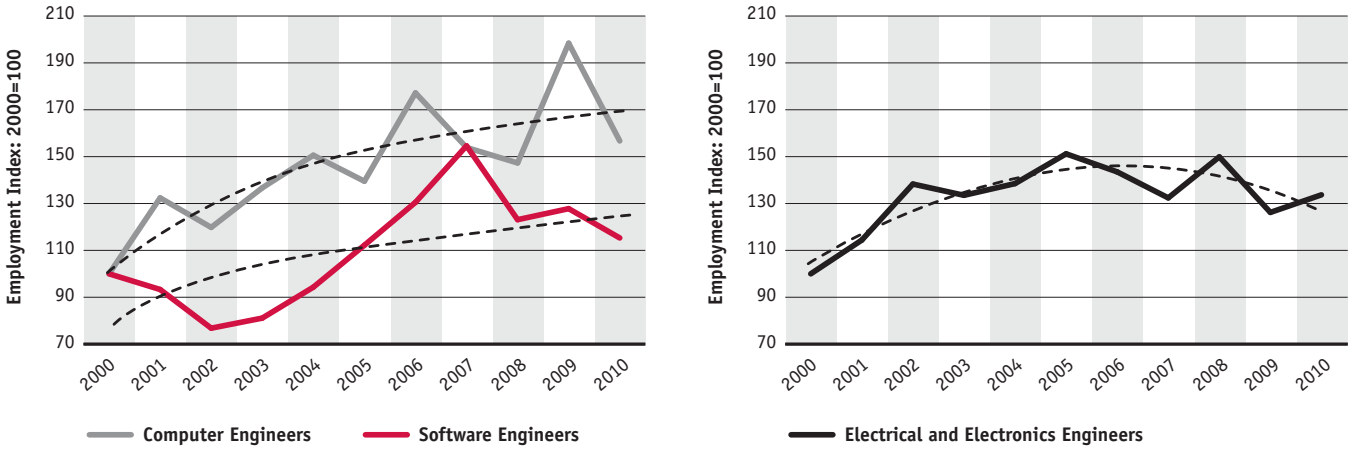
The trend in employment growth for computer engineers and software engineers was particularly strong from 2005 through to 2009. Employment in both occupations turned down in 2010, reflecting the decline in ICT investment that occurred in 2010. By comparison, the overall employment trend for electrical and electronics engineers was weaker.

Employment trends for all three categories of engineers are strongly affected by trends in R&D. As noted earlier, the rate of growth in R&D spending declined after 2005 when the appreciation of the Canadian dollar weakened Canada's cost advantage in the international competition for R&D work.

Occupation	Estimated Employment 2010
Computer Engineers (NOC C047)	25,400
Software Engineers and Designers (NOC C073)	30,300
Electrical and Electronics Engineers (NOC C033)*	10,000

* This estimate applies to Electronics Engineers only

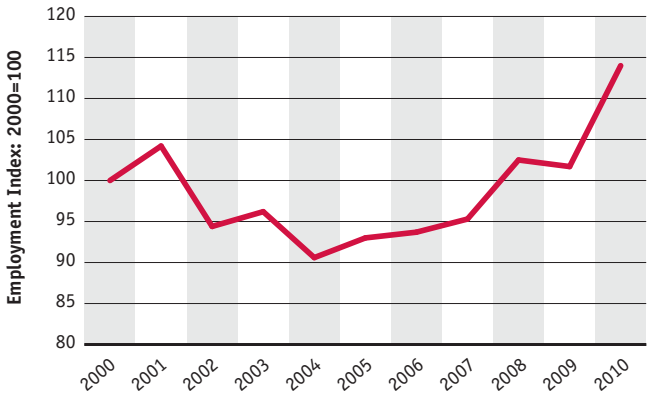
Figure No. 2-17
Employment Trend for Computer Engineers (NOC C047), Software Engineers and Designers (NOC C073), Electrical and Electronics Engineers (NOC C033)
Index: 2000=100
Statistics Canada, *Labour Force Survey* (Special Tabulation)



3. Computer Programmers

Computer programmers were among the occupations that were most severely affected by the bursting of the dot.com bubble and the end of the Y2K demand spike. Employment declined until 2004. Thereafter, employment increased by somewhat more than 3.0% per year. This is less than the employment growth rate for computer engineers and somewhat less than the employment growth rate for software engineers.

Figure No. 2-18
Employment Trend for Computer Programmers (NOC C074)
Index: 2000=100
Statistics Canada, *Labour Force Survey* (Special Tabulation)



Three factors tend to dampen the growth in demand for computer programmers. First, lower value programming is increasingly undertaken in off-shore locations. Second, outsourcing conserves on the overall requirements for programmers by utilizing programmers across more than one client. Third, trends such as Software-as-a-Service (SaaS), the move from proprietary software applications to customized off-the-shelf applications, and Service-oriented Architecture (SOA), all reduce the requirement for programmers.

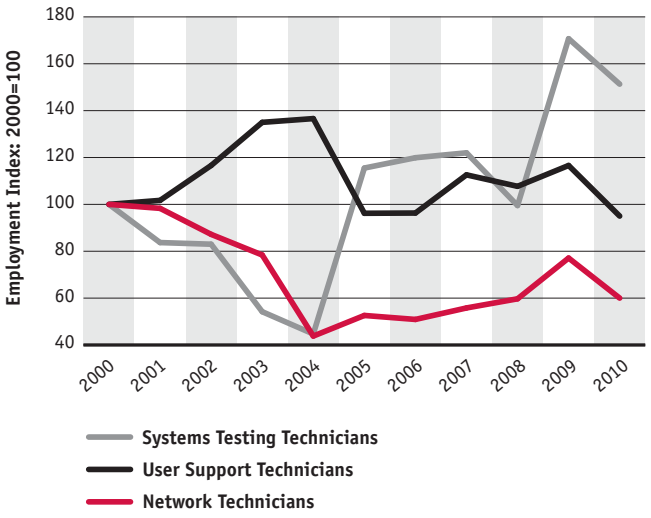
Occupation	Estimated Employment 2010
Computer Programmers (NOC C074)	100,400

4. Technicians

Figure 2-19 shows that employment trends for ICT technicians have been mixed.

Employment for user support technicians declined sharply when the first wave of outsourcing re-shaped the way ICT User industries managed their ICT. As well, many ICT Producers also outsourced at least Tier 1 support for their products and services. Since 2004, outsourcing and offshoring substantially offset the employment growth that otherwise would have occurred from the diffusion of ICT products and services. Self-help portals on the web have

Figure No. 2-19
Employment Trend for
Systems Testing Technicians (NOC C183)
User Support Technicians (NOC C182)
Computer Network Technicians (NOC C181)
Index: 2000=100
Statistics Canada, *Labour Force Survey* (Special Tabulation)



also diminished the need for user support technicians. There is no reason to expect a change in this trend over the next five years.

In contrast with the employment trajectory for user support technicians, employment of system testing technicians has increased rapidly since 2004. In part this reflects the increased reliance of ICT Users on their networks and the increased economic cost of system and application down-time.

Since the middle of the last decade, and up to the recession, employment of network technicians increased by 5.0–8.0% per year. For network technicians, there are two important changes in the technology environment—the increased importance of wireless networks and the emergence of the Cloud. The increased importance of wireless networks has changed skill requirements. The Cloud also will alter skill requirements. However, **the more important effect of Cloud computing will be to reduce the need for physical infrastructure and for the network technicians who maintain that infrastructure**.

Occupation	Estimated Employment 2010
Systems Testing Technicians (NOC C183)	7,800
User Support Technicians (NOC C182)	64,500
Computer Network Technicians (NOC C181)	48,800

D. Skill Trends

1. Technical Skill Needs:

Figure No. 2-20 summarizes the average degree of difficulty employers reported in the Ipsos Reid survey in recruiting particular ICT technical skills. Responses were based on an ascending 1–5 scale.

What is striking about Figure No. 2-20 is that, **in general, employers are not reporting significant difficulty in recruiting mainstream *technical skills per se***.

Figure No. 2-21drills further into the survey results to relate hiring difficulty to use of particular ICT technologies. Skills are then categorized into three groups based on the degree of difficulty reported by employers that use the technology.

As can be seen in Figure No. 2-21, employers that operate legacy applications, use SOA, and operate SAP, other ERP applications and CRM applications generally report above average difficulty in recruiting these technical skills. Conversely, employers that require support for SQL, networks (both wired and wireless), web design, Windows 7, and java platforms generally report below average difficulty in recruiting for those skills. These findings are generally consistent with those reported in various proprietary reports on 'skills in demand'.[17] They also reflect the weaker labour market conditions that prevailed in the last quarter of 2010.

Figure No. 2-22 reports hiring intentions for application development skills based on a survey conducted by Sapphire/IBM between June and September of 2010. The survey, it should be noted, reports hiring intentions, not expected difficulty in hiring, although there is undoubtedly a link between these. The Sapphire/IBM data are broadly similar to our own survey results, but suggest that hiring persons with .Net and java skills may be more challenging that suggested in our surveys.

[17] See, for example, reports published by Sapphire/IBM, Robert Half, and IDC Canada.

Figure No. 2-20
Degree of Difficulty in Recruiting Particular Technical Skills (Scale of 1–5 in Ascending Difficulty)
Executive Interviews conducted for ICTC by Ipsos-Reid
(n=100)

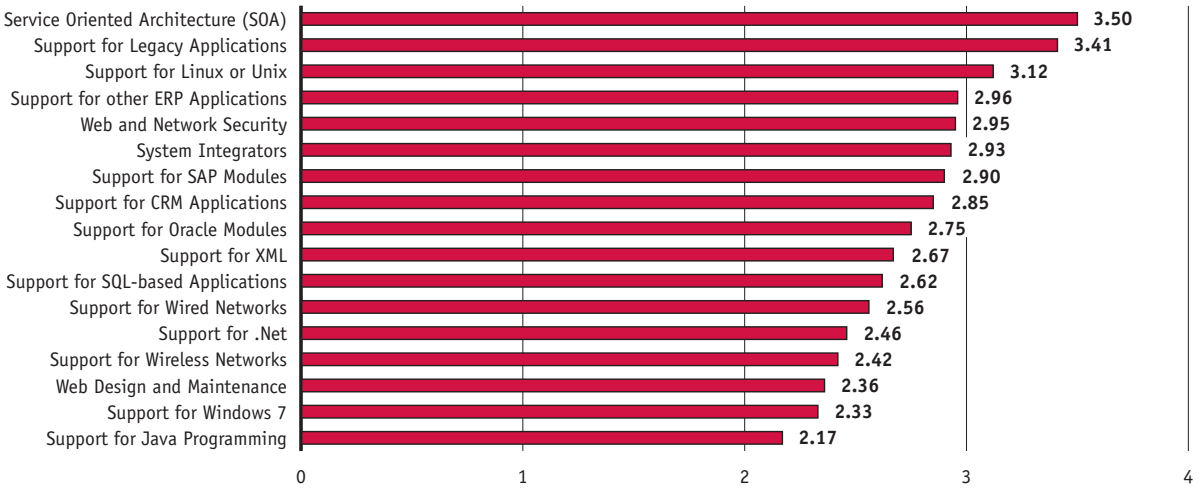
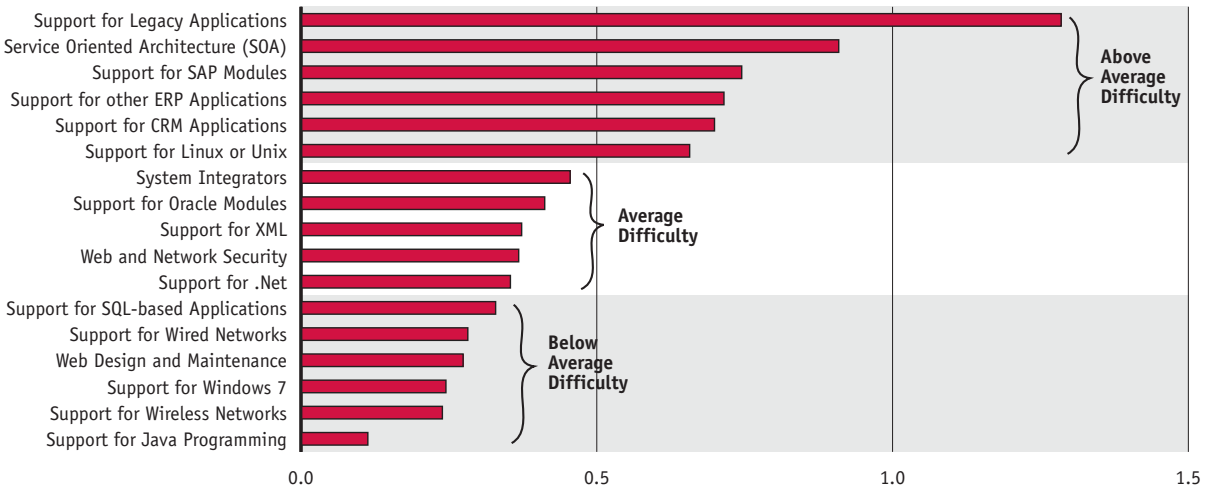
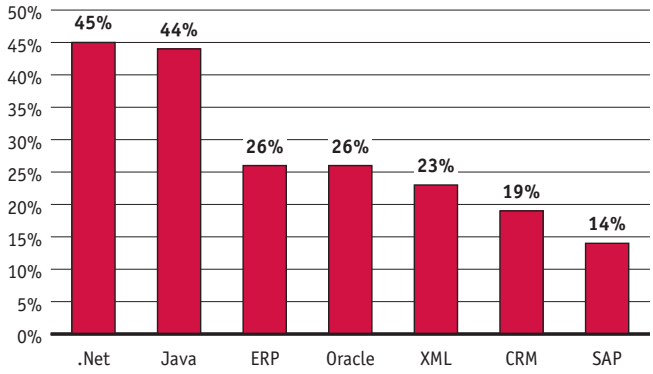


Figure No. 2-21
Recruitment Difficulty for Particular ICT Technical Skills relative to the Use of Those Technologies[18]
Executive Interviews conducted for ICTC by Ipsos-Reid
(n=100)



[18] The survey asked whether employers used a particular ICT technology and then asked about their degree of difficulty in recruiting that technical skill on a 1–5 scale. Figure No. 2-21 reports the ratio of those that report difficulty at levels 4 or 5 to those that reported using the technology. This ratio yields an approximate indicator of recruitment difficulty in relation to the use of the technology.

Figure No. 2-22
Application Development Skills in Demand
Percent of Survey Respondents Reporting Intention to Recruit for a Specific Skill
Sapphire/IBM Survey (2010)[19]
(Reproduced with Permission)



2. Certifications:

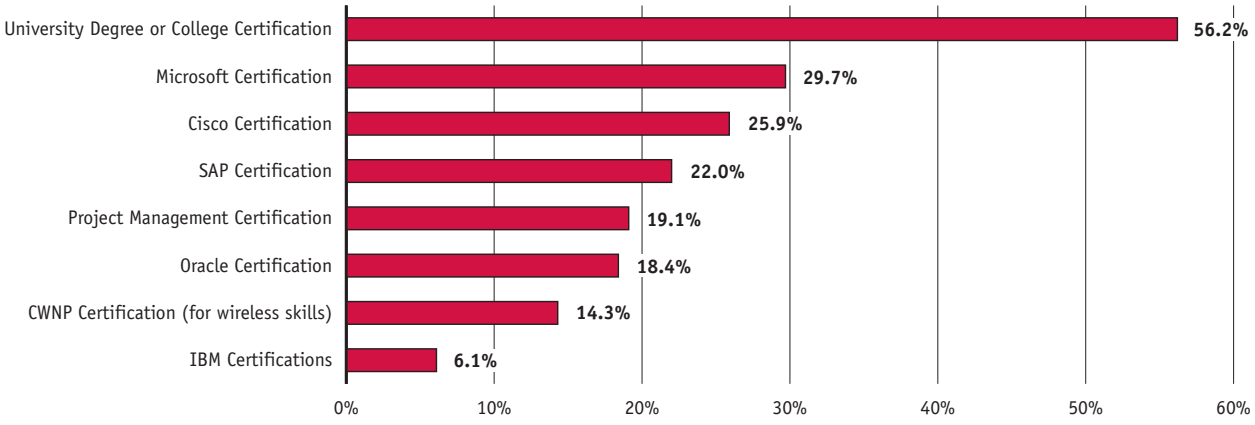
Figure 2-23 shows that **a university or college certification is by far the most important certification for employers**. Employers that attach moderate or high importance to a university or college qualification also are more likely to attach higher importance to industry certifications. In other words, **in the main, industry certifications are complements to, not substitutes for, a university degree or a college certification**. From the perspective of students, there is a significant advantage in completing a university or college program that offers both a post-secondary qualification *and* an industry certification.

3. Complementary Skill Needs:

Figure 2-24 shows the proportion of employers in the Ipsos Reid survey that reported moderate or significant difficulty in recruiting ICT professionals with key skills that complement ICT skills.

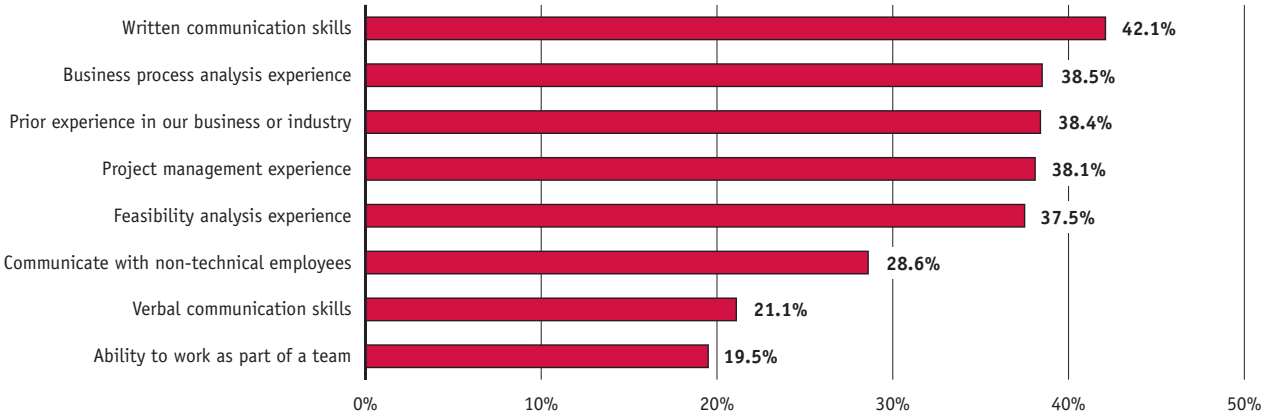
In general, employers reported that meeting their technical ICT skills is not their principal challenge. Rather, their most serious challenge is recruiting ICT professionals who have the *equally* important complementary skills.

Figure No. 2-23
Percentage of Employers who require Skills covered by a Certification and regard that Certification as Moderately or Very Important
Executive Interviews conducted for ICTC by Ipsos-Reid
(n=100)



[19] Sapphire/IBM, Canadian IT Staffing Outlook (2010).

Figure No. 2-24
Percent of Employers reporting Moderate or Significant Difficulty in Recruiting Particular Non-Technical Skills (Score of 4 or 5 on a 1–5 in Ascending Scale)
Executive Interviews conducted for ICTC by Ipsos-Reid
(n=100)



In our interviews and focus groups, employers distinguished between three types of complementary skills. The first are 'soft skills' such as written communication skills, the ability to communicate with non-technical employees and the ability to work as part of a team. The second are 'context skills' or 'domain understanding'. These are the skills that arise from understanding the business or organizational context in which ICT is being applied. The third are 'domain-specific technical skills'. These are the *non-ICT* technical skills that are associated with a particular industry or product. It is clear from our interviews and focus groups that **the economic value of ICT skills increases exponentially when they are allied with these complementary skills. Conversely, when ICT skills stand alone, they become 'commodity skills' which often can be provided more economically by off-shore suppliers**.

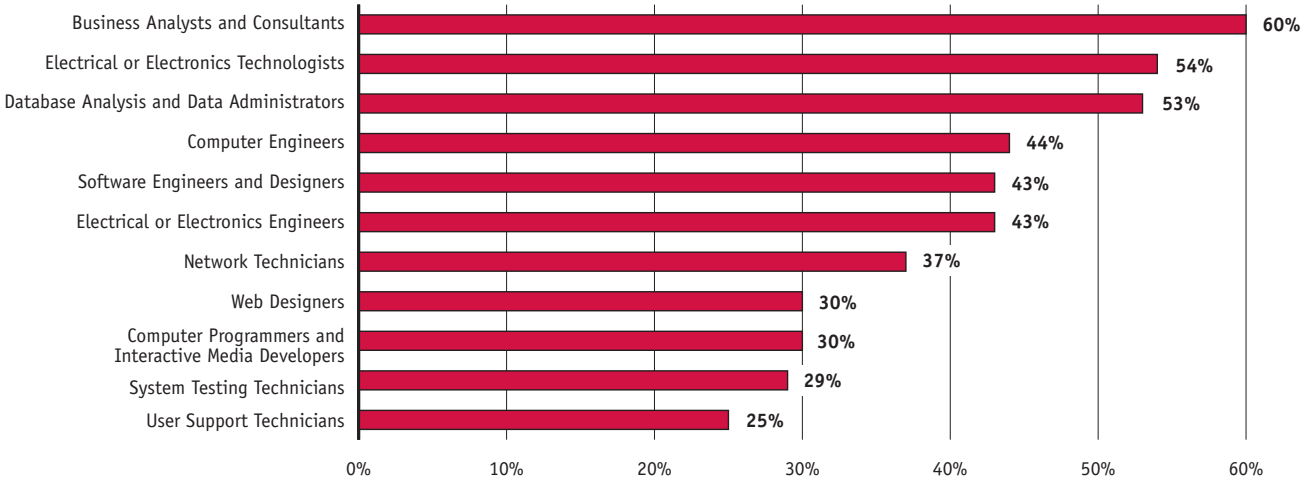
4. Experience Thresholds:

The overwhelming majority of ICT jobs require three to eight years of relevant experience. The essential reason for the experience threshold is that, in the view of most employers, the majority of post-secondary programs do *not* graduate students with the mix of technical and complementary skills that employers need. Most employers, therefore, have no choice but to impose experience requirements for new hires. As a result, **recent graduates must compete for the limited number of entry-level jobs where employers accept the cost of developing complementary skills and also bear the risk of their investment being lost if employees are 'poached'**.

Figure 2-25 shows the consequence of the **misalignment between the skill profile of recent graduates and the skill profile needed by the majority of employers**. As can be seen, even for junior or entry-level jobs, a large percentage of employers will *not* consider a recent graduate with no prior experience.

There is an inexorable logic to the dynamics of the ICT labour market. The post-secondary system produces too few graduates with skill profiles that are commensurate with employers' needs. As a result, many employers impose experience thresholds even for entry level jobs. This, in turn, has two consequences. First, many recent graduates have considerable difficulty transitioning into employment. And second, the intake at the bottom of the ICT job structure is too small to meet the subsequent need for *experienced* ICT professionals. As a result, **the ICT labour market is characterized by recurring and systemic skills shortages**. These shortages constrain the competitiveness of

Figure No. 2-25
Percent of Employers who would *not* consider Someone with less than One Year of Experience for a Junior or Entry-Level ICT Job
Executive Interviews conducted for ICTC by Ipsos-Reid
(n=35 to 81 depending on occupation)



the ICT industry and hamper the efficiency of ICT operations in User Industries. **The problem cannot be addressed in a piece-meal way. It requires looking holistically at how ICT programs are designed: what mix of skills students acquire in those programs, how they obtain practical experience alongside theoretical training, how the skill profile of graduates aligns with employers needs, and how recent graduates are then transitioned into entry-level jobs**.

5. The Aesthetic Dimension of User Interface

The role of aesthetics in designing user interface is not new. The Usability Professionals Association has been stressing the importance of aesthetic considerations in interface design for more than twenty years. However, the importance of mobile apps and gaming products, together with the contribution of design to the success of Apple's products, has focused new attention on the role aesthetic factors in developing products and designing their user interface. Many companies in ICT Producer Industries increasingly see design has a source of potentially significant competitive advantage that complements their core technical capabilities. As a result, **aesthetic or design capability has now entered the lexicon of skills that need to be allied to core technical skills**.

6. Highly-Qualified Professionals

Based on Labour Force Survey data, approximately 14.2% of ICT professionals have a post-graduate qualification. More significantly, between 2005 and 2010, persons with post-graduate qualifications accounted for more than a fifth (22.8%) of the increase in ICT employment. Though not restricted to the Producer Industries, the need for highly qualified professionals is more pronounced in these industries. This has implications for industry and government support for post-graduate studies and for immigration policy. **Both industry strategy and public policy need to align to the reality that the ICT sector in Canada increasingly is being anchored in highly specialized technical skills**.

3. Description of Labour Market Rankings

The *2011 Outlook* describes the labour market across 14 Core ICT Occupations and six regions. The labour market is portrayed in terms of five rankings. These rankings depict how the ICT labour market is experienced by both employers and job seekers. The forecast horizon is five years.

The Labour Market Rankings:

The labour market rankings are established on the basis of a forecasting model that incorporates supply and demand factors and is then adjusted based on industry consultations and an assessment of the likely impact of technology trends and off-shoring. The demand estimates are based on projections of output at the industry and regional level developed for ICTC by the Centre for Spatial Economics. Supply estimates take account of the historic responsiveness of the labour force to changes in employment, trends in enrolments and graduation in relevant post-secondary programs, and labour force aging estimates. The industry consultations which are relied on to adjust the forecast estimates are derived from executive interviews, focus groups, a web-based survey of employers, and an interview-based survey of employers. The latter survey was administered for ICTC by Ipsos Reid. A detailed description of the methodology is set out in Appendix A.

The five labour market rankings are:

The five labour market rankings are described in detail on the following pages. A matrix presentation showing how the descriptive variables change across the rankings is included in Appendix D.

The Timing of Changes in the Rankings:

In some projections, the forecasting model indicates a **change in conditions in a particular year. This should be interpreted as a signal that supply or demand conditions in the labour market are changing**. The timing of the change is a best estimate, based on current trends. **The timing could be brought forward or delayed** if technology adoption differs from what is expected, if ICT spending patterns depart from the forecast, if immigration or enrolments depart from projections, or if retirements are accelerated or delayed.

None of the Rankings describe Optimal Conditions:

***None* of the five labour market rankings represents optimal conditions. In all five rankings there are serious shortcomings that affect employers and job-seekers. What changes across the rankings is the severity of the problems that employers and job-seekers face**. In many regions, there are "Skills Shortages in Many Fields (Yellow)". Yellow is the most common ranking condition, but it can hardly be described as optimal. As will be evident from the description of this ranking, this ranking is characterized by widespread skills shortages, especially of *experienced* ICT professionals, and by serious difficulties in absorbing new graduates and internationally educated professionals (IEPs).

The negative characteristics of the various labour market rankings can only be altered by changing the way the labour market works. They cannot be changed by leaving the system on automatic pilot. That means dealing with the institutions or patterns that shape supply conditions. These include:

- the lack of gender diversity in the ICT labour pool,
- enrolment and graduation trends, including post-graduate trends,
- the design of post-secondary programs to better meet the capabilities profile required by employers,
- the immigration system, including the system's capacity to fast-track individuals with needed skills,
- the system for integrating IEPs,
- the way that recent graduates are transitioned into employment, and
- the opportunities for current ICT professionals to re-skill.

In the absence of human resources planning strategies that deal with the institutional mechanisms that shape supply (or fail to shape it), the ICT labour market will remain on automatic pilot. This will constrain the capacity of employers to grow their ICT work force and also limit the employment opportunities of those who want to pursue ICT careers.

Acute Excess of Supply over Demand

Recruiting Conditions: Employers typically experience **no difficulty recruiting for most types of ICT jobs**, at established compensation norms. They have **moderate, but manageable recruitment difficulties when recruiting for specific industry or technical experience or for leading edge skills**. Employers will only hire applicants that have the right mix of technical skills, related work experience and inter-personal skills. Employers make use of Temporary Foreign Workers only in exceptional cases.

Jobs and Job-Seekers: **Recent graduates experience acute difficulty in finding jobs commensurate with their training**. Many are forced to take jobs outside of the field for which they were trained. Most are 'crowded out' of the labour market by more experienced, laid-off ICT professionals who are seeking re-employment. **Unpaid internships are common. Recently arrived IEPs with no Canadian experience find it almost impossible to secure any ICT job, unless their English or French language skills are excellent**. Most are 'crowded out' of the ICT labour market by more experienced, laid-off ICT professionals who are seeking re-employment. **Typically firms have a hiring freeze. Exiting staff are not replaced. Job offers are predominantly for temporary or contract assignments**. Employee compensation and consultants' fees are stable and generally keeping pace with inflation. **Bonuses, however, are often suspended**. Job hopping and retention are not problems. Hiring inducements are not needed. Job applicants will often travel for an interview and are willing to relocate. There is little risk of project delays or cost overruns as a result of skill shortages. Outsourcing, when it occurs, is motivated entirely by cost reduction.

ICT Service Firms: The volume of consulting work is very low by historic norms as companies and organizations defer significant ICT investments. The volume of search work is **very low by historic norms** as companies and organizations are not hiring on a permanent basis. The volume of temporary placement work is very low by historic norms. However, the number of persons available for temporary work is high by historic norms.

Unemployment: Measured ICT occupational unemployment is 4.0% or higher.

Excess of Supply over Demand

Recruiting Conditions: Employers typically experience **no difficulty recruiting for most types of ICT jobs that require less than five years of experience**. In large labour markets (population 1.0 million or more), employers are generally able to recruit ICT workers with more than 5 years of experience. However, **in smaller labour markets, there are moderate difficulties in recruiting ICT workers with more than five years of experience**. Employers experience **moderate, but manageable, recruitment difficulties when hiring for specific industry or technical experience or for leading edge skills**. Employers will only hire applicants that have the right mix of technical skills, related work experience, and inter-personal skills. Employers make use of Temporary Foreign Workers only in exceptional cases.

Jobs and Job-Seekers: **Recent graduates experience acute difficulty in finding jobs commensurate with their training**. Many are forced to take jobs outside of the field for which they were trained. Most are 'crowded out' of the labour market by more experienced, laid-off ICT professionals who are seeking re-employment. **Unpaid internships are common. Recently arrived IEPs with no Canadian experience find it almost impossible to secure any ICT job, unless their English or French language skills are excellent**. Most are 'crowded out' of the ICT labour market by more experienced, laid-off ICT professionals who are seeking re-employment.

Offers for jobs requiring less than five years of experience are predominantly for temporary or contract assignments. Offers for jobs requiring five or more years of experience are about evenly divided between temporary or contract assignments Contract jobs are often used as a screening mechanism. Employee compensation and consultants' fees are stable and generally keeping pace with inflation. **Bonuses are paid, but not increasing**.

Excess of Supply over Demand *(continued)*

Job hopping and retention are not problems. Hiring inducements are not needed. Job applicants will often travel for an interview and are willing to relocate. There is little risk of project delays or cost overruns as a result of skill shortages. Outsourcing, when it occurs, is motivated entirely by cost reduction.

ICT Service Firms: The volume of consulting work is **lower than historic norms**. The volume of search work is also lower than historic norms. The number of persons available for temporary work is high by historic norms.

Unemployment: Measured ICT occupational unemployment is 3.5% to 3.9%.

Skills Shortages in Many Fields

Recruiting Conditions: Employers typically experience **no difficulty recruiting for most types of ICT jobs that require less than five years of experience**. However, **employers do experience difficulty recruiting for jobs that require five or more years of experience. These challenges are greater in population centres with less than 1.0 million population**. Search times increase for candidates with specific industry or technical experience or leading edge skills. **Delays in filling jobs may cause operational problems**. The use of search firms also increases. Employers strongly prefer applicants that have the right mix of technical skills, related work experience, and inter-personal skills, but will compromise for highly specialized or leading edge technical skills. Employers make moderate use of Temporary Foreign Workers where leading edge skills or highly specific experience are required, especially in areas where it may be difficult to attract domestic candidates who are willing to relocate.

Jobs and Job-Seekers: **Recent graduates who have participated in co-op or internship programs are generally able to obtain employment that is commensurate with their training**. Graduates from traditional programs typically experience much longer search periods and often are obliged to take ICT jobs for which they are over-qualified. Recently arrived IEPs with no Canadian experience find it almost impossible to secure an ICT job commensurate with their qualifications, unless their English or French language skills are excellent. **To gain Canadian experience, most IEPs take jobs for which they are over-qualified**. There is a discernible benefit to IEPs who participate in bridging programs that address language and experience deficits.

Job offers are about evenly divided between temporary and permanent jobs, even for jobs that require less than five years of years experience. Contract jobs are often used as a screening mechanism. Employee compensation and consultants' fees increase about 1–2% above inflation. Bonuses increase moderately.

Job hopping and retention are not serious problems, but **quitting for better opportunities does occur**. Hiring inducements are not needed. Job applicants will often travel but will require reimbursement for an interview. Applicants are generally willing to relocate. There is little risk of project delays or cost overruns as a result of skill shortages. Companies and organizations are cautious about outsourcing owing to possible quality risks, but continue to be attracted to outsourcing for cost reductions.

ICT Service Firms: The volume of consulting work is **on par with historic norms** as companies and organizations resume making ICT investments at historically normal levels. Many consulting firms increase their staffing. Hiring tends to be a mix of project-specific and core. The volume of search work and temporary placement work is on par with historic norms. The number of persons available for temporary work is also at historic norms. However, it is **common for employees to leave temporary assignments for other job offers**.

Unemployment: Measured ICT occupational unemployment is 3.0% to 3.4%

Excess of Demand over Supply: Pervasive Shortages

Recruiting Conditions: Employers experience **moderate difficulty in all labour markets in recruiting for jobs that require less than five years of experience**. This difficulty is **more significant in labour markets with a population under 1.0 million. Employers in all labour markets encounter significant difficulty in recruiting for most types of ICT jobs that require five or more years of experience**. To expand the pool of potential applicants, employers actively seek candidates from outside local and regional labour markets and reimburse these applicants for travel expenses related to interviews. Employers frequently participate in multi-employer job fairs.

Employers find it exceedingly difficult to recruit candidates with specific industry or technical experience or leading edge skills. Some employers report it is impossible to find qualified candidates. Delays in filling such jobs are systemic and cause operational problems. Use of search firms is the norm. Skill availability becomes a key factor in determining where to locate operations. **While employers prefer applicants that have the right mix of technical skills, related work experience, and interpersonal skills, they regularly compromise to meet their need for technical skills**. Employers make regular use of Temporary Foreign Workers, especially in labour markets where unemployment rates are especially low. **Companies and organizations are attracted to outsourcing about equally for cost reduction reasons and to alleviate skill shortages**. Skill shortages make delays and cost overruns a serious risk.

Jobs and Job-Seekers: **Recent graduates have little difficulty in obtaining employment that is commensurate with their training. Recently arrived IEPs with no Canadian experience, but with adequate language skills, are generally able to find employment that is approximately commensurate with their technical qualifications**, though not necessarily commensurate with their prior managerial experience. Most job offers are for permanent jobs. **There is pressure on employee compensation**. **Bonuses rise significantly**. There is a **significant increase in the use of perks**, including training benefits. Job hopping is common. Retention is a serious problem. Travel reimbursement for job interviews is the norm, as is relocation assistance. **Referral rewards for current staff, and retention bonuses to reduce turnover are common**.

ICT Service Firms: The volume of consulting work is **substantially higher than historic norms**. Resources are stretched to meet commitments. Firms may decline work or abstain from bidding on work that they previously would have undertaken. **Consultants' fees rise by 5–10% per year. Most large consulting firms are trying to expand their staff resources**. There is an **increase in sole sourcing** by customers to ensure priority. The volume of search work is substantially higher than historic norms. Search firms must invest considerably more professional time finding appropriate candidates. The volume of temporary placement work is substantially higher than historic norms. However, **the number of persons available for temporary work is well below historic norms. Staffing agencies are heavily reliant on recently arrived IEPs**.

Unemployment: Measured ICT occupational unemployment is 2.5% to 2.9%.

Acute Excess of Demand over Supply: Absolute Supply Constraints

Recruiting Conditions: Employers experience **significant difficulty across-the-board, in all labour markets, in recruiting for virtually all types of ICT jobs**. Employers in all labour markets have significant difficulty in recruiting for most types of ICT jobs that require more than five years of experience. To expand the pool of potential applicants, employers actively seek candidates from outside local and regional labour markets and reimburse these applicants for travel expenses related to interviews. Employers frequently participate in multi-employer 'job fairs' to expand their applicant pool. Large employers also engage in active international recruiting. **Employers will hire any applicant that has the required technical skills and some approximately relevant experience**.

Employers find it exceedingly difficult to recruit candidates with specific industry or technical experience or leading edge skills. **Some employers report it is impossible to find qualified candidates. Delays in filling such jobs are systemic and cause operational problems**. Use of search firms is the norm.

Skill availability becomes a key factor in determining where to locate operations. There are systemic delays, cancellations and cost overruns as a result of skill shortages. The primary motivation for outsourcing is to alleviate skill shortages.

Jobs and Job-Seekers: **Recent graduates have little difficulty in obtaining employment that is commensurate with their training. Recently arrived IEPs with no Canadian experience, but with adequate language skills, are generally able to find employment that is commensurate with their qualifications and experience. IEPs with language challenges are still hired**. Large firms often offer language instruction. Employers make regular use of Temporary Foreign Workers in most regions. Virtually all job offers are for permanent jobs. **There is significant pressure across-the-board on compensation, bonuses and perks**.

Job hopping is systemic. Retention bonuses and incentives are widespread. Travel reimbursement for job interviews is the norm as is relocation assistance. **Referral rewards** for current staff, and **retention bonuses** to reduce turnover are quite common

ICT Service Firms: **Consultants' fees rise by more than 10% per year. The volume of consulting work exceeds capacity**. There is a widespread perception that consulting firms are **stretched to their limit**. Most large consulting firms are trying to expand their staff resources. Sole sourcing is common by customers to ensure priority. The volume of search work is substantially higher than historic norms. Search firms must invest considerably more professional time finding appropriate candidates. The volume of temporary placement work is substantially higher than historic norms. However, the number of persons available for temporary work is well below historic norms. Staffing agencies are heavily reliant on recently arrived IEPs.

Unemployment: Measured ICT occupational unemployment is less than 2.5%.

4. Atlantic Region Outlook

Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages	Acute Excess of Demand over Supply: Absolute Supply Constraints

	2010	2011	2012	2013	2014	2015	2016
A122 Computer and information systems managers							
A311 Telecommunication carriers managers							
C033 Electrical and electronics engineers							
C047 Computer engineers (except software engineers)							
C071 Information systems analysts and consultants							
C072 Database analysts and data administrators							
C073 Software engineers and designers							
C074 Computer programmers and interactive media developers							
C075 Web designers and developers							
C141 Electrical & electronics engineering technologists & technicians							
C181 Computer network technicians							
C182 User support technicians							
C183 Systems testing technicians							
F124 Broadcast technicians							

Snapshot

Atlantic region employers will experience significant challenges recruiting for jobs that require five or more years of experience. The comparatively small size of the experienced labour pool will exacerbate these shortages as will the challenge of persuading out-of-region job-seekers to relocate to the Atlantic region. Recruitment challenges will be especially difficult for companies that are seeking leading edge skills. Smaller companies often will have difficulty competing for talent with public sector employers and with large outsourcers that use the Atlantic region as a base. Delays in filling these jobs will cause operational problems. After 2013, skill shortages will pose increasing risks to project timelines and project costs.

Recent graduates of co-op programs will generally be able to obtain employment commensurate with their training. However, graduates from traditional programs will experience much longer search periods. Many graduates from programs that lack a *practicum* component will be obliged to take ICT jobs for which they are over-qualified. Internationally educated professionals (IEPs) will experience similar difficulties.

Skills shortages will be more acute in four occupations:

- Computer and Information Systems Managers,
- Information Systems Analysts and Consultants,
- Electrical and Electronics Engineering Technologists and Technicians, and
- Broadcast Technicians.

Technology trends (most notably the adoption of 'Cloud' computing) and off-shoring will weaken demand for:

- Many types of Computer Programmers
- Computer Network technicians, and
- User Support Technicians, especially those without industry certifications.

Trends

Profile of ICT Employment:

Atlantic Canada accounts for approximately 5% of all workers in ICT Occupations.

The Atlantic region is an important centre for both domestic outsourcing operations and for 'near-shoring', *i.e.*, supplying outsourced ICT services to the United States. CGI, EDS, IBM, Xwave, Keane and CenterBeam, among others, all have facilities in the Atlantic region to service their outsourcing clients. The region is also host to major in-house technical support centres, especially in the telecom and wireless industries.

The prominence of outsourcing and user support work has a significant impact on the occupational profile of ICT employment in the Atlantic region. Three occupations that are central to outsourcing are: Computer Programmers, Computer Network Technicians, and User Support Technicians. In the Atlantic region, these three occupations account for around 41% of ICT employment whereas, on a national basis, their share in total ICT employment is only 34%.

Demand Trends:

Over the period 2011–2016, domestic spending on ICT will grow at a slower pace than during the five years prior to the downturn in 2008. Spending is projected to increase by approximately 3.6% annually. This compares with a 5.6% annual growth rate prior to the downturn. As a result, employment that is dependent on domestic ICT spending will grow more slowly over the next five years than prior to the downturn.

ICT Producers that sell into the international market can anticipate a recovery in demand on par with the growth rates that preceded the downturn, but only if they have a presence in the Asian market. Over the period 2011 to 2016, the Asian market will account for around 43% of the world growth in ICT spending. ICT Producers that are reliant on the U.S. and European markets should anticipate a slower growth in demand, unless their technology enjoys unique competitive advantages.

R&D spending by the private sector is projected to increase by 1.0% to 2.0% annually in value terms. The commensurate annual employment will increase 1.0% or less. This will primarily affect the demand for engineers involved in design functions.

Outsourcing, Off-shoring and Near-Shoring:

Domestic outsourcing of ICT work is projected to increase by approximately 5% per year over the next five years. This is a positive factor for ICT employment in the Atlantic region. The growth of near-shoring work, however, will be constrained by the appreciation of the Canadian dollar. Interviews with industry leaders suggest that the appreciation of the Canadian dollar has substantially reduced the Atlantic region's cost advantage. This is confirmed by the KPMG *Competitive Alternatives* comparison of regional costs which suggests that Halifax now has only an 8% (approximately) cost advantage over major U.S. centres in providing corporate and IT services.[20] Based on this change in relative costs, the *2011 Outlook* anticipates that near shoring work will increase by only 2.0 % to 3.0% per year.

The profile of outsourced work will also change. Some of the lower-value outsourced work that is currently undertaken in Atlantic Canada—notably Tier-1 'help desk'—will be displaced by off-shore resources and by the increased use of automated 'self-help' systems. Census data indicate that approximately 40% of User Support Technicians in the Atlantic region have no post-secondary qualifications. Some of the jobs performed by these individuals will be off-shored. Similarly, some lower-value programming work—'commodity work'—will also migrate to off-shore centres. Higher value application support work and Tier 2 technical support will be much less affected by off-shoring trends.

In the *2011 Outlook*, these trends are reflected in the weaker demand growth that is projected for User Support Technicians and Computer Programmers.

Recruitment Conditions:

In general, employers will have little or no difficulty filling ICT jobs that require less than five years of experience. More significant challenges will arise when recruiting for jobs that require five or more years of experience. These challenges will be especially difficult in Atlantic Canada owing to the comparatively small size of the experienced labour pool from which employers can recruit and their difficulty inducing out-of-region job-seekers to relocate. Recruitment challenges will be particularly difficult for companies that are seeking leading edge skills. Some employers will need to use Temporary Foreign Worker programs where those programs operate or nominee programs to recruit foreign ICT specialists with skills that cannot be sourced regionally.

[20] KPMG, *Competitive Alternatives*, 2010. www.competitivealternatives.com

Job hopping will not be a systemic problem. However, in the generally improved labour market conditions that will arise, especially after 2011, quitting for better opportunities will occur and turnover will increase. The talent pool will also be under pressure from out-of-region recruiters. Experienced ICT professionals can often command a higher salary premium for their experience in other regions.

Compared with other regions, immigration does not play as significant a role in meeting ICT human resources needs in the Atlantic region. As a result, some types of skills shortages tend to arise at an earlier stage in the economic cycle. This is especially the case with jobs that require highly specialized skills or significant business experience.

In 2011, there is little risk of project delays or cost overruns as a result of skill shortages. In 2012, the risk will increase marginally, but can likely be managed by longer hours and drawing on contract resources. After 2013, however, the risks of delays and cost over-runs will increase.

Job-Seekers:

Recent graduates of co-op or internship programs will generally be able to obtain employment that is commensurate with their training. However, graduates from traditional programs that do not have a *practicum* component will experience much longer search periods. In many cases, they will be obliged to take ICT jobs for which they are over-qualified.

Recently arrived IEPs who have no Canadian experience will find it almost impossible to secure an ICT job commensurate with their qualifications, unless their English language skills are excellent. To gain Canadian experience, most IEPs will need to consider jobs for which they are over-qualified.

Job offers will be about evenly divided between temporary and permanent jobs. Employers will use contract jobs as a screening mechanism, especially for jobs that require less than five years of experience.

Specific Occupations

Computer and Information Systems Managers:

Shortages of Computer and Information Systems Managers will be driven by demographic factors which will account for approximately 80% of the demand. The shortages will be most acute for positions that require ten years or more of previous managerial experience.

Hiring requirements could be brought forward, if the retirement rate before age 65 increases above projections. Conversely a deferral of retirement plans would ease human resources planning challenges. In some sectors, notably the public sector and major utilities, the average age of managers tends to be higher and the need to replace retiring managers will occur earlier.

The labour market ranking for this occupation moves from 'Skill Shortages in Many Fields (Yellow) ' in the first part of the forecast period to 'Excess of Demand over Supply: Pervasive Shortages (Orange)'. This reflects the cumulative impact of retirement factors.

Telecommunications Carriers Managers:

The overall labour market conditions for Telecommunications Carriers Managers correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking. However, this ranking conflates two distinct trends. In the wired segment of the industry, employment growth will be slow and demand will be determined almost entirely by replacement requirements. In the wireless segment of the industry, the growth in the user base and the entry of new suppliers will support increased demand. Employers in the wireless sector of the telecommunications industry will face more difficult hiring challenges.

Electrical and Electronics Engineers:

Demand for Electrical and Electronics Engineers declined in 2010 as a consequence of the general economic downturn. This decline is expected to be temporary and comparatively brief. Over the entire forecast period, labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking in the projection system. In these circumstances, recent graduates without co-op or internship experience will have difficulty finding employment. Employers will experience moderate to significant difficulties in recruiting Electronics Engineers with five or more years of experience and with technology-specific experience.

Computer Engineers:

Demand for computer engineers will be held back by the slowdown in R&D spending and by the lower rate of spending growth for ICT, especially for hardware. For most of the forecast period, labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking in the

projection system. In these circumstances, employers will experience moderate to significant difficulties in recruiting computer engineers with five or more years of experience and with technology-specific experience. Recruitment challenges will be aggravated by the small size of the labour market pool in Atlantic Canada with advanced ICT qualifications. More serious shortage conditions are projected to emerge towards the end of the forecast period.

Information Systems Analysts and Consultants (Business Analysts):

The continued penetration of ICT into new domains will increase the need for Information Systems Analysts and Consultants. The adoption of e-health technologies will be particularly important, although the ICT adoption trend is by no means limited to the health care sector.

Information Systems Analysts and Consultants require a mix of technical ICT skills and an understanding of the business and organizational processes of ICT Users. This mix of ICT technical skills and an understanding of business processes is in systemic short supply. The supply challenges are compounded by the additional factor that experience must be domain-specific. A Business Analyst with experience in one domain (*e.g.*, supply chain management in the retail sector) is not readily deployable in another domain (*e.g.*, the health care sector). In the labour market forecast, these supply challenges are evident in the skill shortages that are expected to be systemic from 2013 onwards. If spending on ICT projects accelerates before 2013, the shortage conditions will be brought forward.

The labour market ranking for Information Systems Analysts and Consultants moves from 'Skill Shortages in Many Fields (Yellow)' in the first part of the forecast period to 'Excess of Demand over Supply: Pervasive Shortages (Orange)' by 2012. These pervasive shortages may arise earlier. In these circumstances, delays in filling job openings will be systemic and will cause operational problems. Some employers will find that it is impossible to recruit qualified candidates. From an overall perspective on the ICT labour market, the pending shortage of Information Systems Analysts and Consultants is the number one human resources planning challenge.

Database Analysts and Administrators:

Labour market conditions for Database Analysts and Administrators will gravitate to the 'Skill Shortages in Many Fields (Yellow)' ranking throughout the forecast period. Although some lower-value database work will be off-shored, more complex analysis will continue to be done either in-house or by domestic based outsourcing operations.

Domain-specific experience is a critical qualification for Database Analysts and Administrators. The need for domain-specific experience will aggravate recruitment challenges.

Legacy applications are particularly important in the database field. The skills required to maintain legacy applications are not being renewed. Employers that need to support their legacy applications will have increasing difficulty in recruiting those skills. These shortages may drive some employers to off-shore their application support work or replace their legacy applications with customized off-the-shelf applications.

Software Engineers and Designers:

Demand for Software Engineers declined in 2010. This decline is expected to be temporary. However, demand is expected to increase only moderately over the forecast period. For most of the forecast period, labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking in the projection system.

Software Engineering has the highest proportion of professionals with graduate degrees (27.3%) of all the ICT Occupations. The supply of experienced Software Engineers is comparatively limited in the Atlantic region. So also is the supply of persons with advanced degrees in software engineering. The lack of scale is a major problem for both employers and job-seekers. For employers, the small labour pool compounds the challenges in finding Software Engineers with relevant experience. For job-seekers, the small size of the market for Software Engineers means that many will be unable to find jobs that match their qualifications.

Computer Programmers and Interactive Media Developers:

In the Atlantic region, the ICT labour market for Computer Programmers will be dominated by a widespread and serious mismatch between the skills and experience needed by employers and the skills and experience (or lack thereof) offered by a many job-seekers. On the demand side three trends will weaken the demand for *certain types* of Computer Programmers. The first, and most important of these trends, will be the continuing migration of lower-value programming work to off-shore locations. The second trend of importance will be the increasing prominence of design strategies that reduce the amount of programming and application support required. Service-oriented architecture (SOA) is central to this trend. And finally, a third factor that will reduce the demand for certain types of programming skills is the general movement away from proprietary software applications to customized off-the-shelf applications. This includes Software-as-a-Service provided by Cloud services. The skills that are affected by these trends will be in decline over the forecast period.

At the same time, other trends in ICT will generate new (or continuing) skill requirements that employers will have difficulty meeting. Industry interviews indicate a general shortage of experienced Computer Programmers who can work in a java programming environment. As well, employers will continue to confront a shortage of qualified job-seekers who have experience in customizing and supporting particular applications in a specific domain context. The increase in the importance of domain experience compounds the challenge of meeting skill needs. Recruiting Programmers who can support legacy applications will be an *increasing* challenge as Programmers with experience supporting these applications retire.

The result of these trends is that there will be an *increasing* misalignment between the skills and experience of job-seekers and the skills and experience that are required by employers.

Web Designers and Developers:

The extension of web applications to an increasing range of businesses and business operations will support moderate growth in demand for Web Designers and Developers. This growth, however, will be somewhat undercut by the trend to off-shore or automate some of the basic aspects of web design and web maintenance. The growth of mobile devices has also generated a need to optimize existing sites for these devices. The growing importance of web interfaces increases the importance of the aesthetic dimension ('the coolness') of user design. Employers seeking this additional skill will encounter pervasive shortages which will only be alleviated when more programs link traditional design skills with training in web development.

A notable feature of web design has been the increased technical sophistication of web sites. Web designs that were previously undertaken in HTML by the 'self-taught' have been replaced by automated templates. Customized web development now requires a greater level of technical skill, including the ability to program in a range of platforms at both the server and the client level. Industry interviews suggest a shortage of experienced Web Designers who can work in Flash.

Electrical and Electronics Engineering Technologists and Technicians:

Demand for electrical and electronics engineering technologists and technicians is projected to increase over the forecast period such that skill shortages become evident by 2014. The growth in demand is being driven by the increased application of ICT to various manufactured products and production processes. It is important to distinguish between Electronics Engineering Technologists and Technicians and Electronics Engineers. Engineers are primarily employed in design functions. The key determinant of demand for Engineers, therefore, is new investment spending and R&D spending. Technicians and Technologists are primarily employed in operations functions and in maintenance and support functions. The key determinant of demand for Technicians and Technologists, therefore, is the growth in the installed base of electronics equipment and applications. Most electronics equipment and applications are proprietary. Consequently, many employers have formalized training for new hires.

Computer Network Technicians:

Demand for Computer Network Technicians is projected to weaken over the forecast period, moving from 'Skill Shortages in Many Fields (Yellow)' to 'Excess of Supply over Demand (Green)'. This is a change from the period prior to the economic downturn when demand increased strongly. The change in labour market conditions arises from the anticipated impact of 'Cloud' computing and, to a lesser degree, 'virtualization'. As discussed earlier in this report,

one of the important implications of 'Cloud' computing—noted in the *OECD Information Technology Outlook, 2010*—is the reduction in physical infrastructure requirements and the consequent reduction in the employment of persons who maintain networks. The adoption of 'Cloud' computing is not a certainty. However, the view taken in this report is that the economic attraction of 'Cloud' computing for User Industries is so strong that those incentives will drive its adoption over the forecast period.

A related trend relevant to Computer Network Technicians is the increased importance of integrating wired networks with wireless networks. This trend also implies new skill needs beyond the traditional core of technical skills.

User Support Technicians:

Labour market conditions for User Support Technicians are projected to be weak, corresponding to 'Excess of Supply over Demand (Green)' at least in the initial part of the forecast period. The primary reason for this trend is that, 'Tier 1 Help Desk' work will migrate increasingly to off-shore locations. As noted earlier, Census data indicate that 40% of User Support Technicians in the Atlantic region have no *post-secondary qualifications*. The skills of these workers are easily reproducible at substantially lower costs in off-shore jurisdictions. Persons with sufficient training to assume 'Tier 2' or 'Tier 3' help desk roles will continue to be in demand. 'Tier 3' Support Technicians typically hold industry certifications in addition to a post-secondary qualification. Notwithstanding the general excess supply of User Support Technicians, employers in many parts of the Atlantic region will encounter difficulty in recruiting persons with industry certifications in addition to their post-secondary qualifications. Strategies to strengthen the Atlantic region's competitive edge in 'near-shoring' and 'outsourcing' should focus on strengthening human resources, rather than trying to offset the appreciation of the Canadian dollar. A key focus should be to expand the pool of User Support Technicians with industry recognized certifications *e.g.*, MSCE, Oracle, SAP, Cisco, *etc.*

Systems Testing Technicians:

Demand for Systems Testing Technicians will increase moderately over the forecast period in tandem with the increased penetration of ICT into other domains in business and the public sector. E-health systems, in particular, are likely to increase the demand for reliability testing as will concerns about liability from malfunctioning systems.

Broadcast Technicians:

The need for Broadcast Technicians is driven by two factors—retirements and an expansion of the broadcast industry. The growing penetration of fibre optic cabling and the integration of broadcasting with telecom and the internet will also alter the skills profile required by employers. The need to replace retiring workers is especially significant in the Atlantic region. Pervasive shortages are expected to arise this year and to continue over most of the forecast period.

5. Quebec Outlook

Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages	Acute Excess of Demand over Supply: Absolute Supply Constraints

	2010	2011	2012	2013	2014	2015	2016
A122 Computer and information systems managers							
A311 Telecommunication carriers managers							
C033 Electrical and electronics engineers							
C047 Computer engineers (except software engineers)							
C071 Information systems analysts and consultants							
C072 Database analysts and data administrators							
C073 Software engineers and designers							
C074 Computer programmers and interactive media developers							
C075 Web designers and developers							
C141 Electrical & electronics engineering technologists & technicians							
C181 Computer network technicians							
C182 User support technicians							
C183 Systems testing technicians							
F124 Broadcast technicians							

Snapshot

Quebec employers will experience significant challenges recruiting for jobs that require five or more years of experience. These challenges will be greater outside of the Montreal region owing to the comparatively smaller size of the experienced labour pool. Recruitment challenges will be especially difficult for companies that are seeking leading edge skills. Delays in filling these jobs will cause operational problems.

Recent graduates of co-op programs will generally be able to obtain employment commensurate with their training. However, graduates from traditional programs will experience much longer search periods. Many will be obliged to take ICT jobs for which they are over-qualified. Internationally educated professionals (IEPs) will experience similar difficulties.

Skills shortages will be more acute in three occupations:

- Computer and Information Systems Managers,
- Information Systems Analysts and Consultants, and
- Broadcast Technicians.

The ICT industry is currently experiencing and will continue to experience significant challenges in recruiting Computer Programmers who have leading edge or highly specialized skills and can combine these technical skills with essential soft skills (most notably team working, communications and problem solving).

Towards the end of the forecast period, there is also a significant risk of shortages arising for

- Computer Engineers, and
- Electrical and Electronics Engineering Technologists and Technicians.

Technology trends (most notably the adoption of 'Cloud' computing) and off-shoring will reduce demand for:

- Computer Network technicians, and
- User Support Technicians.

Skill shortages outside of the greater Montreal region will arise sooner and will be more acute owing to the smaller size of those labour markets.

Trends

Profile of ICT Employment:

Quebec accounts for approximately 23% of all workers in ICT Occupations.

Quebec has both a substantial ICT User Industry base and also an important ICT Producer Industry base. There are similarities in the skills needs of ICT Users and ICT Producers, but also important differences.

Quebec has a particularly notable presence in the development of applications for electronic gaming. Help desk operations (both in-house and outsourced) are attracted to Quebec by the province's supply of qualified and bilingual workers. The need to provide web services in both English and French also leads many companies and organizations to source some or all of their web support operations in Quebec. As a result, Quebec has become a significant exporter of ICT services to other regions of Canada, as well as to the United States.

Demand Trends:

Over the period 2011–2016, domestic spending on ICT will grow at a slower pace than during the five years prior to the downturn in 2008. Spending is projected to increase by approximately 3.6% annually. This compares with a 5.6% annual growth rate prior to the downturn. As a result, employment that is dependent on domestic ICT spending will grow more slowly over the next five years than prior to the downturn. In the labour market forecast, these trends are reflected in the intermediate ranking that applies to the majority of occupations.

Quebec-based ICT Producers that sell into the international market can anticipate a recovery in demand on par with the growth rates that preceded the downturn, but only if they have a presence in the Asian market. Over the period 2011 to 2016, the Asian market will account for around 43% of the world growth in ICT spending. Quebec-based ICT Producers that are reliant on the U.S. and European markets should anticipate a slower growth in demand, unless their technology enjoys unique competitive advantages.

R&D spending by the private sector is projected to increase by 1.0% to 2.0% annually in value terms. The commensurate annual employment will increase 1.0% or less. This will affect primarily the demand for Computer Engineers and Software Engineers who focus on system and application design.

Outsourcing, Off-shoring and Near-Shoring:

Domestic outsourcing of ICT work is projected to increase by approximately 5% per year over the next five years. The growth of near-shoring exports to the U.S, however, will be constrained by the appreciation of the Canadian dollar. Nevertheless, the employment generated by near-shoring work is expected to increase by 1.0 to 2.0% per year over the forecast period.

The profile of outsourced work will change over the forecast period. Some of the lower-value outsourced work that is currently undertaken in Quebec—notably Tier-1 'help desk'—is at risk of being displaced by off-shore resources or by the increased use of automated 'self-help' systems. The bilingual 'anchor' will reduce, but will not eliminate, the movement of help desk work to off-shore locations. Some lower-value programming work—'commodity work'—also will migrate to off-shore centres. Higher value application support work and Tier 2 technical support will be largely unaffected by off-shoring trends.

Recruitment Conditions:

In general, employers will have little or no difficulty filling ICT jobs that require less than five years of experience. However, much more significant challenges will arise when recruiting for jobs that require five or more years of experience. These challenges will be more difficult outside of the Montreal region owing to the comparatively small size of the experienced labour pool from which employers can recruit and their difficulty in inducing job-seekers to relocate. Recruitment challenges will be especially difficult for companies that are seeking leading edge skills. These difficulties are likely to increase over the forecast period. Delays in filling these jobs will cause operational problems. Some employers will need to use Temporary Foreign Worker programs where those programs operate or nominee programs to recruit foreign ICT specialists with skills that cannot be sourced regionally.

Job hopping will not be a systemic problem. However, quitting for better opportunities will occur and turnover rates will increase over the forecast period.

Internationally educated professionals (IEPs) account for around 7.0–8.0% of workers in ICT Occupations. This compares with approximately 14% on a national basis. The occupations with the highest proportions of IEPs are Computer Engineers (14%) and Software Engineers (13%). Access to IEPs will reduce, but will not eliminate, the severity of skills shortages.

Skills shortages will be a serious challenge for both ICT Producers and ICT Users. For ICT Producers, the shortages will focus on Computer Programmers and Software Engineers with more than five years of experience, with proficiency in leading edge skills and with the ability to work in a team-based development environment. For ICT Users, the most serious shortages will focus on Computer and Information Systems Managers and Business Analysts.

Job-Seekers:

Recent graduates of co-op or internship programs will generally be able to obtain employment that is commensurate with their training. However, graduates from traditional programs that do not have a *practicum* component will experience much longer search periods. In many cases, they will be obliged to take ICT jobs for which they are over-qualified.

Recently arrived IEPs who have no Canadian experience will find it almost impossible to secure an ICT job commensurate with their qualifications, unless their French language skills are excellent. In the ICT Producer industries it is also important to have competence in English as most programming is done initially in English. To gain Canadian experience, most IEPs will need to consider jobs for which they are over-qualified.

Specific Occupations

Computer and Information Systems Managers:

Shortages of Computer and Information Systems Managers will be driven by demographic factors which will account for approximately 80% of the demand. The shortages will be most acute for positions that require ten years or more of previous managerial experience.

As noted, retirement is by far the most important determinant of hiring requirements. Hiring requirements could be brought forward, if the retirement rate before age 65 increases above projections. In some sectors, notably the public sector and major utilities, the average age of managers tends to be higher and the need to replace retiring managers will occur earlier.

The labour market ranking for this occupation will move from 'Skill Shortages in Many Fields (Yellow)' in the first part of the forecast period to 'Excess of Demand over Supply: Pervasive Shortages (Orange)' in 2013. This reflects the cumulative impact of retirement factors.

Telecommunications Carriers Managers:

The overall labour market conditions for Telecommunications Carriers Managers correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking. However, this ranking conflates two distinct trends. In the wired segment of the industry, employment growth will be slow. Demand for managers in the wired segment of the telecommunications industry will be determined almost entirely by replacement requirements. In the wireless segment of the industry, the growth in the user base and the entry of new suppliers will support increased demand. Employers in the wireless sector of the telecommunications industry will face more difficult hiring challenges.

Electrical and Electronics Engineers:

Electronics engineers are primarily employed in designing hardware applications. Spending on R&D is projected to grow more slowly over the next five years compared to the five years before the general economic downturn. The slower growth of R&D spending will constrain the employment growth of Electronics Engineers.

Labour market conditions are currently estimated to be weak, but will improve over the forecast period. After 2012, labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking. In these circumstances, recent graduates without co-op or internship experience will have difficulty finding employment. Employers will experience moderate to significant difficulties in recruiting Electronics Engineers with five or more years of experience and with technology-specific experience. Employers seeking leading edge skills will have much more significant difficulty in meeting their needs.

Computer Engineers:

Demand for computer engineers also will be held back by the slowdown in R&D spending and by the lower rate of spending growth for ICT, especially for hardware. For most of the forecast period, labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking. Employers will encounter moderate to significant difficulties in recruiting computer engineers with five or more years of experience and with technology-specific experience. More serious shortage conditions are projected to arise towards the end of the forecast period. Employers seeking leading edge skills will have much more significant difficulty in meeting their needs especially towards the end of the forecast period.

Information Systems Analysts and Consultants (Business Analysts):

The continued penetration of ICT into new domains will increase the need for Information Systems Analysts and Consultants. The adoption of e-health technologies will be particularly important, although the ICT adoption trend is by no means limited to the health care sector.

Information Systems Analysts and Consultants require a mix of technical ICT skills and an understanding of the business and organizational processes of ICT Users. This mix of ICT technical skills and an understanding of business and organizational processes is in systemic short supply. The supply challenges are compounded by the additional factor that experience must be domain-specific. A Business Analyst with experience in one domain (*e.g.*, supply chain management in the retail sector) is not readily deployable in another domain (*e.g.*, the health care sector). In the labour market forecast, these supply challenges are evident in the skill shortages that are expected to be systemic from 2013 onwards. If spending on ICT projects accelerates before 2013, the shortage conditions will be brought forward.

The labour market ranking for Information Systems Analysts and Consultants will be 'Excess of Demand over Supply: Pervasive Shortages (Orange)' for most (or all) of the forecast period. In these circumstances, delays in filling jobs openings will be systemic and will cause operational problems. Some employers will find that it is impossible to recruit qualified candidates, especially outside of the greater Montreal area.

Database Analysts and Administrators:

Labour market conditions for Database Analysts and Administrators will generally gravitate to the 'Skill Shortages in Many Fields (Yellow)' ranking over the forecast period. Towards the end of the forecast period (2015), there may be a risk of tighter labour market conditions and more pervasive skills shortages. Three factors are supporting the demand for Database Analysts and Administrators: (i) an increase in replacement demand as a result of an increase in retirements, (ii) the increased use of databases to manage more aspects of business operations, and (iii) the increased use of data mining to identify marketing opportunities.

Domain-specific experience is a critical qualification for Database Analysts and Administrators. The need for domain-specific experience will increase the recruitment difficulties experienced by employers and draw out the job-search period for job-seekers. Legacy applications are particularly important in the database field. The skills required to maintain legacy applications are not being renewed.

Software Engineers and Designers:

Software design is highly internationalized. Some large developers maintain design centres in more than one country. The geographic location of design work is determined by a number of factors. These include the cost of skilled labour, business ownership and structure, and the availability of skills—especially advanced and specialized skills. Software Engineers have the highest proportion of workers with graduate degrees (27%) of all ICT Occupations. Employers' skills needs are highly granular. That is to say, when hiring Software Engineers, employers have highly specific experience and technology requirements. Meeting these needs is challenging in almost all circumstances.

For most of the forecast period, labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking. In these circumstances employers will experience moderate to significant difficulty in recruiting qualified candidates with relevant technology and business experience. Employers seeking leading edge skills will have much more significant difficulty in meeting their needs. Employers will sometimes need to make use of Temporary Foreign Workers or 'fast track' channels in the immigration system to meet their skill needs.

Computer Programmers and Interactive Media Developers:

In Quebec, the ICT labour market for Computer Programmers will be dominated by a widespread and serious mismatch between the skills and experience needed by employers and the skills and experience (or lack thereof) offered by a many job-seekers. This skills mismatch will be especially serious in the ICT Producer industries.

On the demand side three trends will weaken the demand for *certain types* of Computer Programmers. The first, and most important of these trends, will be the continuing migration of lower-value programming work to off-shore locations. The second trend of importance will be the increasing prominence of design strategies that reduce the amount of programming and application support required. Service-oriented architecture (SOA) is central to this trend. And finally, a third factor that will reduce the demand for

certain types of programming skills is the general movement away from proprietary software applications to customized off-the-shelf applications. This includes Software-as-a-Service provided by Cloud services. The skills that are affected by these trends will be in decline over the forecast period.

At the same time, other trends in ICT will generate new (or continuing) skill requirements that employers will have difficulty meeting. Industry interviews indicate a general shortage of experienced Computer Programmers who can work in a java and SQL programming environment. As well, employers will continue to confront a shortage of qualified job-seekers who have experience in customizing and supporting particular applications in a specific domain context. The importance of domain experience compounds the challenge of meeting skill needs. As always, ICT Producers will need leading edge skills. And finally, recruiting Programmers who can support legacy applications will be an *increasing* challenge for the public sector and large employers in the private sector as Programmers with experience supporting these applications retire.

The result of these trends is that there will be an *increasing* misalignment between the skills and experience of job-seekers and the skills and experience that are required by employers.

Web Designers and Developers:

The extension of web applications to an increasing range of businesses and business operations will support moderate growth in demand for Web Designers and Developers. This growth, however, will be somewhat undercut by the trend to off-shore or automate some of the basic aspects of web design and web maintenance. However, the growth of mobile devices has generated a need to optimize existing sites for these devices. As well, the need for many Canadian web sites to be bilingual ensures a continuing market for Quebec-based web designers and maintainers.

The growing importance of web interfaces increases the importance of the aesthetic dimension ('the coolness') of user design. Employers seeking this additional skill will encounter pervasive shortages which will only be alleviated when more programs link traditional design skills with training in web development.

A notable feature of web design has been the increased technical sophistication of web sites. Web designs that were previously undertaken in HTML by the 'self-taught' have been replaced by automated templates. Customized web development now requires a greater level of technical skill, including the ability to program in range of platforms at both the server and the client level.

Electrical and Electronics Engineering Technologists and Technicians:

Demand for electrical and electronics engineering technologists and technicians is projected to increase moderately over the forecast period. The growth in demand will be supported by the increased application of ICT to various manufactured products and production processes but held back by slower overall economic growth.

It is important to distinguish between Electronics Engineering Technologists and Technicians and Electronics Engineers. Engineers are primarily employed in design functions. The key determinant of demand for Engineers, therefore, is new investment spending and R&D spending. Technicians and Technologists are primarily employed in operations functions and in maintenance and support functions. The key determinant of demand for Technicians and Technologists, therefore, is the growth in the installed base of electronics equipment and applications. Most electronics equipment and applications are proprietary. Consequently, many employers have formalized training for new hires. The forecasting model indicates that shortages could arise towards the end of the forecasting period. These shortages will be largely the result of cumulative replacement demand arising from retirements.

Computer Network Technicians:

Demand for Computer Network Technicians is projected to weaken over the forecast period, moving between 'Skill Shortages in Many Fields (Yellow)' and 'Excess of Supply over Demand (Green)'. This is a change from the period prior to the economic downturn when employment grew strongly. The change in labour market conditions will arise from the anticipated impact of 'Cloud' computing. As discussed earlier in this report, one of the important implications of 'Cloud' computing—noted in the *OECD Information Technology Outlook, 2010*—is the reduction in physical infrastructure requirements and the consequent reduction in the employment of persons who maintain networks. The adoption of 'Cloud' computing is not a certainty. However, the view taken in this report is that the economic attraction of 'Cloud' computing for User Industries is so strong that the economic incentives will drive its adoption over the forecast period. A related trend relevant to Computer Network Technicians is the increased importance of integrating wired networks with wireless networks. This trend also implies new skill needs beyond the traditional core of technical skills.

User Support Technicians:

The demand for User Support Technicians is projected to be weaker over much of the forecast period, corresponding to 'Excess of Supply over Demand (Green)' in the rankings used for the projection system. The primary reason for this trend is that, 'Tier 1 Help Desk' work will migrate increasingly to off-shore locations. 'Tier 2' and 'Tier 3' user support will be largely immune to this trend. 'Tier 3' Support Technicians typically hold industry certifications in addition to a post-secondary qualification. Notwithstanding the general excess of supply over demand, employers outside of the greater Montreal may encounter difficulty in recruiting persons with industry certifications in addition to their post-secondary qualifications.

Systems Testing Technicians:

Demand for Systems Testing Technicians will increase moderately over the forecast period in tandem with the increased penetration of ICT into other domains in business and the public sector. The decline in demand in 2010, which is projected to continue into 2011, is attributable to the downturn in hardware spending. This is projected to recover by 2012. The implementation of e-health systems will increase the demand for reliability testing as will concerns about liability from malfunctioning systems.

Broadcast Technicians:

The need for Broadcast Technicians is driven by two factors—retirements and an expansion of the broadcast industry. The growing penetration of fibre optic cabling and the integration of broadcasting with telecom and the internet will also alter the skills profile required by employers. Pervasive shortages are expected to arise over the course of the forecast period.

6. Ontario Outlook

Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages	Acute Excess of Demand over Supply: Absolute Supply Constraints

	2010	2011	2012	2013	2014	2015	2016
A122 Computer and information systems managers							
A311 Telecommunication carriers managers							
C033 Electrical and electronics engineers							
C047 Computer engineers (except software engineers)							
C071 Information systems analysts and consultants							
C072 Database analysts and data administrators							
C073 Software engineers and designers							
C074 Computer programmers and interactive media developers							
C075 Web designers and developers							
C141 Electrical & electronics engineering technologists & technicians							
C181 Computer network technicians							
C182 User support technicians							
C183 Systems testing technicians							
F124 Broadcast technicians							

Snapshot

Ontario employers will experience significant challenges recruiting for jobs that require five or more years of experience. These challenges will be greater outside of the Greater Toronto Area owing to the smaller size of the experienced labour pool. Recruitment challenges will be especially difficult for companies that are seeking leading edge skills. Delays in filling these jobs will cause operational problems for Ontario employers.

Recent graduates of co-op programs will generally be able to obtain employment commensurate with their training. However, graduates from traditional programs will experience much longer search periods. Many will be obliged to take ICT jobs for which they are over-qualified. Internationally educated professionals (IEPs) with no Canadian experience will find it almost impossible to secure an ICT job commensurate with their qualifications, unless their English language skills are excellent. To gain Canadian experience, most IEPs will be obliged to take jobs for which they are over-qualified.

Skills shortages will be more acute in four occupations:

- Computer and Information Systems Managers,
- Telecommunications Carriers Managers,
- Information Systems Analysts and Consultants, and
- Broadcast Technicians.

The ICT industry is currently experiencing and will continue to experience significant challenges in recruiting Computer Programmers who have leading edge or highly specialized skills and can combine these technical skills with essential soft skills (most notably team working, communications and problem solving). These shortages will continue to be more challenging for employers located outside the Greater Toronto Area.

Technology trends (most notably the adoption of 'Cloud' computing) and out-sourcing will weaken the labour market for:

- Computer Network technicians, and
- User Support Technicians.

Trends

Profile of ICT Employment:

Ontario accounts for approximately 47% of all workers in ICT Occupations. The ICT labour market in Ontario is shaped by three factors:

- First, the ICT Sector has a significantly greater presence in Ontario than in other regions. Industry Canada estimated Ontario's share of employment in the ICT sector to be around 45% (based on 2005 data);
- Second, Ontario has a larger share of head office employment. To a significant degree, ICT is a head office function. For this reason, Ontario employs approximately half of all ICT workers in the User Industries;
- Third, in Ontario, labour supply conditions are much more strongly influenced by immigration. Internationally educated professionals account for just under one ICT worker in five. Roughly 50% or more of internationally educated professionals intending to work in ICT occupations settle initially in Ontario.

The role of head offices in the Ontario economy, including in particular those in the financial sector and in government departments, means that Ontario has a large base of legacy applications that must be maintained.

Ontario was particularly affected by the dot.com recession at the beginning of the last decade. The wave of downsizing that occurred between 2001 and 2004 caused a sharp decline in the number of recent graduates who were hired into ICT jobs during that period. Five years later, *i.e.*, between 2006 and 2009, this manifested itself in an acute shortage of ICT professionals with five years or more of experience. The shortage of professionals with five years or more of experience has eased somewhat, but continues to be a serious challenge for employers.

Demand Trends:

Over the period 2011–2016, domestic spending on ICT will grow at a slower pace than during the five years prior to the downturn in 2008. Spending is projected to increase by approximately 3.6% annually. This compares with a 5.6% annual growth rate prior to the downturn. As a result, employment that is dependent on domestic ICT spending will grow more slowly over the next five years than prior to the downturn. In the labour market forecast, these trends are reflected in the intermediate ranking that applies to the majority of occupations.

Ontario-based ICT Producers that sell into the international market can anticipate a recovery in demand on par with the growth rates that preceded the downturn, but only if they have a presence in the Asian market. Over the period 2011 to 2016, the Asian market will account for around 43% of the world growth in ICT spending. Ontario-based ICT Producers that are reliant on the U.S. and European markets should anticipate a slower growth in demand, unless their technology enjoys unique competitive advantages.

R&D spending by the private sector is projected to increase by 1.0% to 2.0% annually in value terms. The commensurate annual employment will increase 1.0% or less. This will affect primarily the demand for Computer Engineers and Software Engineers who focus on system and application design.

Outsourcing:

Domestic outsourcing of ICT work is projected to increase by approximately 5% per year over the next five years. Although Ontario has a significant outsourcing industry, the net effect of the growth in outsourcing is to move some ICT jobs out of Ontario, principally to Quebec or the Atlantic region or to off-shore centres.

As discussed elsewhere in this report, the ICT work that is most at risk of being outsourced and therefore moved outside of Ontario is Tier-1 'help desk' work and lower-value programming work.

Recruitment Conditions:

In general, employers will have little or no difficulty filling ICT jobs that require less than five years of experience. However, much more significant challenges will arise when recruiting for jobs that require five or more years of experience. These challenges will be more difficult outside of the Greater Toronto Area owing to the smaller size of the experienced labour pool from which employers can recruit and their difficulty in inducing job-seekers to relocate. Many IEPs are reluctant to move outside of the Greater Toronto Area. Consequently, immigration will provide less relief for skill shortages than the overall numbers might suggest.

Recruitment challenges will be especially difficult for companies that are seeking leading edge skills. Delays in filling these jobs will cause operational problems and constrain growth. Some employers will need to use the Temporary Foreign Worker programs when that program operates or nominee programs to recruit foreign ICT specialists with skills that cannot be sourced regionally.

Job hopping will not be a systemic problem over the period 2011 to 2016. However, quitting for better opportunities will occur and turnover rates will increase.

Job-Seekers:

Recent graduates of co-op or internship programs will generally be able to obtain employment that is commensurate with their training. However, graduates from traditional programs that do not have a *practicum* component will experience much longer search periods. In many cases, they will be obliged to take ICT jobs for which they are over-qualified.

Recently arrived IEPs who have no Canadian experience will find it almost impossible to secure an ICT job commensurate with their qualifications, unless their English language skills are excellent. To gain Canadian experience, most IEPs will need to consider jobs for which they are over-qualified. Bridging programs that combine language improvement, training in Canadian business practices, and an internship will have their maximum benefit in the ICT labour market conditions that are projected for Ontario.

Specific Occupations

Computer and Information Systems Managers:

Shortages of Computer and Information Systems Managers will be driven by demographic factors which will account for approximately 80% of the demand. The shortages will be most acute for positions that require ten years or more of previous managerial experience.

As noted, retirement is by far the most important determinant of hiring requirements. Hiring requirements could be brought forward, if the retirement rate before age 65 increases above projections. In some sectors, notably the public sector and major utilities, the average age of managers tends to be higher and the need to replace retiring managers will occur earlier.

The labour market ranking for this occupation moves from 'Skill Shortages in Many Fields (Yellow)' in the first part of the forecast period to 'Excess of Demand over Supply: Pervasive Shortages (Orange)' in 2014. This reflects the cumulative impact of retirement factors. The more serious shortage conditions projected by the model could occur sooner, if retirements are brought forward.

Telecommunications Carriers Managers:

Demographic factors also lead the labour market conditions for Telecommunications Carriers Managers to move from the 'Skill Shortages in Many Fields (Yellow)' ranking to 'Excess of Demand over Supply: Pervasive Shortages (Orange)'. This ranking conflates two distinct trends that need to be unpacked. In the wired segment of the industry, employment growth will be slow. Demand for managers in the wired segment of the telecommunications industry will be determined almost entirely by replacement requirements. In the wireless segment of the industry, the growth in the user base and the entry of new suppliers will support increased demand. Employers in the wireless sector of the telecommunications industry will face more difficult hiring challenges.

Electrical and Electronics Engineers:

Electronics engineers are primarily employed in designing hardware applications. Spending on R&D is projected to grow more slowly over the next five years compared to the five years before the general economic downturn. The slower growth of R&D spending will constrain the employment growth of Electronics Engineers.

Labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking. However, the forecasting model does signal a risk of shortages when R&D and global spending on ICT hardware pick up additional momentum in 2012.

Employers will experience moderate to significant difficulties in recruiting Electronics Engineers with five or more years of experience and with technology-specific experience. Leading edge skills will continue to be a systemic problem for employers in the ICT Producer industries. These shortages may necessitate flexible use of 'fast track' channels in the immigration system to meet the need for some highly specialized skills.

Computer Engineers:

Demand for computer engineers also will be held back by the slowdown in R&D spending and by the lower rate of spending growth for ICT, especially for hardware. Throughout the forecast period, labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking. Employers will encounter moderate to

significant difficulties in recruiting computer engineers with five or more years of experience and with technology-specific experience. IEPs account for almost one quarter of Computer Engineers in Ontario. Consequently, improving the integration of IEPs is an important dimension of a strategy to alleviate skills shortages.

Information Systems Analysts and Consultants (Business Analysts):

The continued penetration of ICT into new domains will increase the need for Information Systems Analysts and Consultants. The adoption of e-health technologies will be particularly important, although the ICT adoption trend is by no means limited to the health care sector.

Information Systems Analysts and Consultants require a mix of technical ICT skills and an understanding of the business and organizational processes of ICT Users. This mix of ICT technical skills and an understanding of business and organizational processes is in systemic short supply. The supply challenges are compounded by the additional factor that experience must be domain-specific. A Business Analyst with experience in one domain (*e.g.*, supply chain management in the retail sector) is not readily deployable in another domain (*e.g.*, the health care sector). In the labour market forecast, these supply challenges are evident in the skill shortages that are expected to be systemic from 2013 onwards. If spending on ICT projects accelerates before 2013, the shortage conditions will be brought forward. In these circumstances, delays in filling jobs openings will be widespread and will cause operational problems. Especially after 2013, some employers will find that it is impossible to recruit qualified candidates.

Over most of forecast period, the ranking for this occupation is 'Excess of Demand over Supply: Pervasive Shortages (Orange)'.

Database Analysts and Administrators:

Labour market conditions for Database Analysts and Administrators will gravitate to the 'Skill Shortages in Many Fields (Yellow)' ranking over the forecast period. Three factors are supporting the demand for Database Analysts and Administrators: (i) an increase in replacement demand as a result of retirements, (i) the increased use of databases to manage more aspects of business operations, and (iii) the increased use of data mining to identify marketing opportunities. Domain-specific experience is a critical qualification for Database Analysts and Administrators. The need for domain-specific experience increases the recruitment difficulties experienced by employers and draws out the job-search period for job-seekers.

Legacy applications are particularly important in the database field. The skills required to maintain legacy applications are not being renewed.

Software Engineers and Designers:

Software design is highly internationalized. Some large developers maintain design centres in more than one country. The geographic location of design work is determined by a number of factors. These include the cost of skilled labour, business ownership and structure, and the availability of skills—especially advanced and specialized skills. Software Engineers have the highest proportion of workers with graduate degrees (27%) of all ICT Occupations.

Employers' skill needs are highly granular. That is to say, when hiring Software Engineers, employers have highly specific experience and technology requirements. Meeting these needs is challenging in almost all circumstances. More than a quarter of Software Engineers in Ontario are IEPs. Consequently, improving the integration of IEPs is an important dimension of a strategy to alleviate skills shortages.

Throughout the forecast period, labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking in the projection system. The continued flow of IEPs into the Ontario ICT labour market will address enough of the skill shortage challenge to prevent shortage conditions from driving the labour market into a higher ranking. Nevertheless, employers will experience difficulty in recruiting qualified candidates with *relevant* technology and business experience. In light of the premium that is attached to experience in this occupation, recent graduates without co-op or internship experience will have considerable difficulty finding employment. Employers will sometimes need to make use of the Temporary Foreign Worker program when it operates or 'fast track' channels in the immigration system to meet their skill needs.

A key skill that many employers identify as being in especially short supply is the ability to design the fundamental 'architecture' of an application.

Computer Programmers and Interactive Media Developers:

In Ontario, the ICT labour market for Computer Programmers will be dominated by a widespread and serious mismatch between the skills and experience needed by employers and the skills and experience (or lack thereof) offered by many job-seekers. This skills mismatch will be especially serious in the ICT Producer industries.

On the demand side three trends will weaken the demand for *certain types* of Computer Programmers. The first, and most important of these trends, will be the continuing migration of lower-value programming work to off-shore locations. The second trend of importance will be the increasing prominence of design strategies that reduce the amount of programming and application support required. Service-oriented architecture (SOA) is central to this trend. And finally, a third factor that will reduce the demand for certain types of programming skills is the general movement away from proprietary software applications to customized off-the-shelf applications. This includes Software-as-a-Service provided by Cloud services. The skills that are affected by these trends will be in decline over the forecast period.

At the same time, other trends in ICT will generate new (or continuing) skill requirements that employers will have difficulty meeting. Industry interviews indicate a general shortage of experienced Computer Programmers who can work in a java, .Net and SQL programming environment. As well, employers will continue to confront a shortage of qualified job-seekers who have experience in customizing and supporting particular applications in a specific domain context. The importance of domain experience compounds the challenge of meeting skill needs. As always, ICT Producers will need leading edge skills. And finally, recruiting Programmers who can support legacy applications will be an *increasing* challenge for the public sector and large employers in the private sector as Programmers with experience supporting these applications retire.

The result of these trends is that there will be an *increasing* misalignment between the skills and experience of job-seekers and the skills and experience that are required by employers.

The adoption of e-health technologies will pose distinct challenges in recruiting Computer Programmers to support those applications.

Web Designers and Developers:

The extension of web applications to an increasing range of businesses and business operations will support moderate growth in demand for Web Designers and Developers. This growth, however, will be somewhat undercut by the trend to off-shore or automate some of the basic aspects of web design and web maintenance. However, the growth of mobile devices has generated a need to optimize existing sites for these devices.

The growing importance of web interfaces increases the importance of the aesthetic dimension ('the coolness') of user design. Employers seeking this additional skill will encounter pervasive shortages which will only be alleviated when more programs link traditional design skills with training in web development.

A notable feature of web design has been the increased technical sophistication of web sites. Web designs that were previously undertaken in HTML by the 'self-taught' have been replaced by automated templates. Customized web development now requires a greater level of technical skill, including the ability to program in a range of platforms at both the server and the client level. Proficiency in Flash is especially important in this field.

Electrical and Electronics Engineering Technologists and Technicians:

Demand for electrical and electronics engineering technologists and technicians is projected to increase moderately over the forecast period. The growth in demand will be supported by the increased application of ICT to various manufactured products and production processes but held back by slower overall economic growth.

It is important to distinguish between Electronics Engineering Technologists and Technicians and Electronics Engineers. Engineers are primarily employed in design functions. The key determinant of demand for Engineers, therefore, is new investment spending and R&D spending. Technicians and Technologists are primarily employed in operations functions and in maintenance and support functions. The key determinant of demand for Technicians and Technologists, therefore, is the growth in the installed base of electronics equipment and applications. Most electronics equipment and applications are proprietary. Consequently, many employers have formalized training for new hires.

Computer Network Technicians:

The labour market conditions for Computer Network Technicians are projected to show some weakness over the forecast period, moving between 'Skill Shortages in Many Fields (Yellow)'and 'Excess of Supply over Demand (Green)'. This is a change from the period prior to the economic downturn when employment grew strongly. The change in labour market conditions arises from the anticipated impact of 'Cloud' computing. As discussed earlier in this report, one of the important implications of 'Cloud' computing—noted in the *OECD Information Technology Outlook, 2010*—is the reduction in physical infrastructure requirements and the consequent reduction in the employment of persons who maintain networks. The adoption of 'Cloud' computing is not a certainty. However, the view taken in this report is that the economic attraction of 'Cloud' computing for User Industries is so strong that the economic incentives will drive its adoption over the forecast period. A related trend relevant to Computer Network Technicians is the increased importance of integrating wired networks with wireless networks. This trend also implies new skill needs beyond the traditional core of technical skills.

User Support Technicians:

Labour market conditions for User Support Technicians are projected to be weak until 2013 or later. The primary reason for this trend is that more 'Tier 1 Help Desk' work will be outsourced in response to cost-savings pressures and this will lead to the relocation of some of that work to the Atlantic region or to off-shore locations. 'Tier 2' and 'Tier 3' user support will be largely immune to this trend. 'Tier 3' Support Technicians typically hold industry certifications in addition to a post-secondary qualification. Notwithstanding the general weakness of the overall market for User Support Technicians, employers outside of the Greater Toronto Area may encounter difficulty in recruiting persons with industry certifications to meet their requirement for 'Tier 2' and 'Tier 3' user support.

Systems Testing Technicians:

Demand for Systems Testing Technicians will return to moderate growth over the forecast period in tandem with the increased penetration of ICT into other domains in business and the public sector. The decline in demand in 2010, which could continue into 2011, is attributable to the downturn in hardware spending. Spending on hardware will recover in 2011 or 2012 at the latest. The implementation of e-health systems will increase the demand for reliability testing as will concerns about liability from malfunctioning systems.

Broadcast Technicians:

The need for Broadcast Technicians is driven by two factors—retirements and an expansion of the broadcast industry. The growing penetration of fibre optic cabling and the integration of broadcasting with telecom and the internet will also alter the skills profile required by employers. Pervasive shortages are expected to arise over the course of the forecast period.

7. Manitoba and Saskatchewan Outlook

Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages	Acute Excess of Demand over Supply: Absolute Supply Constraints

	2010	2011	2012	2013	2014	2015	2016
A122 Computer and information systems managers							
A311 Telecommunication carriers managers							
C033 Electrical and electronics engineers							
C047 Computer engineers (except software engineers)							
C071 Information systems analysts and consultants							
C072 Database analysts and data administrators							
C073 Software engineers and designers							
C074 Computer programmers and interactive media developers							
C075 Web designers and developers							
C141 Electrical & electronics engineering technologists & technicians							
C181 Computer network technicians							
C182 User support technicians							
C183 Systems testing technicians							
F124 Broadcast technicians							

Snapshot

Employers in Manitoba and Saskatchewan will experience significant challenges recruiting for jobs that require five or more years of experience. Recruitment challenges will be especially difficult for companies that are seeking leading edge skills. Delays in filling these jobs will cause operational problems.

Recent graduates of co-op programs will generally be able to obtain employment commensurate with their training. However, graduates from traditional programs may experience longer search periods.

The key problems for employers in Manitoba and Saskatchewan are the limited size of the regional labour pool and the difficulty in inducing job-seekers to relocate to the Prairie region. *The Prairie region is almost entirely dependent on its own resources to train and supply ICT workers*. The difficulty that employers encounter in meeting their skill needs is a factor encouraging some ICT work to be outsourced.

Shortages will be more acute in four occupations:

- Computer and Information Systems Managers,
- Telecommunications Carriers Managers,
- Information Systems Analysts and Consultants, and
- Database Analysts and Administrators

Technology trends (most notably the adoption of 'Cloud' computing) and out-sourcing will reduce demand for:

- Computer Network technicians, and
- User Support Technicians.

Trends

Profile of ICT Employment:

Manitoba and Saskatchewan account for approximately 4% of all workers in ICT Occupations. The User Industries account for the majority of ICT employment. ICT employment in Manitoba and Saskatchewan is skewed to lower skilled and moderately skilled occupations. User Support Technicians, for example, account for around 16% of ICT employment compared to 11% on a national basis. Higher-skilled occupations account for 37% of ICT employment compared to a national average of around 45%.

The Prairie region is caught in a difficult situation. The shortage of ICT workers with university level training discourages companies in the ICT sector from locating in the region. On the other hand, the comparative paucity of companies in the ICT sector discourages students from pursuing an ICT career or remaining in the Prairie region after they graduate.

In 2009 Manitoba and Saskatchewan accounted for only 1% of graduates in computer science, computer engineering and electrical and electronics engineering. This graduate deficit is not offset by immigration in any significant way. Fewer than 4% of the workers in ICT Occupations are internationally educated professionals.

Demand Trends:

Over the period 2011–2016, domestic spending on ICT will grow at a slower pace than during the five years prior to the downturn in 2008. Spending is projected to increase by approximately 3.6% annually. This compares with a 5.6% annual growth rate prior to the downturn. As a result, employment that is dependent on domestic ICT spending will grow more slowly over the next five years than prior to the downturn. In the labour market forecast, these trends are reflected in the intermediate ranking that applies to the majority of occupations.

Outsourcing:

Domestic outsourcing of ICT work is projected to increase by approximately 5% per year over the next five years. While some outsourcers have operations in Manitoba and Saskatchewan, the net effect of the growth in outsourcing is to move some ICT jobs out of the Prairie region. As discussed elsewhere in this report, the ICT work that is most at risk of being outsourced, and therefore moved outside of Manitoba and Saskatchewan, is Tier-1 'help desk' work and lower-value programming work.

Recruitment Conditions:

In general, employers will have difficulty in filling ICT jobs that require five or more years of experience. However, employers will have much less difficulty in filling ICT jobs that require less than five years of experience. Recruitment challenges will be especially difficult for companies that are seeking leading edge skills. A particular area of importance is the health care sector where the implementation of e-health applications will put significant pressure on available human resources. Delays in filling these jobs will cause operational problems and constrain growth.

Job-Seekers:

Recent graduates will generally be able to obtain employment that is commensurate with their training, especially if they are graduates of a program that has a co-op or *practicum* component. The exception will be graduates who are only qualified for Tier-1 'help desk' work. Demand for these skills will be weak over the entire forecast period.

Specific Occupations

Computer and Information Systems Managers:

Shortages of Computer and Information Systems Managers will be driven by demographic factors which will account for approximately 80% of the demand. The shortages will be most acute for positions that require ten years or more of previous managerial experience.

As noted, retirement is by far the most important determinant of hiring requirements. Hiring requirements could be brought forward, if the retirement rate before age 65 increases above projections. In some sectors, notably the public sector and major utilities, the average age of managers tends to be higher and the need to replace retiring managers will occur earlier.

The labour market ranking for this occupation moves from 'Skill Shortages in Many Fields (Yellow)' in the first part of the forecast period to 'Excess of Demand over Supply: Pervasive Shortages (Orange)' in 2014. This reflects the cumulative impact of retirement factors. Shortages could arise sooner if retirements are brought forward. This is especially likely in the public sector where the managerial age structure tends be somewhat older and early retirement options more available.

Telecommunications Carriers Managers:

Demographic factors also lead the labour market conditions for Telecommunications Carriers Managers to move from the 'Skill Shortages in Many Fields (Yellow)' ranking to 'Excess of Demand over Supply: Pervasive Shortages'. This ranking conflates two distinct trends that need to be unpacked. In the wired segment of the industry, employment growth will be slow. Demand for managers in the wired segment of the telecommunications industry will be determined almost entirely by replacement requirements. In the wireless segment of the industry, the growth in the user base and the entry of new suppliers will support increased demand. Employers in the wireless sector of the telecommunications industry will face more difficult hiring challenges.

Electrical and Electronics Engineers:

Electronics engineers are primarily employed in designing hardware applications. The forecasting model estimates that labour market conditions are correspond to the 'Shortages in Many Fields (Yellow)' ranking. However, this is based on low levels of demand and corresponding low levels of supply. The actual situation for employers who require electronics engineers will be much more challenging than suggested by the labour market ranking. Employers will experience significant difficulty in recruiting Electronics Engineers with five or more years of experience *and with technology-specific experience*. Leading edge skills will also be a systemic problem for employers in the ICT sector. Addressing these shortages will require flexible use of 'fast track' channels in the immigration system to meet the need for some highly specialized skills.

Computer Engineers:

In the Prairie region, both demand for Computer Engineers and their supply are limited. As with Electronics Engineers, the forecasting model interprets supply and demand trends as corresponding to the 'Skill Shortages in Many Fields (Yellow)' ranking. However, this assessment is based on the symmetry between comparatively low levels of demand and low levels of supply. Employers who are seeking to hire a Computer Engineer will encounter an exceptionally difficult recruitment environment, especially if they are seeking to hire an experienced Computer Engineer with experience in their sector.

Information Systems Analysts and Consultants (Business Analysts):

The continued penetration of ICT into new domains will increase the need for Information Systems Analysts and Consultants. The adoption of e-health technologies will be particularly important, although the ICT adoption trend is by no means limited to the health care sector.

Information Systems Analysts and Consultants require a mix of technical ICT skills and an understanding of the business and organizational processes of ICT Users. This mix of ICT technical skills and an understanding of business and organizational processes is in systemic short supply. The supply challenges are compounded by the additional factor that experience must be domain-specific. A Business Analyst with experience in one domain (*e.g.*, supply chain management in the retail sector) is not readily deployable in another domain (*e.g.*, the health care sector). In the labour market forecast, these supply challenges are evident in the skill shortages that are expected to be systemic from 2013 onwards. If spending on ICT projects accelerates before 2013, the shortage conditions will be brought forward. In these circumstances, delays in filling jobs openings will be widespread and will cause operational problems. Especially after 2013, some employers will find that it is impossible to recruit qualified candidates.

Over most of forecast period, the ranking for this occupation is 'Excess of Demand over Supply: Pervasive Shortages (Orange)'.

Database Analysts and Administrators:

Labour market conditions for Database Analysts and Administrators will fluctuate between the 'Skill Shortages in Many Fields (Yellow)' ranking and the 'Excess of Demand over Supply: Pervasive Shortages' ranking. Three factors will support the demand for Database Analysts and Administrators: (i) an increase in replacement demand as a result of retirements, (ii) the increased use of databases to manage more aspects of business operations, and (iii) the increased use of data mining to identify marketing opportunities. Domain-specific experience is a critical qualification for Database Analysts and Administrators. The need for domain-specific experience will increase the recruitment difficulties experienced by employers and draw out the job-search period for job-seekers.

Legacy applications are particularly important in the database field, especially, but not solely, in the public sector. The skills required to maintain legacy applications are not being renewed by the post-secondary system. Nor is international or inter-provincial migration easing the current and future shortages. Supporting legacy applications will pose a particular challenge in the Prairie region. Skills shortages may drive the early replacement of some legacy applications.

Software Engineers and Designers:

As with Electronics Engineers and Computer Engineers, the forecasting model interprets the symmetry between low levels of demand and low levels of supply as corresponding to the 'Skill Shortages in Many Fields (Yellow)' ranking. This ranking, however, understates the challenge that employers will face in seeking to recruit experienced Software Engineers. Employers' skills needs are highly granular. That is to say, when hiring Software Engineers, employers have highly specific experience and technology requirements. Meeting these needs is challenging in almost all circumstances. In the Prairie region meeting highly specific skill and experience needs in software engineering will be exceptionally difficult.

Computer Programmers and Interactive Media Developers:

In Manitoba and Saskatchewan, the ICT labour market for Computer Programmers will be dominated by a widespread and serious mismatch between the skills and experience needed by employers and the skills and experience (or lack thereof) offered by a many job-seekers.

On the demand side three trends will weaken the demand for *certain types* of Computer Programmers. The first, and most important of these trends, will be the continuing trend to outsource lower-value programming work. On balance, this will move work out of the Prairie region. The second trend of importance will be the increasing prominence of design strategies that reduce the amount of programming and application support required, chiefly among large organizations in the ICT User industries. Service-oriented architecture (SOA) is central to this trend. And finally, a third factor that will reduce the demand for certain types of programming skills is the general movement away from proprietary software applications to customized off-the-shelf applications. This includes Software-as-a-Service provided by Cloud services. The skills that are affected by these three trends will be in decline over the forecast period.

At the same time, other trends in ICT will generate new (or continuing) skill requirements that employers will have difficulty meeting. Industry interviews indicate a general shortage of experienced Computer Programmers who can work in a java programming environment. As well, employers will continue to confront a shortage of qualified job-seekers who have experience in customizing and supporting particular applications in a specific domain context. The importance of domain experience compounds the challenge of meeting skill needs. And finally, recruiting Programmers who can support legacy applications will be an *increasing* challenge as Programmers with experience supporting these applications retire.

The result of these trends is that there will be an *increasing* misalignment between the skills and experience of job-seekers and the skills and experience that are required by employers. This misalignment will significantly exacerbate skill shortages and hiring difficulties.

Web Designers and Developers:

The extension of web applications to an increasing range of businesses and business operations will support moderate growth in demand for Web Designers and Developers. This growth, however, will be somewhat undercut by the trend to off-shore or automate some of the basic aspects of web design and web maintenance.

The growing importance of web interfaces increases the importance of the aesthetic dimension ('the coolness') of user design. Employers seeking this additional skill will encounter pervasive shortages which will only be alleviated when more programs link traditional design skills with training in web development.

A notable feature of web design has been the increased technical sophistication of web sites. Web designs that were previously undertaken in HTML by the 'self-taught' have been replaced by automated templates. Proficiency in Flash programming has now become a central skill requirement in this occupation. Today, customized web development requires a greater level of technical skill, including the ability to program in a range of platforms at both the server and the client level.

Electrical and Electronics Engineering Technologists and Technicians:

Demand for electrical and electronics engineering technologists and technicians is projected to increase moderately over the forecast period. The growth in demand will be supported by the increased application of ICT to various manufactured products and production processes but held back by slower overall economic growth.

It is important to distinguish between Electronics Engineering Technologists and Technicians and Electronics Engineers. Engineers are primarily employed in design functions. Technicians and Technologists are primarily employed in operations functions and in maintenance and support. The key determinant of demand for Technicians and Technologists, therefore, is the growth in the installed base of electronics equipment and applications.

Computer Network Technicians:

The labour market conditions for Computer Network Technicians are projected to show some weakness over the forecast period, moving between 'Skill Shortages in Many Fields (Yellow)' and 'Excess of Supply over Demand (Green)'. This is a change from the period prior to the economic downturn when employment grew strongly. The change in projected labour market conditions arises from the anticipated impact of 'Cloud' computing. As discussed earlier in this report, one of the important implications of 'Cloud' computing—noted in the *OECD Information Technology Outlook, 2010*—is the reduction in physical infrastructure requirements and the consequent reduction in the employment of persons who maintain networks. The adoption of 'Cloud' computing is not a certainty. However, the view taken in this report is that the economic attraction

of 'Cloud' computing for User Industries is so strong that the cost-saving incentives will drive adoption over the forecast period. A related trend relevant to Computer Network Technicians is the increased importance of integrating wired networks with wireless networks. This trend also implies new skill needs beyond the traditional core of technical skills.

User Support Technicians:

Labour market conditions for User Support Technicians are projected to be weak throughout the entire forecast period. The primary reason for this trend is that more 'Tier 1 Help Desk' work will be outsourced in response to cost-savings pressures and this will lead to the relocation of much of that work outside the Prairie region. 'Tier 2' and 'Tier 3' user support will be largely immune to this trend. 'Tier 3' Support Technicians typically hold industry certifications in addition to a post-secondary qualification. Notwithstanding the general weakness of the overall market for User Support Technicians, employers will encounter difficulty in recruiting persons with industry certifications to meet their requirement for 'Tier 2' and 'Tier 3' user support.

Systems Testing Technicians:

Demand for Systems Testing Technicians will move between 'Excess of Supply over Demand (Green)' and 'Skill Shortages in Many Fields (Yellow)'. The primary reason for the weakness in demand is the slowdown in the rate of new spending on systems and applications. On the other hand, the implementation of e-health technologies and updating of legacy systems will generate new demand later in the forecast period.

Broadcast Technicians:

In the Prairie region, the need for Broadcast Technicians is driven primarily by retirement trends. The growing penetration of fibre optic cabling and the integration of broadcasting with telecom and the internet will also alter the skills profile required by employers.

8. Alberta

Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages	Acute Excess of Demand over Supply: Absolute Supply Constraints

	2010	2011	2012	2013	2014	2015	2016
A122 Computer and information systems managers							
A311 Telecommunication carriers managers							
C033 Electrical and electronics engineers							
C047 Computer engineers (except software engineers)							
C071 Information systems analysts and consultants							
C072 Database analysts and data administrators							
C073 Software engineers and designers							
C074 Computer programmers and interactive media developers							
C075 Web designers and developers							
C141 Electrical & electronics engineering technologists & technicians							
C181 Computer network technicians							
C182 User support technicians							
C183 Systems testing technicians							
F124 Broadcast technicians							

Snapshot

The Alberta economy experienced a sharp downturn in 2009 and a partial recovery in 2010. In 2011, Alberta (along with Saskatchewan) will experience the strongest growth. Over the period 2011–2014, the Alberta government anticipates real GDP growth of approximately 3.2% and unemployment of just under 5.0%.[21] This contrasts with the period prior to the economic downturn at the end of 2008 when unemployment averaged only 3.6%. Although a return of 'hyper-growth' is not expected, the Alberta economy is projected to grow faster than the Canadian economy over the next few years. Alberta's growth rate after 2014 hinges on energy prices and the degree to which high energy prices can be sustained by the international economy.

Over the course of 2011, the labour market for most ICT occupations will tighten. Recruitment challenges will re-emerge, in particular for ICT jobs that require five or more years of experience. Recruitment challenges will be especially difficult for companies that are seeking leading edge skills. Delays in filling jobs will cause operational problems.

Recent graduates will generally be able to obtain employment commensurate with their training. However, graduates from co-op programs will have a significant competitive advantage in securing entry-level or junior jobs. Internationally educated professionals (IEPs) with no Canadian experience will find it difficult to secure an ICT job commensurate with their qualifications, unless their English language skills are strong.

More acute and more pervasive skills shortages will arise in three occupations:

- Computer and Information Systems Managers,
- Telecommunications Carriers Managers, and
- Information Systems Analysts and Consultants.

A significant acceleration of capital spending in the oil and gas industry would bring these shortages forward and also cause shortages in other ICT occupations, most notably in Computer Programmers and Database Analysts. Under these conditions, most labour markets would be ranked as 'Excess of Demand over Supply: Pervasive Shortages (Orange)' and

[21] Government of Alberta, Ministry of Finance and Enterprise, *2011–2014 Economic Outlook*, (February 2011).

in some cases 'Acute Excess of Demand over Supply: Absolute Supply Constraints (Red)'. However, *even under less aggressive growth assumptions, pervasive shortages will still affect approximately 60% of ICT jobs in the province*.

Except under assumptions of a resumption of 'hyper growth', labour shortages will not be universal. Technology trends (chiefly the adoption of 'Cloud' computing and 'virtualization') and out-sourcing will weaken demand for:

- Computer Network technicians,
- Some types of Computer Programmers, and
- User Support Technicians.

Trends

Alberta accounts for approximately 10% of all workers in ICT Occupations. There is a significant ICT Industry in Alberta centred on telecommunications as well as a growing number of small and medium-sized companies producing ICT products or services.

Impact of the Oil and Gas Sector on ICT Employment:

Prior to 2009, acute labour shortages were pervasive in the Alberta economy. In ICT Occupations, these shortages were evident in virtually every occupation. The onset of the global financial crisis and the downturn in the oil and gas industry put a number of capital spending projects on hold. The decline in employment of 'natural and applied science' occupations (which includes ICT Occupations) was more than 6%. To some degree, the increase in unemployment was eased by recent migrants to Alberta returning to their province of origin. Nevertheless, employment conditions for virtually all ICT Occupations weakened considerably in 2009. This weakness carried over into 2010. In 2011, the provincial economy is projected to rebound as a result of higher energy and commodity prices. Growth rates will exceed the national average (which will be weak), but are not expected to return to the hyper-growth levels seen prior to the downturn in 2009.

The oil and gas industry plays a key role in the dynamics of Alberta's ICT labour market. Swings in capital spending on energy projects lead to a ramping up (or a winding down) of the industry's requirements for ICT skills. ICT is critically important to the energy industry, but is a relatively small proportion of its cost structure. Consequently, the oil and gas industry frequently offers a wage premium to attract the ICT human resources that it needs. This draws ICT workers from other sectors of the Alberta economy. As a result, shortages emerge in the broader provincial economy. When capital sending on energy projects is put on hold the process works in reverse. ICT workers leave the energy industry and seek employment in other sectors. The previous shortages are eased until the cycle again changes.

Demand Trends:

Over the period 2011–2016, domestic spending on ICT will grow at a slower pace than during the five years prior to the downturn in 2008. On a national basis, spending is projected to increase by approximately 3.6% annually, compared with a 5.6% annual growth rate prior to the downturn. In Alberta, ICT spending will increase somewhat more rapidly than the national average, but will still be below the growth rates seen prior to the downturn.

Alberta-based ICT Producers that sell into the international market can anticipate a recovery in demand on par with the growth rates that preceded the downturn, but only if they have a presence in the Asian market. Over the period 2011 to 2016, the Asian market will account for around 43% of the world growth in ICT spending. Alberta-based ICT Producers that are reliant on the U.S. and European markets should anticipate a slower growth in demand, unless their technology enjoys unique competitive advantages.

ICT employment that is supported by R&D spending is projected to increase by approximately 1.0% per year. This affects primarily Computer Engineers, Electronics Engineers and Software Engineers, all of whom are primarily engaged in the design of systems and applications.

Outsourcing:

Domestic outsourcing of ICT work is projected to increase by 5% per year over the next five years. The outsourcing industry has only a small presence in Alberta owing to the province's higher wage and cost structure and its recurring skills shortages. Consequently, the net effect of the growth in outsourcing is to move some ICT jobs out of Alberta.

As discussed elsewhere in this report, the ICT work that is most at risk of being outsourced and therefore moved outside of Alberta is Tier-1 'help desk' work and lower-value programming work. However, the experience of skills shortages in the period prior to 2009 has made companies in Alberta highly sensitive to the risks of future skills shortages. Consequently, many companies are attracted to outsourcing as a risk mitigation strategy.

Recruitment Conditions:

In general, employers will have little difficulty filling ICT jobs that require less than five years of experience. However, significant challenges will arise when recruiting for jobs that require five or more years of experience. Recruitment challenges will be especially difficult for companies that are seeking leading edge skills. Delays in filling these jobs will cause operational problems and will constrain potential growth. Some employers will need to use the Temporary Foreign Worker program when that program operates, or nominee programs, to recruit foreign ICT specialists with skills that cannot be sourced regionally.

Job hopping will increase over the forecast period, but will not be as serious as in the period prior to 2009.

Job-Seekers:

Recent graduates will generally be able to obtain employment that is commensurate with their training. However, graduates from programs that have a co-op component will have a distinct advantage.

Recently arrived IEPs with no Canadian experience will find it difficult to secure an ICT job commensurate with their qualifications, unless their English language skills are strong. To gain Canadian experience, many IEPs will need to consider jobs for which they are over-qualified. Bridging programs that combine language improvement training in Canadian business practices and an internship will have their maximum benefit in the ICT labour market conditions that are projected for Alberta.

Specific Occupations

Computer and Information Systems Managers:

Shortages of Computer and Information Systems Managers will be driven by demographic factors which will account for approximately 80% of the demand. The shortages will be most acute for positions that require ten years or more of previous managerial experience.

As noted, retirement is by far the most important determinant of hiring requirements. Hiring requirements could be brought forward, if the retirement rate before age 65 increases above projections. In some sectors, notably the public sector and major utilities, the average age of managers tends to be higher and the need to replace retiring managers will occur earlier.

The labour market ranking for this occupation moves from 'Skill Shortages in Many Fields (Yellow)' in the first part of the forecast period to 'Excess of Demand over Supply (Orange)' in 2015. This reflects the cumulative impact of retirement factors. Earlier retirements would bring these shortages forward.

Telecommunications Carriers Managers:

Demographic factors also lead the labour market conditions for Telecommunications Carriers Managers to move from the 'Skill Shortages in Many Fields (Yellow)' ranking to 'Excess of Demand over Supply: Pervasive Shortages (Orange)'. These rankings, however, conflates two distinct trends. In the wired segment of the telecom industry, employment growth will be slow. Demand for managers in the wired segment of the telecommunications industry will be determined almost entirely by replacement requirements. In the wireless segment of the industry, the growth in the user base and the entry of new suppliers will support increased demand. Employers in the wireless sector of the telecommunications industry will face more difficult hiring challenges.

Electrical and Electronics Engineers:

Electronics engineers are primarily employed in designing hardware applications. Spending on R&D is projected to grow more slowly over the next five years compared to the five years before the general economic downturn. The slower growth of R&D spending will constrain the employment growth of Electronics Engineers.

Labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking. This may underestimate the trajectory of demand. Small and medium ICT Producers that provide customized products for the energy industry, both in Canada and abroad, may experience stronger demand and therefore accelerate their R&D investments. This would lead to additional pressures on the supply of skills that are not reflected in this forecast.

Employers will experience moderate to significant difficulties in recruiting Electronics Engineers with five or more years of experience and with technology-specific experience. Leading edge skills will continue to be a systemic problem for employers in the ICT sector. These shortages may necessitate flexible use of 'fast track' channels in the immigration system to meet the need for some highly specialized skills. IEPs account for approximately one fifth of Electrical and Electronics Engineers in Alberta.

Computer Engineers:

Demand for computer engineers also will be held back by the slowdown in R&D spending and by the lower rate of spending growth for ICT, especially for hardware. Throughout the forecast period, labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking in the projection system. Employers will encounter more significant difficulties in recruiting computer engineers with five or more years of experience and with technology-specific experience.

Information Systems Analysts and Consultants (Business Analysts):

The continued penetration of ICT into new domains will increase the need for Information Systems Analysts and Consultants. The adoption of e-health technologies will be particularly important, although the ICT adoption trend is by no means limited to the health care sector.

Information Systems Analysts and Consultants require a mix of technical ICT skills and an understanding of the business and organizational processes of ICT Users. This mix of ICT technical skills and an understanding of business and organizational processes is in systemic short supply. The supply challenges are compounded by the additional factor that experience must be domain-specific. A Business Analyst with experience in one domain (*e.g.*, supply chain management in the retail sector) is not readily deployable in another domain (*e.g.*, the health care sector). In the labour market forecast, these supply challenges are evident in the shortages that are expected to be systemic from 2012 onwards. If spending on ICT projects accelerates before 2012, as some industry observers anticipate, the shortage conditions will be brought forward. In these circumstances, delays in filling jobs openings will be widespread and will cause operational problems. By 2012, some employers will find that it is impossible to recruit qualified candidates.

Database Analysts and Administrators:

Labour market conditions for Database Analysts and Administrators will gravitate to the 'Skill Shortages in Many Fields (Yellow)' ranking over the forecast period. Three factors are supporting the demand for Database Analysts and Administrators: (i) an increase in replacement demand as a result of retirements, (ii) the increased use of databases to manage more aspects of business operations, and (iii) the increased use of data mining to identify marketing opportunities. Domain-specific experience is a critical qualification for Database Analysts and Administrators.

The need for domain-specific experience will increase the recruitment difficulties experienced by employers and draw out the job-search period for job-seekers. Legacy applications are particularly important in the database field. The skills required to maintain legacy applications are not being renewed.

Software Engineers and Designers:

Software design is highly internationalized. Some large developers maintain design centres in more than one country. The geographic location of design work is determined by a number of factors. These include the cost of skilled labour, business ownership and structure, and the availability of skills—especially advanced and specialized skills. Software Engineers have the highest proportion of workers with graduate degrees (27%) of all ICT Occupations.

Employers' skills needs are highly granular. That is to say, when hiring Software Engineers, employers have highly specific experience and technology requirements. Meeting these needs is challenging in almost all circumstances. In Ontario and B.C., more than a quarter of Software Engineers are IEPs. In Alberta the comparable proportion (based on 2006 Census data) was 5%.

Over the forecast period, labour market conditions are expected to move from 'Skill Shortages in Many Fields (Yellow)' to 'Excess of Demand over Supply: Pervasive Shortages (Orange)'. The timing of this shift in labour market conditions will depend on when investment in R&D ratchets up. Employers will experience particular difficulty in recruiting qualified candidates with relevant technology and business experience. In this field, recent graduates without co-op or internship experience will have difficulty finding employment owing to the high premium that is attached to prior experience. Employers will sometimes need to make use of the Temporary Foreign Worker program when it operates or 'fast track' channels in the immigration system to meet their skill needs.

Computer Programmers and Interactive Media Developers:

The labour market for Computer Programmers will be dominated by a widespread and serious mismatch between the skills and experience needed by employers and the skills and experience (or lack thereof) offered by a many job-seekers. This skills mismatch will be especially serious in the ICT Producer industries and will exacerbate labour shortages that may emerge later in the forecast period.

On the demand side three trends will weaken the demand for *certain types* of Computer Programmers. The first, and most important of these trends, will be the continuing migration of lower-value programming work to off-shore locations. The second trend of importance will be the increasing prominence of design strategies that reduce the amount of programming and application support required. Service-oriented architecture (SOA) is central to this trend. And finally, a third factor that will reduce the demand for certain types of programming skills is the general movement away from proprietary software applications to customized off-the-shelf applications. This includes Software-as-a-Service provided by Cloud services. The skills that are affected by these trends will be in decline over the forecast period.

At the same time, other trends in ICT will generate new (or continuing) skill requirements that employers will have difficulty meeting. Industry interviews indicate a general shortage of experienced Computer Programmers who can work in a java, .Net and SQL programming environment. As well, employers will continue to confront a shortage of qualified job-seekers who have experience in customizing and supporting particular applications in a specific domain context. The importance of domain experience compounds the challenge of meeting skill needs. As always, ICT Producers will need leading edge skills. And finally, recruiting Programmers who can support legacy applications will be an *increasing* challenge for the public sector and large employers in the private sector as Programmers with experience supporting these applications retire.

The result of these trends is that there will be an *increasing* misalignment between the skills and experience of job-seekers and the skills and experience that are required by employers.

Web Designers and Developers:

The extension of web applications to an increasing range of businesses and business operations will support moderate growth in demand for Web Designers and Developers. This growth, however, will be somewhat undercut by the trend to off-shore or automate some of the basic aspects of web design and web maintenance. However, the growth of mobile devices has generated a need to optimize existing sites for these devices.

The growing importance of web interfaces increases the importance of the aesthetic dimension ('the coolness') of user design. Employers seeking this additional skill will encounter pervasive shortages which will only be alleviated when more programs link traditional design skills with training in web development.

A notable feature of web design has been the increased technical sophistication of web sites. Web designs that were previously undertaken in HTML by the 'self-taught' have been replaced by automated templates. Customized web development now requires a greater level of technical skill, including the ability to program in a range of platforms at both the server and the client level. The ability to work in a Flash programming environment is now essential in this occupation.

Electrical and Electronics Engineering Technologists and Technicians:

Demand for electrical and electronics engineering technologists and technicians is projected to increase moderately over the forecast period. The growth in demand will be supported by the increased application of ICT to various manufactured products and production.

It is important to distinguish between Electronics Engineering Technologists and Technicians and Electronics Engineers. Engineers are primarily employed in design functions. The key determinant of demand for Engineers, therefore, is new investment spending and R&D spending. Technicians and Technologists are primarily employed in operations functions and in maintenance and support functions. The key determinant of demand for Technicians and Technologists, therefore, is the growth in the installed base of electronics equipment and applications.

Computer Network Technicians:

The demand for Computer Network Technicians is projected to be weaker than demand for most other ICT occupations, moving between 'Skill Shortages in Many Fields (Yellow)' and 'Excess of Supply over Demand (Green)'. This is a change from the period prior to the economic downturn when employment grew strongly. The projected change in labour market conditions arises from the anticipated impact of 'Cloud' computing. As discussed earlier in this report, one of the important implications of 'Cloud' computing—noted in the *OECD Information Technology Outlook, 2010*—is the reduction in physical infrastructure requirements and the consequent reduction in the employment of persons who maintain networks. The adoption of 'Cloud' computing is not a certainty. However, the view taken in this report is that the economic attraction of 'Cloud' computing for User Industries is so strong that cost-saving incentives will drive its adoption over the forecast period. A related trend relevant to Computer Network Technicians is the increased importance of integrating wired networks with wireless networks. This trend also implies new skill needs beyond the traditional core of technical skills.

User Support Technicians:

Labour market conditions for User Support Technicians are projected to be weak until 2013 or later. The primary reason for this trend is that more 'Tier 1 Help Desk' work will be outsourced in response to cost-savings pressures and this will lead to the relocation of some of that work to the Atlantic region or to off-shore locations. 'Tier 2' and 'Tier 3' user support will be largely immune to this trend. 'Tier 3' Support Technicians typically hold industry certifications in addition to a post-secondary qualification. Notwithstanding the general weakness of the overall market for User Support Technicians, employers may encounter difficulty in recruiting persons with industry certifications to meet their requirement for 'Tier 2' and 'Tier 3' user support.

Systems Testing Technicians:

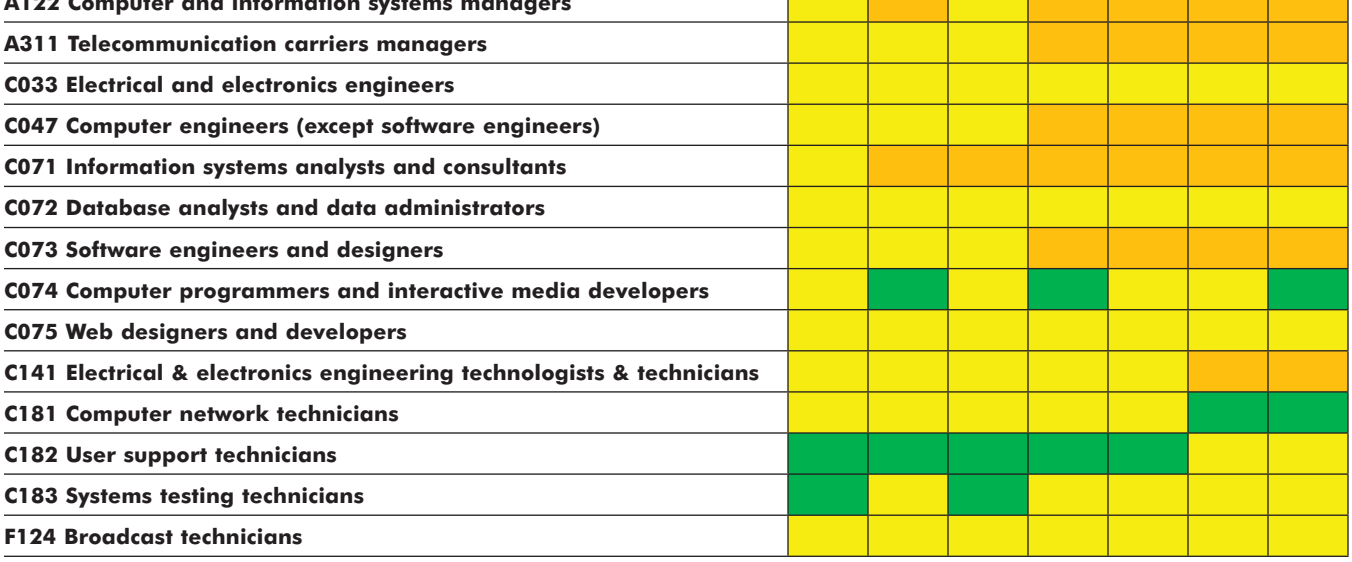
Demand for Systems Testing Technicians will return to moderate growth over the forecast period in tandem with the increased penetration of ICT into other domains in business and the public sector. The decline in demand in 2010 was attributable to the downturn in hardware spending. Spending on hardware will recover in 2011. The implementation of e-health systems also will increase the demand for reliability testing as will concerns about liability from malfunctioning systems.

Broadcast Technicians:

The need for Broadcast Technicians is driven by two factors—retirements and an expansion of the broadcast industry. The growing penetration of fibre optic cabling and the integration of broadcasting with telecom and the internet will also alter the skills profile required by employers. Pervasive shortages are expected to arise over the course of the forecast period.

9. British Columbia

Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages	Acute Excess of Demand over Supply: Absolute Supply Constraints



Snapshot

Growth in the B.C. economy is projected to be above the national average in 2011 and 2012. Over the course of the forecast period, the labour market for most ICT Occupations will tighten. Recruitment challenges will re-emerge, in particular for ICT jobs that require five or more years of experience or require leading edge skills. Delays in filling these jobs will cause operational problems.

Recent graduates of co-op programs will generally be able to obtain employment commensurate with their training. Graduates from traditional programs will experience longer search periods. Internationally educated professionals (IEPs) with no Canadian experience will find it difficult to secure an ICT job commensurate with their qualifications, unless their English language skills are strong.

More pervasive shortages will arise in five occupations:

- Computer and Information Systems Managers,
- Telecommunications Carriers Managers,
- Computer Engineers,
- Information Systems Analysts and Consultants, and
- Electrical and Electronics Engineering Technologists and Technicians.

An acceleration of capital spending in the resource industries would exacerbate these shortages and potentially bring them forward. Shortages would also arise in other ICT occupations.

Technology trends (most notably the adoption of 'Cloud' computing and 'virtualization') and out-sourcing will weaken demand for:

- Computer Programmers and Interactive Media Developers,
- Computer Network technicians, and
- User Support Technicians.

Demand for Systems Testing Technicians will be weaker in the first part of the forecast period, but will strengthen as increased spending on ICT hardware raises the demand for reliability testing.

Trends

British Columbia accounts for approximately 11% of all workers in ICT Occupations. The ICT Producer Industries predominate, accounting for almost two-thirds of ICT occupational employment. ICT Producers in British Columbia is constrained by the scale of the labour market which makes recruiting for specialized skills especially difficult.

Demand Trends:

Over the period 2011–2016, domestic spending on ICT will grow at a slower pace than during the five years prior to the downturn in 2008. On a national basis, spending is projected to increase by approximately 3.6% annually compared with a 5.6% annual growth rate prior to the downturn. In British Columbia, ICT spending will increase somewhat more rapidly than the national average but will still be lower than before the downturn in 2009.

B.C.-based ICT Producers that sell into the international market can anticipate a recovery in demand on par with the growth rates that preceded the downturn, but only if they have a presence in the Asian market. Over the period 2011 to 2016, the Asian market will account for around 43% of the world growth in ICT spending. B.C.-based ICT Producers that are reliant on the U.S. and European markets should anticipate a slower growth in demand, unless their technology enjoys unique competitive advantages.

ICT employment that is supported by R&D spending is projected to increase by approximately 1.0% per year. This affects primarily Computer Engineers, Electronics Engineers and Software Engineers.

Outsourcing:

Domestic outsourcing of ICT work is projected to increase by 5% per year over the next five years. The outsourcing industry has a significant presence in B.C. Nevertheless, the net effect of the growth in outsourcing is to move some ICT jobs out of B.C.—mainly to the Atlantic region or off-shore.

As discussed elsewhere in this report, the ICT work that is most at risk of being outsourced and therefore moved outside of B.C. is Tier-1 'help desk' work and lower-value programming work.

Recruitment Conditions:

In general, employers will have little difficulty filling ICT jobs that require less than five years of experience. However, more significant challenges will arise when recruiting for jobs that require five or more years of experience. Recruitment challenges will be especially difficult for companies that are seeking leading edge skills. Delays in filling these jobs will cause operational problems and will constrain growth. Some employers will need to use the Temporary Foreign Worker program when that program operates or nominee programs to recruit foreign ICT specialists with skills that cannot be sourced regionally.

British Columbia, like Ontario, was particularly affected by the dot.com recession at the beginning of the last decade. The wave of downsizing that occurred between 2001 and 2004 caused a sharp decline in the number of recent graduates who were hired into ICT jobs during that period. Five years later, *i.e.*, between 2006 and 2009, this manifested itself in an acute shortage of ICT professionals with five years or more of experience. The shortage of professionals with five years or more of experience has eased somewhat, but will continue to be a serious challenge for employers.

Job hopping may increase over the forecast period, especially for occupations where labour market conditions are projected to be 'Excess of Demand over Supply: Pervasive Shortages (Orange)'.

Job-Seekers:

Recent graduates of co-op or internship programs will generally be able to obtain employment that is commensurate with their training. However, graduates from traditional programs that do not have a *practicum* component may experience longer search periods.

Recently arrived IEPs who have no Canadian experience will find it difficult to secure an ICT job commensurate with their qualifications, unless their English language skills are strong. To gain Canadian experience, many IEPs will need to consider jobs for which they are over-qualified. Bridging programs that combine language improvement, training in Canadian business practices, and an internship will have their maximum benefit in the ICT labour market conditions that are projected for British Columbia.

Specific Occupations

Computer and Information Systems Managers:

Shortages of Computer and Information Systems Managers will be driven by demographic factors which will account for approximately 80% of the demand. The shortages will be most acute for positions that require ten years or more of previous managerial experience.

As noted, retirement is by far the most important determinant of hiring requirements. Hiring requirements could be brought forward, if the retirement rate before age 65 increases above projections. In some sectors, notably the public sector and major utilities, the average age of managers tends to be higher and the need to replace retiring managers will occur earlier.

The labour market ranking for this occupation moves from 'Skill Shortages in Many Fields (Yellow)' to 'Excess of Demand over Supply: Pervasive Shortages (Orange)' in 2011. This reflects the cumulative impact of retirement factors. Shortages will continue over most of the forecast period.

Telecommunications Carriers Managers:

Demographic factors also lead the labour market conditions for Telecommunications Carriers Managers to move from the 'Skill Shortages in Many Fields (Yellow)' ranking to 'Excess of Demand over Supply: Pervasive Shortages (Orange)' by 2013. This ranking, however, conflates two distinct trends that need to be unpacked. In the wired segment of the industry, employment growth will be slow. Demand for managers in the wired segment of the telecommunications industry will be determined almost entirely by replacement requirements. In the wireless segment of the industry, the growth in the user base and the entry of new suppliers will support increased demand. Employers in the wireless sector of the telecommunications industry will face more difficult hiring challenges.

Electrical and Electronics Engineers:

Electronics engineers are primarily employed in designing hardware applications. Spending on R&D is projected to grow more slowly over the next five years compared to the five years before the general economic downturn. The slower growth of R&D spending will constrain the employment growth of Electronics Engineers.

Labour market conditions will correspond to the 'Skill Shortages in Many Fields (Yellow)' ranking in the projection system throughout the forecast period. This may underestimate the trajectory of demand. Small and medium ICT Producers that provide customized products for the energy industry, both in Canada and abroad, may experience stronger demand and therefore accelerate their R&D investments. This could lead to additional pressures on the supply of skills that are not reflected in this forecast.

Employers will experience difficulties in recruiting Electronics Engineers with five or more years of experience and with technology-specific experience. Leading edge skills will continue to be a systemic problem for employers in the ICT sector. These shortages may necessitate flexible use of 'fast track' channels in the immigration system to meet the need for some highly specialized skills. IEPs account for approximately one third of Electrical and Electronics Engineers in B.C.

Computer Engineers:

In the first half of the forecast period, demand for computer engineers will be held back by the slowdown in R&D spending and by the lower rate of spending growth for ICT, especially for hardware. However, as global spending on ICT hardware picks up, the demand for Computer Engineers in B.C. will also increase. By 2013, labour market conditions will move from a 'Skill Shortages in Many Fields (Yellow)' ranking to 'Excess of Demand over Supply: Pervasive Shortages (Orange)'. As a result, employers will encounter increasing difficulty in recruiting Computer Engineers with the right 'package' of experience and technology skills. Delays in filling job openings will be widespread and will cause operational problems. Some employers will find it impossible to recruit the skills they require.

Information Systems Analysts and Consultants (Business Analysts):

The continued penetration of ICT into new domains will increase the need for Information Systems Analysts and Consultants. The adoption of e-health technologies will be particularly important, although the ICT adoption trend is by no means limited to the health care sector.

Information Systems Analysts and Consultants require a mix of technical ICT skills and an understanding of the business and organizational processes of ICT Users. This mix of ICT technical skills and an understanding of business and organizational processes is in systemic short supply. The supply challenges are compounded by the additional factor that experience must be domain-specific. A Business Analyst with experience in one domain (e.g., supply chain management in the retail sector) is not readily deployable in another domain (e.g., the health care sector).

In B.C., pervasive shortages of Information Systems Analysts and Consultants are projected to emerge in 2011 and to persist for the entire forecast period. In these circumstances, delays in filling job openings will be widespread and will cause operational problems.

Database Analysts and Administrators:

Labour market conditions for Database Analysts and Administrators will gravitate to the 'Skill Shortages in Many Fields (Yellow)' ranking over the forecast period. Three factors are supporting the demand for Database Analysts and Administrators: (i) an increase in replacement demand as a result of retirements, (ii) the increased use of databases to manage more aspects of business operations, and (iii) the increased use of data mining to identify marketing opportunities. Domain-specific experience is a critical qualification for Database Analysts and Administrators. The need for domain-specific experience will increase the recruitment difficulties experienced by employers and draw out the job-search period for job-seekers. Legacy applications are particularly important in the database field. The skills required to maintain legacy applications are not being renewed.

Software Engineers and Designers:

Software design is highly internationalized. Some large developers maintain design centres in more than one country. The geographic location of design work is determined by a number of factors. These include the cost of skilled labour, business ownership and structure, and the availability of skills—especially advanced and specialized skills. Software Engineers have the highest proportion of workers with graduate degrees (27%) of all ICT Occupations.

Employers' skill needs are highly granular. That is to say, when hiring Software Engineers, employers have highly specific experience and technology requirements. Meeting these needs is challenging in almost all circumstances. In B.C., more than a quarter of Software Engineers are IEPs.

Over the forecast period, labour market conditions will move from 'Skill Shortages in Many Fields (Yellow)' to 'Excess of Demand over Supply: Pervasive Shortages (Orange)'. Employers will experience significant difficulty in recruiting qualified candidates with relevant technology and business experience. In this field, employers attach a high premium to prior experience. Recent graduates without co-op or internship experience will have difficulty finding entry-level employment. To meet their need for highly specialized skills, employers will sometimes need to make use of the Temporary Foreign Worker program when it operates or 'fast track' channels in the immigration system to meet their skill needs.

Industry interviews identify 'software architects' who undertake high-level design of applications as a key skills shortage.

Computer Programmers and Interactive Media Developers:

In British Columbia, the labour market for Computer Programmers will be dominated by a widespread and serious mismatch between the skills and experience needed by employers and the skills and experience (or lack thereof) offered by many job-seekers. This skills mismatch will be especially serious in the ICT Producer industries where it will exacerbate skills shortages.

On the demand side three trends will weaken the demand for *certain types* of Computer Programmers. The first, and most important of these trends, will be the continuing migration of lower-value programming work to off-shore locations. The second trend of importance will be the increasing prominence of design strategies that reduce the amount of programming and application support required. Service-oriented architecture (SOA) is central to this trend. And finally, a third factor that will reduce the demand for certain types of programming skills is the general movement away from proprietary software applications to customized off-the-shelf applications. This includes Software-as-a-Service provided by Cloud services. The skills that are affected by these trends will be in decline over the forecast period.

At the same time, other trends in ICT will generate new (or continuing) skill requirements that employers will have difficulty meeting. Industry interviews indicate a general shortage of experienced Computer Programmers who can work in a java and SQL programming environment. As well, employers will continue to confront a shortage of qualified job-seekers who have experience in customizing and supporting particular applications in a specific domain context. The importance of domain experience compounds the challenge of meeting skill needs. As always, ICT Producers will need leading edge skills. And finally, recruiting Programmers who can support legacy applications will be an *increasing* challenge for the public sector and large employers in the private sector as Programmers with experience supporting these applications retire.

The result of these trends is that there will be an *increasing* misalignment between the skills and experience of job-seekers and the skills and experience that are required by employers. *The 'excess supply' conditions signalled by the forecast model should be interpreted as flagging this systemic skills mismatch, rather than indicating easier hiring conditions*.

Web Designers and Developers:

The extension of web applications to an increasing range of businesses and business operations will support moderate growth in demand for Web Designers and Developers. This growth, however, will be somewhat undercut by the trend to off-shore or automate some of the basic aspects of web design and web maintenance. However, the growth of mobile devices has generated a need to optimize existing sites for these devices.

The growing importance of web interfaces increases the importance of the aesthetic dimension ('the coolness') of user design. Employers seeking this additional skill will encounter pervasive shortages which will only be alleviated when more programs link traditional design skills with training in web development.

A notable feature of web design has been the increased technical sophistication of web sites. Web designs that were previously undertaken in HTML by the 'self-taught' have been replaced by automated templates. Customized web development now requires a greater level of technical skill, including the ability to program in a range of platforms at both the server and the client level. The ability to program in a Flash environment is a key skill requirement in this occupation.

Electrical and Electronics Engineering Technologists and Technicians:

Demand for electrical and electronics engineering technologists and technicians is projected to increase over the forecast period. Towards the end of the forecast period, shortages are projected. The growth in demand will be supported by the increased application of ICT to various manufactured products and production processes.

It is important to distinguish between Electronics Engineering Technologists and Technicians and Electronics Engineers. Engineers are primarily employed in design functions. The key determinant of demand for Engineers, therefore, is new investment spending and R&D spending. Technicians and Technologists are primarily employed in operations functions and in maintenance and support functions. The key determinant of demand for Technicians and Technologists, therefore, is the growth in the installed base of electronics equipment and applications. Pervasive shortages are projected towards the end of the forecast period.

Computer Network Technicians:

The labour market conditions for Computer Network Technicians are projected to show some weakness over the forecast period, moving from 'Skill Shortages in Many Fields (Yellow)' to 'Excess of Supply over Demand (Green)'. This is a change from the period prior to the economic downturn when employment grew strongly. The change in labour market conditions arises from the anticipated impact of 'Cloud' computing. As discussed earlier in this report, one of the important implications of 'Cloud' computing—noted in the *OECD Information Technology Outlook, 2010*—is the reduction in physical infrastructure requirements and the consequent reduction in the employment of persons who maintain networks. The adoption of 'Cloud' computing is not a certainty. However, the view taken in this report is that the economic attraction of 'Cloud' computing for User Industries is so strong that those incentives will drive its adoption over the forecast period. A related trend relevant to Computer Network Technicians is the increased importance of integrating wired networks with wireless networks. This trend also implies new skill needs beyond the traditional core of technical skills.

User Support Technicians:

Labour market conditions for User Support Technicians are projected to be weak during the first part of the forecast period. The primary reason for this trend is that more 'Tier 1 Help Desk' work will be outsourced in response to cost-savings pressures and this will lead to the relocation of some of that work outside of B.C. 'Tier 2' and 'Tier 3' user support will be largely immune to this trend. 'Tier 3' Support Technicians typically hold industry certifications in addition to a post-secondary qualification. Notwithstanding the general weakness of the overall market for User Support Technicians, employers outside of the Greater Vancouver Area may encounter difficulty in recruiting persons with industry certifications to meet their requirement for 'Tier 2' and 'Tier 3' user support.

Systems Testing Technicians:

Demand for Systems Testing Technicians will return to moderate growth over the forecast period in tandem with the increased penetration of ICT into other domains in business and the public sector. The decline in demand in the first part of the forecast period is attributable to a slow down in hardware spending. The implementation of e-health systems will increase the demand for reliability testing as will concerns about liability from malfunctioning systems.

Broadcast Technicians:

The need for Broadcast Technicians is driven by two factors—retirements and an expansion of the broadcast industry. The growing penetration of fibre optic cabling and the integration of broadcasting with telecom and the internet will also alter the skills profile required by employers.

10. ICT Sector–ICT-Related Occupations

ICT-related Occupations are jobs in the ICT Sector for which formal training or substantial experience in an ICT environment is required but which generally would not be considered to be ICT occupations if they are found outside the ICT Sector. The largest of these occupations is persons engaged in technical sales for companies in the ICT industry. Figure 10-1 lists the ICT-related Occupations.

Figure No. 10-2 sets out the estimated hiring requirements based on employment growth and replacement demand. Employment growth estimates are based on projected increases in industry output. Replacement demand is based on the number of hires needed to replace employees who retire, die or otherwise exit employment in the ICT sector. The 'replacement demand' factor does not take account of employees who change jobs within the ICT sector. Individual companies, therefore, may have a higher replacement requirement if they lose employees to other companies in the ICT sector.

Figure No. 10-1
ICT-Related Occupations

- A016 Senior managers
- A121 Engineering managers
- A123 Architecture and science managers
- A391 Manufacturing managers
- B021 Specialists in human resources
- C011 Physicists and astronomers
- C021 Biologists and related scientists
- C032 Mechanical engineers
- C041 Industrial and manufacturing engineers
- C046 Aerospace engineers
- C048 Other professional engineers, not elsewhere classified
- C061 Mathematicians, statisticians and actuaries
- C132 Mechanical engineering technologists and technicians
- C133 Industrial engineering & manufacturing technologists and technicians
- C143 Industrial instrument technicians and mechanics
- C161 Non-destructive testers and inspectors
- F021 Authors and writers
- F141 Graphic designers and illustrators
- G121 Technical sales specialists, wholesale trade

Figure No. 10-2
Estimated Hiring Requirements for ICT-Related Occupations 2011 to 2016

	Est. Employment 2010	Est. Employment 2016	Employment Growth	Replacement Demand	Hiring Requirements
A016 Senior managers	3,098	3,342	244	245	489
A121 Engineering managers	2,667	2,888	221	212	433
A123 Architecture and science managers	203	220	17	16	33
A391 Manufacturing managers	3,553	3,813	260	281	541
B021 Specialists in human resources	2,151	2,346	194	171	365
C011 Physicists and astronomers	285	308	23	23	46
C021 Biologists and related scientists	101	109	8	8	16
C032 Mechanical engineers	1,873	2,023	150	148	298

(continued on next page)

Figure No. 10-2 *(continued)*
Estimated Hiring Requirements for ICT-Related Occupations
2011 to 2016

	Est. Employment 2010	Est. Employment 2016	Employment Growth	Replacement Demand	Hiring Requirements
C041 Industrial and manufacturing engineers	1,915	2,060	144	152	296
C046 Aerospace engineers	578	622	44	46	90
C048 Other professional engineers, n.e.c.	113	123	9	9	18
C061 Mathematicians, statisticians and actuaries	271	297	25	22	47
C132 Mechanical engineering technologists and technicians	528	570	42	42	84
C133 Industrial engineering and manufacturing technologists and technicians	1,611	1,734	123	127	250
C143 Industrial instrument technicians and mechanics	634	688	54	50	104
C161 Non-destructive testers and inspectors	74	80	6	6	12
F021 Authors and writers	2,932	3,196	264	233	497
F141 Graphic designers and illustrators	4,017	4,390	373	320	693
G121 Technical sales specialists, wholesale trade	18,066	19,657	1,591	1,436	3,027
Totals	**44,670**	**48,466**	**3,792**	**3,547**	**7,339**

11. National Summary of Estimated Hiring Requirements

Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages		Acute Excess of Demand over Supply: Absolute Supply Constraints		
	2010	2011	2012	2013	2014	2015	2016
A122 Computer and information systems managers							
A311 Telecommunication carriers managers							
C033 Electrical and electronics engineers							
C047 Computer engineers (except software engineers)							
C071 Information systems analysts and consultants							
C072 Database analysts and data administrators							
C073 Software engineers and designers							
C074 Computer programmers and interactive media developers							
C075 Web designers and developers							
C141 Electrical & electronics engineering technologists & technicians							
C181 Computer network technicians							
C182 User support technicians							
C183 Systems testing technicians							
F124 Broadcast technicians							

The chart above summarizes national estimates of labour market conditions based on the summation of regional trends. This summary, however, is of limited value. It should be read with caution. In the main, **labour markets in Canada are regional, not national**. While there is mobility across regions, that mobility is rarely sufficient to alter the basic supply and demand conditions. Nevertheless in the above chart, rankings of 'Moderate Excess of Supply over Demand (2)' or 'Moderate Excess of Demand over Supply (4)' are relevant as they indicate that some supply and demand trends cut across regional differences. This is especially likely to be the case when demographic or technology factors are key determinants of expected labour market conditions.

The projected shortage of Information Systems Analysts and Consultants is illustrative of the relevance of a national trend. Shortages are projected in every region. The only difference is when the shortage is projected to become acute. The reasons for the projected skills shortage are essentially the same in every region. First, there is a systemic shortage of persons who combine ICT skills with an understanding of business processes and who have five years or more of relevant experience in a particular domain. Second, the post-secondary system is graduating far too few individuals who combine ICT skills with an understanding of business processes. As discussed earlier, the Business Technology Management (BTM) programs that are promoted by the Canadian Coalition for Tomorrow's ICT Skills addresses this training gap. Although considerable progress has been made in instituting BTM programs, the influx of graduates from these programs into the labour market will not affect supply conditions appreciably over the course of the forecast period.

Figure No. 11-1 summarizes anticipated hiring requirements. Between 2011 and 2016, Canadian employers will need to hire approximately 106,335 ICT workers. This is an annual hiring rate of around 17,722.

Figure No. 11-1
Estimated Hiring Requirements for All ICT Workers: ICT Occupations and ICT-Related Occupations 2011 to 2016

		Employment Growth	Replacement Demand	Total Hiring Requirements 2011–2016
A122	Computer and Information Systems Managers	3,651	5,207	8,858
A311	Telecommunication Carrier Managers	921	1,306	2,227
C033	Electrical or Electronics Engineers	2,499	3,821	6,320
C047	Computer Engineers	2,172	2,332	4,504
C071	Information System Analysts and Consultants	11,443	14,868	26,311
C072	Database Analysis and Data Administrators	1,030	1,401	2,431
C073	Software Engineers and Designers	2,789	2,789	5,578
C074	Computer Programmers & Interactive Media Developers	8,017	6,897	14,914
C075	Web Designers	1,688	1,179	2,867
C141	Electrical & Electronics Engineering Technologists & Technicians	2,125	3,963	6,088
C181	Computer Network Technicians	3,596	4,215	7,811
C182	User Support Technicians	5,062	4,414	9,476
C183	System Testing Technicians	644	547	1,191
F124	Broadcast Technicians	161	260	421
	Total: All ICT Occupations	**45,798**	**53,199**	**98,997**
ICT-Related Occupations		**3,792**	**3,546**	**7,338**
	Total: All ICT Workers	**49,590**	**56,745**	**106,335**

Appendix A: Methodology

Description for Methodology used in the *2011 Outlook*

Occupational Coverage:

The *2011 Outlook* focuses on supply and demand trends for 'Core ICT Occupations'. These are occupations that specialize in developing or supporting information and communications technology (ICT) products and services. The OECD refers to these occupations as 'ICT Specialist Occupations'.[1] Core ICT Occupations are considered to be ICT occupations, regardless of whether the incumbents are employed in the ICT Producer Industries or the ICT User Industries.

Occupational definitions are based on the National Occupational Classification (NOC) system that is developed and maintained by Human Resources and Skills Development Canada. The NOC system classifies and describes occupations based on the nature of their functions and responsibilities.[2] Statistics Canada uses a variant of the NOC system, known as NOC-S, for statistical tracking purposes. The two systems are virtually interchangeable, except for differences in the coding conventions. Statistical sampling limits the degree of occupational detail in the NOC-S system.

Figure A-1 sets out a list of 'Core ICT Occupations' showing both the NOC and the NOC-S codes.

Figure No. A-1
Core ICT Occupations: NOC and NOC-S

NOC	NOC-S	Occupation
0131	A311	Telecommunication Carriers Managers
0213	A122	Computer and Information Systems Managers
2133	C033	Electrical and Electronics Engineers
2147	C047	Computer Engineers (except Software Engineers and Designers)
2171	C071	Information Systems Analysts and Consultants
2172	C072	Database Analysts and Data Administrators
2173	C073	Software Engineers and Designers
2174	C074	Computer Programmers and Interactive Media Developers
2175	C075	Web Designers and Developers
2241	C141	Electrical and Electronics Engineering Technologists and Technicians
2281	C181	Computer Network Technicians
2282	C182	User Support Technicians
2283	C183	Systems Testing Technicians
5224	F124	Broadcast Technicians

[1] OECD, *OECD Information Technology Outlook, 2010*.

[2] www5.hrsdc.gc.ca/NOC/English/NOC/2006/AboutNOC.aspx

The 2011 Outlook also develops employment estimates for a category of occupations termed 'ICT-Related Occupations'. These are occupations that are judged to be ICT Occupations when their incumbents are employed in the ICT industry. Figure No. A-2 lists these occupations.

Figure No. A-2
ICT-Related Occupations
(Considered ICT Occupations if and only if they are in the ICT Producer Industries)

NOC-S	Occupation
A016	A016 Senior managers—Goods production, utilities, transportation and construction
A121	A121 Engineering managers
A123	A123 Architecture and science managers
A391	A391 Manufacturing managers
B021	B021 Specialists in human resources
C011	C011 Physicists and astronomers
C021	C021 Biologists and related scientists
C032	C032 Mechanical engineers
C041	C041 Industrial and manufacturing engineers
C046	C046 Aerospace engineers
C048	C048 Other professional engineers, n.e.c.
C061	C061 Mathematicians, statisticians and actuaries
C132	C132 Mechanical engineering technologists and technicians
C133	C133 Industrial engineering and manufacturing technologists and technicians
C143	C143 Industrial instrument technicians and mechanics
C161	C161 Non-destructive testers and inspectors
F021	F021 Authors and writers
F141	F141 Graphic designers and illustrators
G121	G121 Technical sales specialists, wholesale trade

Figure No. A-3 sets out the definition of the ICT Producer Industries that is used in the *2011 Outlook*. This definition is somewhat broader than the definition used by Industry Canada, which conforms to the OECD definition. The difficulty with the Industry Canada/OECD definition is that data is sometimes not readily available at the level of detail consistent with that definition. Consequently, higher levels of industry aggregation are used in the *2011 Outlook*. Industry definitions are based on the North American Industry Classification System (NAICS).

Figure No. A-3
ICT Producer Industries

NAICS	Industry
3333	Commercial and service industry machinery manufacturing
3341	Computer and peripheral equipment manufacturing
3342	Communications equipment manufacturing
3343	Audio and video equipment manufacturing
3344	Semiconductor and other electronic component manufacturing
3345	Navigational, measuring, medical and control instruments manufacturing
4173	Computer and communications equipment and supplies wholesaler-distributors
5112	Software publishers
5161	Internet publishing and broadcasting
5171	Wired telecommunications carriers
5172	Wireless telecommunications carriers (except satellite)
5173	Telecommunications resellers
5174	Satellite telecommunications
5175	Cable and other program distribution
5179	Other telecommunications
5181	Internet service providers, web search portals
5182	Data processing, hosting and related services
5415	Computer systems design and related services
8112	Electronic and precision equipment repair and maintenance

The *2011 Outlook* analyzes the ICT labour market in terms of six regions:

- Atlantic Canada
- Quebec
- Ontario
- Manitoba and Saskatchewan
- Alberta
- British Columbia

The definition of regions is based on the availability of reliable data.

Supply and demand estimates are developed for each of the ICT Core Occupations in each of the six regions. For ICT-Related Occupations, there are not specific supply functions that can be estimated. Demand is estimated only at the national level. For the ICT Core Occupations, the national estimates are the sum of the regional estimates.

Supply and Demand Drivers:

The principal drivers of future employment demand are:

1. Projected changes in output by industry,
2. Projected changes from recent trends in investment spending on ICT,
3. Projected changes from recent trends in R&D spending by the ICT Sector,
4. Projected changes from recent trends in the import and export of ICT services,
5. Technology trends, and
6. Outsourcing trends

On the supply side, the drivers of changes to supply are:

1. Projected mortality and retirement exits from the ICT labour force,
2. Projected post-secondary enrolment and graduation rates in ICT-related fields,
3. Projected immigration by intended occupation—both permanent immigrants and persons admitted as 'Temporary Foreign Workers', and
4. Changes from trend employment.

The inclusion of 'changes from trend employment' as a supply-side driver reflects the actual dynamics of supply conditions in the ICT labour market. In many ICT Core Occupations, individuals enter (or leave) the ICT labour force from other occupations in response to increases (or decreases) in perceived employment opportunities in ICT.

Labour Market Rankings

The 2011 Outlook describes the ICT labour market in terms of five labour market rankings.

Figure No. A-4
Labour Market Rankings

These rankings combine supply and demand variables to provide a capsule description of how the labour market will be experienced by employers and job-seekers. Detailed descriptions of the rankings are set out in Chapter Three.

Industry Consultations and Input

The *2011 Outlook* uses both quantitative estimates and industry input to gauge current labour market conditions and trends. The key channels for this industry input were:

- telephone interviews with 111 industry informants representing both ICT producers and users,
- eleven focus groups and six webinars with representatives from industry and from the post-secondary education system, involving over 100 persons,
- a web-based survey of 268 employers, and
- six validation meetings with industry representatives to confirm and re-calibrate initial findings and conclusions.

Additionally, the forecast draws on the results of a literature review and proprietary research undertaken by IDC Canada, Sapphire/IBM and other organizations.

Iterations of the Forecast:

The *2011 Outlook* is developed through three iterations.

The first iteration applies an econometric estimate of demand and supply trends.

The second iteration adjusts the rankings derived from the econometric model by factoring in industry input obtained through surveys, interviews and focus groups. Adjustments are also made based on the literature review and proprietary research. These adjustments are an essential component of the forecasting exercise. A number of key variables—e.g., technology trends, outsourcing and offshoring trends, and changes in employers' preferred capabilities profiles—cannot be captured by an econometric model. To ignore these variables would be like putting on a production of *Hamlet* without the ghost.

The second iteration of the forecast also incorporates a narrative discussion which reflects nuances in supply and demand that cannot be capture in an econometric model. This is especially important in light of the granularity of employers' skill and experience requirements and the high levels of aggregation of occupational data in the *Census* and the *Labour Force Survey*.

The results of the second iteration are then presented to regional validation sessions. These validation sessions are a mix of face-to-face meetings and webinars.

The third iteration reflects input from validation sessions. The third iteration is the final, released version of the forecast.

Constructing the First Iteration of the Forecast:

On the demand side the first iteration of the forecast uses an economic model that relates projected changes in output on an industry-by-industry basis (for each of the six regions) to the demand for workers in each of the Core ICT occupation. This model was developed by the Centre for Spatial Economics (C_4SE). The occupational employment demand model is based on C_4SE's January 2011 *Provincial Economic Forecast*. The employment demand model is a 'fixed coefficient' model. That is to say, the relationship between changes in employment and changes in output at the industry level does not change over the forecast period. Changes arising from technology or other factors are exogenous to the model and are factored into the forecast in the second iteration. Employment estimates are grounded in the 2006 Census. The *Labour Force Survey* is used to estimate changes from 2006. However, in light of the sampling error in the Labour Force Survey, outlier datapoints are disregarded.

Figure No. A-5 summarizes the key macroeconomic assumptions and variables in the January 2011 C_4SE forecast.

Figure No. A-5
Key Macroeconomic Assumptions and Estimates (Centre for Spatial Economics)

	2010–2014	2015–2019
Annual Real GDP Growth (Canada)	2.5%	2.2%
Investment in Machinery and Equipment	4.5%	1.8%
Employment Growth	1.9%	0.9%
Unemployment Rate (All Occupations)	7.0%	5.5%
Exchange Rate (C$ in US$)	$0.953	$0.907
WTI Oil $/Barrel (US$)	$105.00	$109.50
U.S. Real GDP Annual Growth	3.0%	2.9%
Eurozone Real GDP Annual Growth	1.6%	1.6%

Estimates of supply are based on:

- enrolment and graduation trends,
- a 'reaction function' which relates growth in supply to a three-year lagged function of changes in employment,
- a demographics model, and
- immigration data.

Enrolment and graduation data are derived from Statistics Canada's Post-Secondary Information System (PSIS) and from Engineers Canada.

The reaction function reflects an important aspect of the ICT labour market, namely that for many occupations, supply increases (or decreases) in response to changes in employment. A three year lag is used for most occupations. For some occupations—notably engineering occupations—enrolment and graduation data provide a basis for estimating prospective supply. Reference is also made to the Labour Market Tracking model developed for Engineers Canada which estimates supply and demand for electrical and electronics engineers, computer engineers and software engineers.

The demographics model uses year-specific age distributions of each occupation, by region, based on the 2006 Census. An aging function and age-specific exit estimates are applied to the 2006 labour force to estimate attrition in the 2006

labour force. The age-specific exit rates are general demographic exit rates for each age. The exit rates are not specific or unique to ICT Occupations. In future forecasts, it may be appropriate to devote resources to estimating exit rates that are specific to ICT Occupations.

Data on permanent and temporary immigration are obtained from Citizenship and Immigration Canada.

Rankings are based on weights assigned to three indicators: (1) a measure of excess supply, (2) replacement demand as a percent of the occupational labour force, and (3) trend growth in the occupational labour force.

The model is initially calibrated such that the rankings for 2010 correspond to the average assessment of the labour market (on a national basis) as derived from the Ipsos-Reid telephone survey of 100 industry leaders and the web-based survey (268 respondents). Regional adjustments are made where appropriate. In this way, the 2010 rankings are grounded in survey-based input from industry.

Constructing the Second Iteration of the Forecast:

The rankings and supply/demand estimates generated by the first iteration of the forecast are adjusted based on:

- Proprietary estimates of ICT spending and ICT outsourcing published by IDC Canada and used with their permission,
- Global projections of ICT spending developed by IHS Global Insight and published by the World Information Technology Services Associations,
- Input derived from interviews and focus groups,
- Input derived from surveys undertaken for the *2011 Outlook*,
- The literature review, most notably:
  - OECD, *OECD Information Technology Outlook, 2010*,
  - Sapphire/IBM, *Canadian IT Staffing Outlook*,
  - World Information Technology Services Association, *Digital Planet, 2010*,
  - Computer Economics, *Technology Trends, 2010/2011*,
  - Society for Information Management, *2010 SIM IT Trends Survey*.

The above sources are also used to support the narrative discussion of ICT labour market trends in each region.

Constructing the Third Iteration of the Forecast:

The rankings and principal conclusions are reviewed with validation groups in each region. These validation meetings were a combination of face-to face meetings and webinars. As appropriate, the rankings and conclusions are adjusted to reflect the advice of the validation groups.

An accompanying publication, *2011 Outlook—Data and Forecast Estimates*, presents the data and the calculations that drive the estimates and the rankings.

Appendix B: Labour Market Rankings Matrix

	Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages	Acute Excess of Demand over Supply: Absolute Supply Constraints
Recruiting for <5 Years Experience	Employers have *no difficulty* recruiting for jobs that require <5 years of experience.	Same as (1) Employers have *no difficulty* recruiting for jobs that require <5 years of experience.	Same as (1) Employers have *no difficulty* recruiting for jobs that require <5 years of experience.	Employers experience *moderate difficulty* across-the-board, in all labour markets, in recruiting for most ICT jobs even when these jobs require <5 years experience. This difficulty is *more significant in labour markets with a population under 1.0 million*.	Employers experience *significant difficulty across-the-board, in all labour markets*, in recruiting for virtually all types of ICT jobs even when these jobs require <5 years experience.
Recruiting for 5+ Years Experience	Employers typically experience *no difficulty* in recruiting for most types of ICT jobs, at established compensation norms in their local labour market.	Employers *in large labour markets typically experience no difficulty* in recruiting for most types of ICT jobs, at established compensation norms in their local labour market. *In labour markets with a population under 1.0 million, moderate difficulties may arise*.	*Employers in most labour markets have moderate difficulty* in recruiting for most types of ICT jobs that require 5+ years of experience. These challenges are greater in population centres with less than 1.0 million population.	Employers in all labour markets encounter *significant difficulty* in recruiting for most types of ICT jobs that require 5+ years of experience. To expand the pool of potential applicants, *employers actively seek candidates from outside local and regional labour markets* and reimburse these applicants for travel expenses related to interviews. Employers frequently *participate in multi-employer 'job fairs'* to expand their applicant pool.	Same as (4) Employers in all labour markets have *significant difficulty* in recruiting for most types of ICT jobs that require 5+ years of experience. To expand the pool of potential applicants, *employers actively seek candidates from outside local and regional labour markets* and reimburse these applicants for travel expenses related to interviews. Employers frequently *participate in multi-employer 'job fairs'* to expand their applicant pool. *Large employers also engage in active international recruiting*.

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	Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages	Acute Excess of Demand over Supply: Absolute Supply Constraints
Recruiting for Specialized Skills or Experience	*Moderate but manageable* recruitment difficulties arise only when specific industry or technical experience is required or leading edge skills are required.	Same as (1) *Moderate but manageable* recruitment difficulties arise only when specific industry or technical experience is required or leading edge skills are required.	*Search times increase* for candidates with specific industry or technical experience or leading edge skills. Delays in filling jobs may cause *operational problems. Use of search firms increases.*	Employers find it *exceedingly difficult* to recruit candidates with specific industry or technical experience or leading edge skills. *Some employers report it is impossible* to find qualified candidates. *Delays in filling such jobs are systemic and cause operational problems. Use of search firms is the norm.* *Skill availability becomes a key factor in determining where to locate operations.*	Same as (4) Employers find it *exceedingly difficult* to recruit candidates with specific industry or technical experience or leading edge skills. *Some employers report it is impossible* to find qualified candidates. *Delays in filling such jobs are systemic and cause operational problems. Use of search firms is the norm.* *Skill availability becomes a key factor in determining where to locate operations.*
The Right Skills Profile	Employers will *only* hire applicants that have the right mix of technical skills, related work experience, and inter-personal skills.	Same as (1) Employers will *only* hire applicants that have the right mix of technical skills, related work experience, and inter-personal skills.	Same as (1) Employers *strongly prefer* applicants that have the right mix of technical skills, related work experience, and inter-personal skills, but *will compromise for highly specialized or leading edge technical skills.*	While employers prefer applicants that have the right mix of technical skills, related work experience, and inter-personal skills, they *regularly compromise to meet their need for technical skills.*	Employers will hire *any applicant that has the required technical skills and some approximately relevant experience.*

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	Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages	Acute Excess of Demand over Supply: Absolute Supply Constraints
Recent Graduates Experience of Labour Market	Recent graduates experience *acute difficulty in finding jobs commensurate with their training*. Many are forced to *take jobs outside of the field* for which they were trained. Most are *'crowded out' of the labour market by more experienced, laid-off ICT professionals who are seeking re-employment*. Unpaid internships are common.	Same as (1) Recent graduates experience *acute difficulty in finding jobs commensurate with their training*. Many are forced to *take jobs outside of the field* for which they were trained. Most are *'crowded out' of the labour market by more experienced, laid-off ICT professionals who are seeking re-employment*. Unpaid internships are common.	Recent *graduates who have participated in co-operative or internship programs are generally able to obtain employment that is commensurate with their training*. Graduates from traditional programs typically experience much longer search periods and often are obliged to take ICT jobs for which they are over-qualified.	Recent graduates have *little difficulty* in obtaining employment that is commensurate with their training.	Same as (4) Recent graduates have *little difficulty* in obtaining employment that is commensurate with their training.
Recent IEP Experience of Labour Market	Recently arrived IEPs with no Canadian experience find it *almost impossible to secure any ICT job, unless their English or French language skills are excellent*. Most are *'crowded out'* of the ICT labour market by more experienced, laid-off ICT professionals who are seeking re-employment.	Same as (1) Recently arrived IEPs with no Canadian experience find it *almost impossible to secure any ICT job, unless their English or French language skills are excellent*. Most are *'crowded out'* of the ICT labour market by more experienced, laid-off ICT professionals who are seeking re-employment.	Recently arrived IEPs with no Canadian experience find it *almost impossible to secure an ICT job commensurate with their qualifications, unless their English or French language skills are excellent*. To gain Canadian experience, most IEPs *take jobs for which they are over-qualified*. There is a discernible benefit to IEPs who participate in bridging programs that address language and experience deficits.	Recently arrived IEPs with no Canadian experience, but *with adequate language skills, are generally able to find employment that is approximately commensurate with their technical qualifications*, though not necessarily commensurate with their prior managerial experience.	Recently arrived IEPs with no Canadian experience, but *with adequate language skills, are generally able to find employment that is commensurate with their qualifications and experience*. IEPs with language challenges are still hired. *Large firms often offer language instruction*.

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	Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages	Acute Excess of Demand over Supply: Absolute Supply Constraints
Employer Use of TFW Program	Employers make use of Temporary Foreign Workers *only in exceptional cases* where leading edge or highly specific skills are required.	Same as (1) Employers make use of Temporary Foreign Workers *only in exceptional cases* where leading edge or highly specific skills are required.	Employers make moderate use of Temporary Foreign Workers where *leading edge skills or highly specific experience are required, especially in areas where it may be difficult to attract domestic candidates who are willing to relocate.*	Employers make *regular use* of Temporary Foreign Workers, especially in labour markets *where unemployment rates are especially low.*	Employers make *regular use* of Temporary Foreign Workers *in most regions.*
Job Offers: Permanent vs Contract	Job offers are *predominantly for temporary or contract assignments.*	Offers for jobs requiring <5 years experience are predominantly for temporary or contract assignments. *Offers for jobs requiring 5+ years experience are about evenly divided between contract and permanent positions.* Contract jobs are often used as a screening mechanism.	*Job offers are about evenly divided between temporary and permanent jobs, even for jobs that require <5 years experience.* Contract jobs are often used as a screening mechanism.	Most job offers are for *permanent jobs.*	Virtually all job offers are for *permanent jobs.*
Compensation / Consultants Fees	Employee compensation and consultants' fees are *stable, keeping pace with inflation.* *Bonus are often suspended.*	Employee compensation and consultants' fees are *stable, keeping pace with inflation.* *Bonuses continue but do not increase.*	Employee compensation and consultants' fees increase about *1–2% above inflation.* *Bonuses increase moderately*	There is *pressure on employee compensation.* *Bonuses rise significantly.* There is a *significant increase in the use of perks*, including training benefits. *Consultants' fees rise by 5–10% per year.*	There is *significant pressure across-the-board on compensation, bonuses and perks.* *Consultants' fees rise by more than 10% per year.*

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	Acute Excess of Supply over Demand	Excess of Supply over Demand	Skills Shortages in Many Fields	Excess of Demand over Supply: Pervasive Shortages	Acute Excess of Demand over Supply: Absolute Supply Constraints
Consulting Firms	The volume of consulting work is *very low* by historic norms as companies and organizations defer significant ICT investments. Typically firms have a *hiring freeze*. Exiting staff are not replaced.	The volume of consulting work is *lower than historic norms* as companies and organizations are very cautious in making significant ICT investments. Consulting firms *replace most exiting staff*, but typically do not expand. Hiring tends to be project-specific.	The volume of consulting work is *on par with historic norms* as companies and organizations resume making ICT investments at historically normal levels. Many consulting firms *increase their staffing*. Hiring tends to be a mix of project-specific and core.	The volume of consulting work is *substantially higher than historic norms. Resources are stretched to meet commitments*. Firms may decline work or abstain from bidding on work that they previously would have undertaken. Most large consulting firms are trying to *expand their staff resources*. There is an increase in sole sourcing by customers to ensure priority.	The volume of consulting work *exceeds capacity*. There is a widespread perception that consulting firms are *stretched to their limit*. Most large consulting firms are trying to *expand their staff* resources. Sole sourcing is common by customers to ensure priority.
Search Firms	The volume of search work is *very low* by historic norms as companies and organizations are not hiring on a permanent basis.	The volume of search work is *lower than historic norms*.	The volume of search work is *on par with historic norms*.	The volume of search work is *substantially higher than historic norms*. Firms must invest considerably more professional time finding appropriate candidates.	Same as (4) The volume of search work is *substantially higher than historic norms*. Firms must invest considerably more professional time finding appropriate candidates.

Appendix C: Industry Consultations

First Name	Last Name	Company
Andre	Cusson	01 Communications Inc
Jason	Huang	AbleTech Solutions Inc.
Peter	Wealick	Aboriginal Computer Solutions
Keith	Lay	ACM Media
Ciro	Desantis	Adaptable Software Ltd.
Cameron	Bramwell	Adlib Software
Claude	Demers	ADRIQ
Leslie	Sim-Kaiser	Advanced Education and Technology
Rollie	Dykstra	Advanced Education and Technology
Darren	Hauch	Alentus Corporation
David	Lareau	Aliments Ultima Inc.
Donald	Hache	Arcom Telecom Ltd.
Terry	Karavoulias	AskMen
Brian	Stewart	Athabasca University Centre for Innovative Management
Scott	Michaels	Atimi Software
Fred	Gurney	B&G Systems Canada
Brian	Giles	B.J. Giles & Associates Ltd.
Dawn	Kingston	Bell Canada
Derek	Bain	Beyond Wireless
Joe	Fitzgerald	Business Telecom Canada Inc.
John	Boyle	C A C Network Services Inc.
Katie	Motta	CAMSC
Sheri	Murphy	Can-Med Health Care
Joanne	Stanley	CATAAlliance
Kevin	Wennekes	CATAAlliance
Monique	Charbonneau	CEFRIO
Darren	Williams	Central Bus Equipment Systems
Marianne	Kayed	Centre for Canadian Language Benchmarks
Catherine	Chandler-Crichlow	Centre of Excellence in Financial Services Education
Gabriel	Vitus	Certified General Accountants Association
John	Patti	CGI

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First Name	Last Name	Company
Mike	Rogers	CGI Inc.
Mark	Wallace	Champlain College St. Lambert
Karen	Hiltz	Christie Digital Systems
Sunil	Sharma	CIPS, BC
Gary	Craven	CIPS, Manitoba
Maria	Galati	CIPS, Saskatchewan
Joe	Mazzei	City of Toronto Economic Development & Culture Strategic Growth & Sector Development
Don	McCormick	Cleankeys Inc
Ravi	Maithel	Clevor Technologies
Dan	Gale	CMC Microsystems
Gerry	Akkerman	Coast Mountain Bus
Karen	Gallant	Communitech
Marj	Akerley	Community and Collaboration Division, CIO Branch, Treasury Board of Canada
Robert	Graham	Community and Collaboration Division, CIO Branch, Treasury Board of Canada
Denise	Woods-Goldstein	CompTIA
Rossitza	Marinova	Concordia University
Ed	Nemes	CONTAX Inc
David	Ticoll	Convergent Strategies
Marc	Gagnon	Convergent Telecom Inc.
Joanne	Petersen	CoreSolutions Software Inc.
Tony	D'Apice	Cossette Communications
Claude	Robitaille	CRIM
Lee	Bradford	CSC Global Technologies Inc.
Rick	Newcombe	Currie Communications Ltd.
Frank	Nemeth	DALSA
George	Mack	Dawson College
Madeleine	Bazerghi	Dawson College
Gary	Zorta	Dawson College
Ken	Fogel	Dawson College

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First Name	Last Name	Company
Jaya	Nikakantan	Dawson College
Marco	De Castris	De Castris Electronics Ltd.
Marwa	Jazi	Dell Canada
Bob	Leech	Deloitte LLP
Anila	Umar	DeVry Institute of Technology
Jolanta	Warpechowska-Gruca	DeVry Institute of Technology
Gilles	Allard	Digimicro Inc.
Celia	Clark	Digital Frog International
Alex	Gault	Digital Media
Ken	Lee	Digital Nova Scotia
		Dimensional Strategies Inc.
Dale	Lemke	Display Systems International, Inc.
Andrew	Brown	ebackup Inc.
Eyo	Sama	EDI Gateway
Harry	Zgnilek	EDI Gateway
Greg	Conner	EDS Advanced Solutions
Elizabeth	Ramirez	EquiSoft
Darlene	Wilson	Ericsson Canada Inc.
Eduardo	Cardozo	EXA Systems Inc.
Tim	McGee	Express Lane Computers
Stephanie	Cyr	Facilite Informatique
Kim	Pasquin	Funcom
Stephanie	Boon	GasBuddy, GB Internet Solutions
Anthony	Bryant	Generation-Clik
Jocelyne	Deschenes	GFI Solutions
Janet	Burrows	Government of New Brunswick
Andy	Gajetzki	Grand Prairie Regional College
Scott	Greenlay	Greenridge Business Systems
Christine	Johnson	Harlequin Enterprises Limited
Keith	Sinclair	Harris Consulting Corp., The

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First Name	Last Name	Company
James	Polley	Hbi College
Dylen	Walters	HumanIT Mac911 Inc.
Guillermo	Acosta	Humber College Institute of Technology & Advanced Learning
William	Hutchison	Hutchison Management International
Tyanne	Fluke	Ian Martin IT Inc.
Gino	Fusaro	IBM
John	Verones	IBM Canada
Kathy	Knight	ICTAM
Nancy	Zubriski	ICTAM
Troy	Havard	ICTAM
Tim	Rogers	Idea Technologies Inc.
Laurent	Lamarre	IEEE Montreal / Hydro Quebec
Andrew	Kostiuk	IEEE Northern Saskatchewan Section
Hugh	Reekie	IEEE Ottawa Section
Stephen	Ibaraki	iGen Solutions Canada
Amer	Mustafa	Indus Systems Inc.
Maja	Rusinowska	Industry Canada
Sandra	Song	Industry Canada
Daniel	Vaudrin	Info Solutions Fuzion Inc.
Real	Alix	Informatiques SoftTarget Inc.
Matt	McPherson	Infornaut Inc.
Joanne	Gillespie	Infoware Canada Inc.
Saeed	ElDarahali	InNOVAcorp.
Bernadette	MacDonald	Innovations Port Support Services Incorporated
Fred	Stam	Intelligent Access Microware
Dorian	Sabaz	Intelligent Robotics Corporation
Stephanie	Clarkson	Intelliware Development Inc.
Michael	Donato	Internet Access Solutions Ltd.
Bruce C.	MacDougall	Internetworking Atlantic Inc
Pierre	Masse	Invera
Ram	Panda	Invera Inc.

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First Name	Last Name	Company
Chris	Krywulak	iQmetrix
Luisa	Dodaro	ISAD Solutions
Bruno	Morel	iWeb
Gabriel	Tremblay	iWeb Technologies Inc.
Michel	Thivierge	iWeb Technologies Inc.
Jon	Arnold	J Arnold & Associates
Jaeson	Tanner	Jaeson Tanner Web Design
Peter	Schaefer	Jesta I.S.
Jack	Kuervers	JPK Computers Inc.
Mathieu	Belanger	K3 Media Inc.
Yvon	Audette	KPMG LLP
Bonneau	Jean-Philippe	La voix des entrepreneurs en T.I. de Quebec (VETIQ)
David	Pepper	Langara College - Library
Yannick	LaRue	LaRue Info Inc.
Belinda	Leung	Linda Lundstrom Inc.
Craig	Francis	LoGograph
Isabelle	Lopez	MA14
Jean-Guy	Faubert	Make Technologies Inc.
Don	Thiessen	Manitoba eHealth - Winnipeg Regional Health Authority
Mark	Zaluski	Manitoba Energy, Science & Technology
Rud	Higgins	Manitoba Energy, Science & Technology
Howard	Mayers	Maysys Consulting Inc.
Anas	Hamoui	McGill University
Jerry	Lim	MDA
Lynne	Goulet-Smith	Medshare Inc.
Gabrielle	Mercier	Mercier, Indus En Mecanique
Kim	Brown	Microquest Inc.
Bernadette	Salmon	MicroSkills
John	Oxley	Microsoft Canada
Edward	Asmar	Minden Gross LLP
Rafik	Berzi	Mingus Software Inc.

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First Name	Last Name	Company
Ernesto	Colarusso	Mipsmedia
Eric	Novinscak	Miradore Ltd.
Vanessa	ROUSSY	Miralis Inc.
Megan	Hall	MKS
Morel	Bachynski	MPB Technologies Inc.
Teresa	Griffin-Muir	MTS Allstream Corp.
Holly	McKnight	NBCC Moncton
Anil	Sanwalka	Neesus Datacom Inc.
Eric	Harding	NIS - Nanaimo Internet Servs
Michel	Cote	NOVO Technologies Inc
Michel	Alloul	Onnet.ca Inc.
Rejean	Martin	Optimum developpement
Audrey	Lambert	Orizon Mobile
Chris	Webber	Pacific Alliance Technologies
Melanie	Mailly	Paradox Security Systems Ltd.
Janice	Retterath	PeerGroup
Albert	Tseng	Philips Medical Systems
Peter	Richardson	Platform Computing Corporation
Marla	Mayes	Point2 Technologies Inc.
Jories	Timmers	Powerex
Marc	St-Cyr	Prisme Audio Enr.
Priscilla	Tumbach	Procura
Wadood	Ibrahim	Protegra
Caroline	Jellinck	Ray & Berndtson
Guy	Dugas	Red River College
Esther	Wirick	RIM
Robert	Fabian	Robert Fabian, Management and Systems Consultant
Kae	Elgie	Rwl Elmira Branch Library
Wendy	Cukier	Ryerson University
Kerry	Augustine	SAIC Canada
Darwin	Risdon	SAIT Polytechnic

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First Name	Last Name	Company
Sandra	Mullings	SAMA
Lisa	Paddick	Sandvine
Marc	Varteressian	Sapphire Canada, A Randstad Company
Michelle	Murray	Sapphire Technologies Canada Limited
Dean	Hartley	Saskatchewan Indian Gaming Authority
Cyrille	Beraud	Savoir-Faire Linux Inc.
Vern	McNees	Scotia Waterous Inc.
Jean	Langlais	Sennheiser (Canada) Inc.
Larry	Carlsen	Sentinel Hill Software Inc.
Nick	Chiovitti	SIA Service Information Access
Shelley	Wollin	Sierra Systems
John	Broere	Sierra Systems Group Inc.
Leslie	Ormel	Sierra Systems Inc
Pat	Watson	SIERRA WIRELESS
Brian	McGurk	Smart Technologies Inc
Louis-Charles	Denault	Socami Inc.
Michel	Dubreuil	Sol Telephonie d'Aff Tellipso
Jim	Catley	Southern Alberta Institute of Technology
Jim	Murtagh	Southern Alberta Institute of Technology
Brad	Zakreski	Storm Applied Technologies
Nigel	Banks	STUDENT REPRESENTATIVE
Sharon	Heppner	Sunshine Coast Regional District Board, British Columbia
Neale	German	Systech Instrumentation Inc.
Josiane	Deslandes	Systematrix
Nathalie	Meunier	Talent Strategie
Suzanne	Hyatt	Tech Capital Partners
Sylvie	Gagnon	TECHNOCompetences
Manouane	Beauchamp	Techno-Competences
Gregory	Wellman	Technocosm
David	Draper	Technology Consultant
Hernan	Cecereu	Technology Trade Consulting

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First Name	Last Name	Company
Les	Duguid	The Economical Insurance Group
Richard	Becker	The Economical Insurance Group
Daniela Crivianu	Gaita	The Hospital for Sick Children
Susan	Viegas	Toronto Financial Services Alliance
Geoffrey	King	Toronto Financial Services Alliance
Clay	Braziller	Triumph Communications
Tim	Richardson	U of T at Scarborough, Division of Management
Michael	Ferri	Unified Alloys
Carey	Williamson	University of Calgary
Adriana	Ieraci	University of Toronto's Knowledge Media Design Institute (KMDI)
Alain	Monney	Valangin Inc.
Louise	Gauthier	Vanier College
Nathalie	Giroux	Vision/R4 Corporation
Ray	Barton	Vitesse Re-SkillingTM Canada
Sarb	Nagra	Web For Less Media Inc.
Alex	Palynchuk	Western Instruments Inc.
Jim	Skippen	Wi-LAN Inc.
Chris	Kendrick	xwave
Dan	Deneau	Zimmer Controls & Contracting

Appendix D: Industry Advisory Committee

Terry Power	Industry Advisory Chair	Information and Communications Technology Council
John Oxley	Director, Community Evangelism	Microsoft Canada
Cecilia Ryan	Vice President, Professional Services	Telus Health Solutions
Glen Reitmeier	Division Manager, IT Services	Manitoba Hydro
Chris Booth	CIO	CitiBank
Marcellus Mindel	Head of Academic Partnerships	IBM Canada
Michel Thivierge	HR Director	iWeb Technologies Inc.
Tracy Cheng	Project Manager, Human Resources	CISCO Systems Canada
Susan Rogers	Manager, Diversity & Inclusion	Xerox Canada Ltd.
Lynda Leonard	Vice-President, Communications	Information Technology Association of Canada (ITAC)

Notes

A not-for-profit sector council, the Information and Communications Technology Council (ICTC), strives to create a prepared, diverse and highly educated Canadian ICT industry and workforce. ICTC is a catalyst for change, pushing for innovations that will provide standards, labour market intelligence, career pathways and immigration for the Canadian ICT industry, educators and governments. We forge partnerships that will help develop the quantity and quality of ICT professionals needed to maintain and improve Canada's position as a leader in the global marketplace.

To achieve these goals, ICTC focuses on five main areas that are proven building blocks for a healthy, successful and forward-looking sector:

- Standards
- Labour Market Intelligence
- Career Pathways
- Immigration Initiatives
- Partnership

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